D 410,292

1837
ARTES VERITAS SCIENTIA
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
TUEBOR
CIRCUMSPICE

605
F22

THE
FAR EASTERN REVIEW

Volume
XXI.

SHANGHAI:
THE FAR EASTERN REVIEW
1925

Index to Vol. XXI.

NOTE :—Illustrated articles are marked with an asterisk (*). Look for general subject rather than the specific titles of the articles.

Page

A

Advance in Flour Milling in China *74
Aglen, Sir Francis 9
Agricultural Experiment Station in Java 241
——Improvement, Does It Pay... 40
Akiyama, Dr. 3
American Club, Shanghai ...*154
Amur Province, Gold Deposits ...*614
Anglo-American Association, Peking... 1
Anti-Japanese 3, 10
Arakawa Flood Prevention Works *319
Architecture and the Buildings of the New Tokyo *468
Armstrong, Whitworth Pneumatic Grinder *629
Asano Cement Co., Ltd., Kawasaki Works *82
Asbestos in the Philippines ...*672
Asia, New 683

B

Bamboo Steel, History of ... 619
Bancroft, Hon. Edgar A. ... *12
Bangkok's Tramways and Lighting *43
Banking in Japan 542
Batu Arang Collieries *46
Bean Oil Industry, Dairen ...*666
Beard, Charles A. *252
Best Year for Dodge Brothers ...*168
Bolshevism 8
Boxer Indemnity, British ... 5
Brains Behind the Daido ...*496
Breaking Ground for Tokyo's New Subway *331
Bridges of Tokyo *313
——Reconstruction of the Kiao-chow-Tsinan Railway ...*228
——Sumida River *307
Brill, J. G. Gasoline Cars ...*626
Brisbane, Arthur 728
British-American Tobacco Company. *675
——Engineering Trade in India... *97
——Pumping Engines for Peking Syndicate Mines *80
Building and Architecture of the New Tokyo *468
——Construction for the New Tokyo *460
Burma, Distribution of Petroleum *95
Bywater, Hector C. 591

C

Canal Plans, Tokyo-Yokohama...*355
Capital Dam of the Chengtu Plain Irrigation *571
Cars, Gasoline, J. G. Brill's ...*626
Cement, China's Tribute to ... 203
——, International Trade in ...*647
——Plant, Modern Japanese ... *82
Central Workshops of the F.M.S. Railways *131
Changing Factors in the Economic Life of China... 149
Changte, New s.s. *673
Channing, C. G. Fairfax 3
Chee Hsin Cement Co., Ltd., Founder of 111
Chemical Trade in the Far East... 78
Chengtu Plain Irrigation, Capital Dam of *571
Chicago Tribune 10
Chihli Province, Engineering Project for Famine Relief ... *23
China, Administration of Communications 638
China and Japan 150
——, Can Extraterritoriality be Abolished in 590
——, Changing Factor in the Economic Life of 149
——, Fire Fighting Machinery ... 704
——, Japan Plan for Reconstruction of 53
——, Machinery Market ... 233
——, Paper Making in 90
——, Petroleum in West ... 600
——, Problem of Trade Mark Protection in 599
——, Shall Japan Lead the Powers in 679
——, Stand By 195
——, Tariff Autonomy for ... 583
——, Unification of the Administrative Control of the Railroads of 588
——, Use of ElectricalMachinery in*220
China's Tin Industry *617
——Tribute to Cement 203
Chinese, Do they Hate the Japanese 680
—— Market for Low Grade Iron and Steel 677
Chinwangtao, Glass Factory ... *76
Chitral *721
Chosen Tobacco Industry ... *31
Coal in the Philippines *558
——, Iron and Mineral Oil ...*739
Cement Plant, Modern Japanese... *82
Collieries, Malayan *46
Commercial and Industrial Position in Japan 687
Communications in China ... 638
——System, Restoration of ...*343
Consortium, Again 201
Construction Work on the F.M.S. Railways *723
Coolidge, Have Faith in *11
Copper in the Philippines ...*609
Cotton Mills and Raw Cotton Supply in Tientsin *123
Cotton Mill, Dah Tung *635
Credit Insurance as a Trade Builder 634

D

Dah Tung Cotton Mill on Tsungming Island *635
Daido *496
Dairen Bean Oil Industry ...*666
——, Development of the Port of *592
Description of a shale Oil Distillation Plant *113
Design and Applications of Power Shovels and Draglines ...*658
Developments in the Far Eastern Iron and Steel Industry ... 109
——of the Port of Dairen ...*592
Diesel Engine in Far Eastern Vessels *676
Direct Current Locomotives for the Yoshino Railway, Japan *579
Discrimination Unfair and Unchristianlike 198
Distribution of Petroleum in Burma... ... ... *95
Dock Project, Singapore 79
Dodge Brothers, Best Year for ...*168
Draglines, Design and Application *658
Dry Dock of Kiangnan Dockyard, Now *238
Dutch East India Railroads ...*224

E

Earthquake Damages Telegraph and Telephone Installations of Japan *115
Economic Development of French Indo-China *759
——Life of China, Changing Factors in 149

EDITORIALS

A Monument to the Japanese Engineer *243
And Yet Again, the Autumn Manoeuvres 633
Back to Portsmouth 103
British Boxer Indemnity ... 5
Bywater's Frightfulness, Mr. ... 591
Can Extraterritoriality Be Abolished in China 590
Changing Factor in the Economic Life of China 149
China, Protests in Vain 108
China's Railways *112
Consortium Again, The 201
Credit Insurance as a Trade Builder 634
Discrimination Unfair and Unchristianlike 198
Do the Chinese Hate the Japanese 680
Dr. Jacob Gould Schurman ...*147
Dr. Schurman's Speech on Extraterritoriality 54
Extraterritoriality Commission ...*729
Have Faith in Coolidge *11
Is China Turning Red 8
Is the Oriental Valuable to the Pacific Coast 196
Japan and China 150
Japan's Alien Land Law ... 148
——Plan for the Reconstruction of China 53
——Stand at the Tariff Conference 636
Labor in China 202
Manchuria, a Survey 537
Manchuria, the Danger Spot of Asia 727
May 30 ... ...*535
More of Mr. Brisbane's Nonsense 728
Perfectly Sound Americanism ... 10
Problem of Trademark Protection in China 599
Recrudescence of Jingoism, The... 106
Red Invasion of Mongolia, The... 631
Red Journalism 538
Root of All the Trouble, The ... *6
Russo-Japanese Agreement ... 56
Sauce for the Gander 50
Shall Japan Lead the Powers in China 679
Sinclair Oil Concession Cancellation, The 153
Spilling the Siberian Beans ... 3
Stand By China 195
Sun Yat-sen *99
Tariff Autonomy for China ... 583
Those Unequal Treaties 52
Unification by Means of Internal Free Trade 9
Up Close 1
Village Grouch, The 200
Voice of New Japan, The ... 49
When Is Co-operation not Co-operation 682
Yokohama Specie Bank and the China Trade 151

Electric Incandescent Lamp Business of the World *766
——Power Company, The Ujigawa *232
——Power Development in Nagoya *671
——Railway, Tokyo-Yokohama...*530
Electric Works, Restoration of Nippon Electric Co. *27
Electrical Equipment Japanese ... 10
——Goods in Java 143
——Engineering in Japan, Manufacturing 515
——Machinery, Use of in China...*220
Electricity Supply of Shanghai ...*611
Electrification of the Java State Railways *655
——Program, Japan Railways ...*405
——Tokaido Main Line 420
Elevator, Automatic *532
Engineer, Japanese, a Monumnet to *243
Engineering Project, A Big, Famine Relief *23
——Trade in India, British ... 97
——Triumph, An *395
——Works, Shibaura *506
Extraterritoriality, A Study in ...*546
——Can be Abolished in China ... 590
——Commission *729
——Dr. Schurman's Speech On ... 54

F

Famine Relief, Engineering Project *23
Far East, Chemical Trade in ... 78
————, Pulverized Coal Plants 125
Far Eastern Iron & Steel Industry, Development in 109
————Vessels, Diesel Engines in *676
F. M. S. Central Workshop of Railway *131
——Construction Work On Railway 723
Ferry Scheme, Proposed for Nanking, Pukow and Wuchang...*716
Financial Independence of the Administration of Communications of the Republic of China 638
Fire Fighting Machinery in China*704
————Methods, Modernizing Tokyo's Antiquated... ...*296
Ford Building Electric Engine ... 111
Forests of the Russian Far East...*217
——, Russo-Japanese Corporation to Exploit Siberia *92
Founder of the Chee Hsin Cement Co., Ltd. 111
French Indo-China, Economic Development of *759
Fukien, Irrigation in *222
Fukuzawa, Momosuke *496
Fushun Power House *125

G

Gas Producer Power Plant in the Philippines *45
——Supply of Tokyo *293
Glass Factory, Modern in China... *76
Gold Deposits, Selemdja Alluvial *614
——Mining in the Philippines... 689
Goto, Viscount S. *252
Greater Osaka *163
Guillemard Bridge Over the Kelantan River *192

H

Hall, Josef 1
Handling Bales of Cotton ...*575
Hanshin Express Electric Railway, Notes on *128
Hanyehping 109
Harbor Extension and Tokyo-Yokohama Canal Plans ...*355
——, Yokohama *433

INDEX

Page

Hayashi, Baron 53
Helms, Birch 198
Helping the Small Property-Owner to Rebuild *465
High Power Radio Station in Java *73
History of Bamboo Steel ...*619
——of Mining in the Philippine Islands *204
Hitachi Electrical Engineering Works *514
Hokkaido, The Diffident *548
Hongkong Government, New Fire-float 13
Hydro-electric Scheme, Malay ... 72
Hydro-Electric Light, Yungan ...*193

I

Immigration 196
In Memory of a Beloved Ruler...*445
India-British Engineering Trade in *97
Indian Railways Make Drastic Changes 13
Indo-China, Sulzer Diesel Engines in the Pnom-Penh Municipal Electric Works *153
Industrial Bank of Japan ...*458
International Trade in Cement...*647
Iron, Coal and Mineral Oil, on the Asiatic Coast of the Pacific Ocean *739
Iron and Steel, Chinese Market for low grade 677
————Industry, Development in Far Eastern... ... 109
Iron in the Philippines 769
Irrigation and River Control in N.E.I. *35
——, Chengtu Plain *571
——in Fukien *222
——System, Sibalom River ...*719
——Works, Valves *26
Iwasaki, Baron *25
Iron Mines of Hsuan-Hua ... 111

J

Japan, Commercial and Industrial Position 687
——Electric Power Co. 10
——, Machinery Manufacturing Industry in *748
——Shall Lead the Powers in China 679
——, The Voice of New 49
Japan's Alien Land Law ... 148
——Banking 542
——Contribution to Naval Architecture *577
——Place in the Race for Air Supremacy *554
—— Plan for the Reconstruction of China 53
——Radio Development in ...*524
——Railway Electrification Program *405
——Stand at the Tariff Conference 636
——Super Power System ...*642
Japanese, Do the Chinese Hate ... 680
——Electrical Equipment ... *10
——Engineer, A Monument to ... 243
——Finance and Trade 733
——Soviet Agreement 65
Java, Agricultural Experiment Station in 241
——, Electric Goods in 143
——, High Power Radio Station *73
——, State Railways, Electrification of *655

K

Kapoh and Its Uses *185
Kawasaki Works of the Asano Cement Co., Ltd. *82
Koihin Electric Power Company, Power Development of ... *65
——Electric Railway *53
Key to Tokyo's Future Prosperity *355
Kiaochow-Tsinan Railway Bridges, Reconstruction of *228
Kiangnan Dockyard, New Dry Dock in *238

Page

Korea, Oriental Development Company in *207
Korea, Tobacco Industry of Chosen *31
Korea, Salt Industry *81
Kunishima Waterworks, Osaka ...*715
Kurenai Maru *28

L

Labor in China 202
Lare Reinforced Concrete Ocean Terminal Nearing Completion at Port of Manila *169
Landmarks in the Tin-Mining Industry *181
Launching of the Taishan ...*668
Lighting the Bund in Shameen ...*604
Lime, manufacture of, in China ...*134
Link-Belt Company *686
Locomotives for the Yoshino Railway *579
——, Peking-Suiyuan Railway,... *20
——, S. M. R. *16
——, Worthington Feed Water Heater... ... ... *41
Lunghai Railway, Eastern Extension *605

M

Machinery Manufacturing Industry in Japan *748
——, Market in China 233
——, Modern Gaining Popularity in Nanking 765
Malaya Hydro-Electric Scheme ... 72
Malayan Colleries *46
Manchuria *60
——, A Survey 537
——, Manufacturing Industries in North *211
——Soya Bean in *236
——Spinning Mills 570
——, The Danger Spot of Asia ... 727
Manila, Large Reinforced Concrete Ocean Terminal Nearing Completion at Port of 169
Manila Railroads *763
Manufacture of Lime in China ...*134
————the Philippines ...*135
Manufacturing Industries of North Manchuria *211
May 30 ... ...*535
Meiji, Emperor, Beautiful Memorial Park *445
Memorandum Relative to the Reconstruction of Tokyo ...*252
Millard, Thomas F. 1
Millard's Review 1
Militarism in China *6
Mineral Oil, Iron, Coal *739
Mining, History of, in the Philippine Islands *204
Minor, Clark H. *610
Mitsubushi Bank *453
——and Hitachi Electrical Engineering Works *514
Mitsui *497
Modern Glass Factory in China... *76
Modern Japanese Cement Plant... *82
Modern Machinery Gaining Popularity in Nanking 765
——Tendencies In Eastern Steel Markets *564
Modernizing Tokyo's Antiquated Fire Fighting Methods ...*296
Morrison Library, New Home ... *25
Motive Power Development, Peking-Suiyuan Railway ... *20
Motorships, New for O.S.K. ... *28
Municipal Central Market, Tokyo *304
Municipal Power Station, Penang *69

N

Nagoya, Electric Power Development in *671
Nanking, Modern Machinery Gaining Popularity In 765
Naval Architecture, Japan's Contribution to *577

Page

Need for Testing materials of the Construction Used in the Far East *700
Netherlands East Indies, Irrigation and River Control ... *35
——————State Railways ...*753
New Asia 683
New B.A.T. Building in Shanghai *675
——Dry Dock of Kiangnan Dockyard *238
New P. & O. Liner—Chitral ...*721
————Steamers *621
Nippon Electric Co., Ltd. Restoration of the Works *27
Noble at Wembley *654
Notes on the Hanshin Express Electric Railway *128

O

Okura, Baron Kihachiro ... *59-60
Omnibus *180
Opening of Japan's First Home Electric *581
Operator Pushes Button, Elevator Does the Rest *532
Oriental Development Company in Korea *207
Osaka-Greater 14,*163
——Kunishima Waterworks ...*715
O. S. K., New Motorships ... *28
Ostroumoff, Boris *547
Otranto, New Orient Line ... 674

P

Palatial Executive Office of the Yokohama Specie Bank ...*448
Paper-making in China *90
Park, Tokyo *445
Poiyang Army Chiefs *6
Peking Syndicate Mines, British Pumping Engines for ... *80
Peking Tramway System... ...*156
Penang Municipal Power Station *69
Penchihu *60
Petroleum, Distribution in Burma *95
——in the Philippines *595
——in West China *600
Philippines, Asbestos in the ...*672
——Coal in *558
——Copper in *609
——Gas Producer Power Plant ... *45
——Gold Mining in the *689
——History of Mining in... ...*204
——Iron in 769
——Manufactures of *135
——Petroleum in *595
Pioneer of Sino-Japanese Cooperation *59
Pnom Penh Municipal Electric Works, Indo-China *153
Port of Tsingtao *734
Powell, J. B. 1
Power Development of Keihin Electric Power Company ... *65
——Plant, Gas Producer in the Philippines *45
——Shovels and Draglines, Designs and Application ...*658
——Station, Penang Municipal... *69
Problem of Professional Status... 544
————Trade Mark Production in China 599
Proposed Train Ferry Scheme for Nanking-Pukow and Wuchang-Hankow *716
Pulverized Coal Plants in the Far East *125
Pumping Engines, British for Peking Syndicate Mines ... *80
Purification of Swimming Bath Water 545
Putnam Weale 1-9

Q

Queensland Sugar Industry ... *93

R

Radio Development in Japan ...*524
——, High Power Station in Java *73

Page

Radio in China 682
Railroads, Dutch East India ...*224
——, Manila *763
——of China, Unification of the Administrative 588
Railway Bridges, Reconstruction of the Kiaochow-Tsinan ...*228
——, Lunghai, Eastern Extension*605
——, The Tientu Light *229
——, Tokyo-Yokohama Electric...*530
Railways Central Workshops of F. M. S. *131
——China's *112
——China's International Control *50
——Electrification of Java State *655
——(Japan) Electrification Program *405
——, Foresight in Construction...*190
——, F. M. S. Construction Work*723
——, Hanshin Express Electric...*128
Railways, Indian 13
——, Netherlands East Indies State *753
——, Peking-Suiyuan Railway... *20
——, South Manchuria Railway... *16
—— (Japan) Restoration ...*395
Ranchi *231
Ranpura and Rawalpindi ...*621
Ratanakosindr *623, 685
Red Invasion of Mongolia ... 632
Red Journalism 538
Reconstruction Budget, The ...*247
——Building Company *465
——of Kiaochow-Tsinan Railway Bridges *228
——of Tokyo, Memorandum Relative to *252
Reinsch, Paul S. 1
Replotting A Great City *257
Restoration of a Factory Plant in Japan *467
——of Communications System ...*343
——of State Railways Japan ...*395
Rivers, Control in N.E.I. ... *35
Round the World for two pence per Mile 713
Russian Far East Forests In ...*217
Russo-Japanese Agreement ... 56
————Company to Exploit Siberian Forests 92

S

Saghalien Oil Concession 56
Salt Industry of Korea *81
Schurman, Dr. Jacob Gould ...*147
——, Dr. Speech of Extraterritoriality 54
Schools for the People *301
Selemdja Alluvial Gold Deposits...*614
Sewerage and Drainage System, Tokyo's Modern *282
Shale Oil Distillation Plant Description of *113
Shameen, Lighting the Bund of...*604
Shanghai Electricity Supply of...*611
——Gets Double Deckers ...*180
——New B. A. T. Building ...*675
Shibaura Engineering Works ...*506
Shidehara, Baron *11
Shiratori, Dr. 25
Shovels, Design and Application of Power *658
Sinclair Oil Concession Cancellation 153
Singapore Dock Project 79
Sino-Japanese Co-operation, A Pioneer of *59
South Manchuria Railway ... *16
Soviet-Japanese Agreement ... 108
Soviet Russia 631
Soya Bean in Manchuria ...*236
Stand By China 195
State Railways of the Netherlands East Indies 753
Steel and Iron, Chinese Market for Low Grade 677
————Industry Developments in Far Eastern ... 109
Steel, History of Bamboo ... 619
—— Markets, Modern Tendencies in Eastern *564

Page

Strikes Economic, Then Political, Now Economic Again ... 540
Study in Extraterritoriality ...*546
Subway, Breaking Ground for Tokyo's New *331
Subway, Tokyo's Municipal Project*337
Sugar Industry of Queensland ... *93
Sugar Rolls 42
Sulzer Diesel Engines in the Pnom Penh Municipal Electric Works, Indo-China *153
Sumida River Bridges *307
Sun Yat-sen 3, *99

T

Taishan, Launching of *668
Tariff Autonomy for China ... 583
——Conference, Japan's Stand at 636
Telegraph and Telephone Installation of Japan, Earthquake Damages *115
Test of Three Cylinder Locomotive for S.M.R. *16
Testing Materials of Construction Used in the Far East Need for*700
Thornycroft Depot at Singapore...*654
Tientsin, A year in *130
——, Cotton Mills and Raw Cotton Supply *123
Tientu Light Railway *229

Page

Tin, China's Industry *617
——Mining Industry Landmarks in*181
Tobacco Industry of Chosen ... *31
Toho Electric Power Company, Ltd. *366, 642
Tokaido Main Line, Electrification*420
Tokin, Zinc Mettalurgy *566
Tokyo, A Million Kilowatt City...*366
——, Architecture and the Buildings of the *468
——, Bay Reclamation Company*361
——, Breaking Ground for New Subway *331
——, Bridges of *313
——, Buildings Construction for the New *460
——, Electric Company *467
——, Electric Light Company ...*366
————Power Company ...*386
—— Gas Company *293
——Gas Supply of *293
——, Memorandum Relative to the Reconstruction of ...*252
——, Modern Sewerage and Drainage System *282
——, Modernizing Antiquated Fire Fighting Methods 296
——, Municipal Subway Project...*337
——, Municipal Waterworks ...*274
——, Replotting *257

Page

Tokyo, Restoration of Communication System *343
——, Tramway System ...*323
——, Yokohama Canal Plans and Harbor Extension *355
——, Yokohama Electric Railway*530
Trade Mark Protection, Problem of in China 599
Tramway, Peking Electric ...*156
Tramways and Lighting, Bangkok *43
Tramways, Tokyo *323
Treaties, Unequal 52
Tsinanfu, Flour Milling *74
Tsingtao, Port of *734
Tsurumi *361

U

Ujigawa Bond Issue *295
——Electric Power Company ...*232
————Company *706
Unification of the Administrative Control of the Railroads of China 588
United States Court for China ... 103
Use of Electrical Machinery in China*220

V

Valves for Irrigation Works ... *26
Vast Field for American Capital...*295

Page

W

Waterworks, Kunishima, Osaka... 715
——, Tokyo Municipal *274
Worthington Locomotive Feed Water Heater *41

Y

Yamada, Y. *65
Yao Hua Mechanical Glass Company *76
Year In Tientsin *130
Yeh Kung-cho 638
Yokohama Brilliant "Come-Back"*433
——Harbor *433
——Restoration of Communications Systems... ... ...*343
——Rising from Its Ashes ...*426
——Specie Bank and the Chinese Trade *151
————, Palatial Office ...*448
Yokohama Tokyo Canal Plans ...*355
Yoshino Railway, Japan *579
Yuan Shih-Kai 6
Yungan Hydro-electric Light ...*193

Z

Zinc Metallurgy in Tonkin ...*566
——Works of Quay Yen ...*566

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.
MAR 2 1925

大正七年七月十日第三種郵便物認可

THE FAR EASTERN REVIEW

FINANCE ENGINEERING COMMERCE

上海仁記路第五號

遠東時報

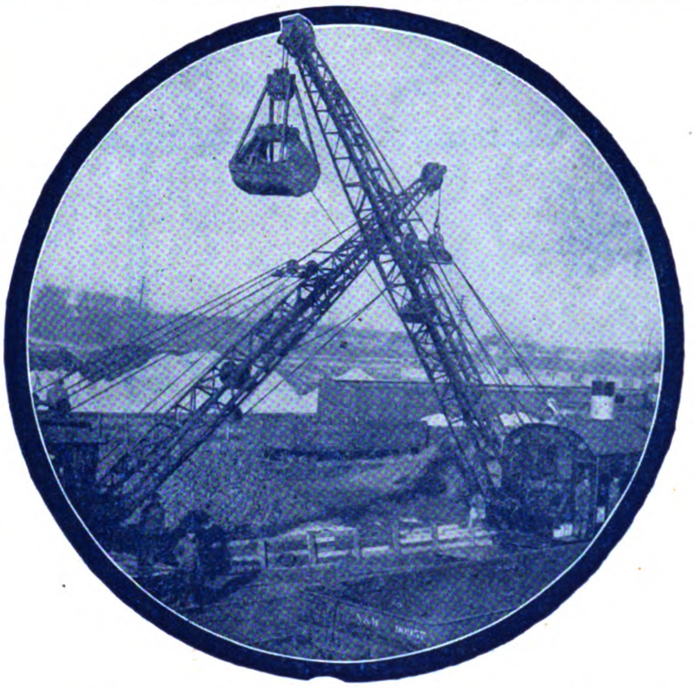
"UP CLOSE"

A Close Up Picture of the Forces Behind the Anti-Japanese Agitation of 1919-20

SPILLING THE SIBERIAN BEANS
HAVE FAITH IN COOLIDGE
THE CAUSE OF ALL THE TROUBLE IN CHINA
IS CHINA TURNING RED?
UNIFICATION BY MEANS OF FREE TRADE
MOTIVE POWER DEVELOPMENT ON PEKING-SUIYANG RAILWAY
NEW O.S.K. MOTORSHIPS
MALAYAN COLLIERIES
BANGKOK'S TRAMWAYS
TOBACCO INDUSTRY OF KOREA
GREATER OSAKA
NEW HOME OF MORRISON LIBRARY

Vol. XXI | January, 1925 | No. 1

A. S. TAYLER



Cut Cost By Better Material-Handling

Browning Locomotive Cranes handle heavy materials better, faster, and cheaper, making savings that result in added profits.

Actual service records of Browning Cranes show decided economies in all industries where heavy materials are handled. They operate with equal efficiency with hook-block, magnet, bucket, wood grapple, drag line, pile driver and steam shovel attachments and as a switch engine.

Put a Browning to work. It will quickly pay for itself out of its savings. Complete descriptive literature on request.

The Browning Company

16226 Waterloo Road
CLEVELAND, OHIO, U.S.A.

New York **Philadelphia** **Chicago** **St. Louis**

Sales Agents:

Portland **Los Angeles** **San Francisco** **Montreal** **Birmingham**
London, England

BROWNING

LOCOMOTIVE CRANES AND BUCKETS

TRADE MARK

"PALMETTO"

is the ideal packing for far distant points where the transportation is so long as to affect most packings.

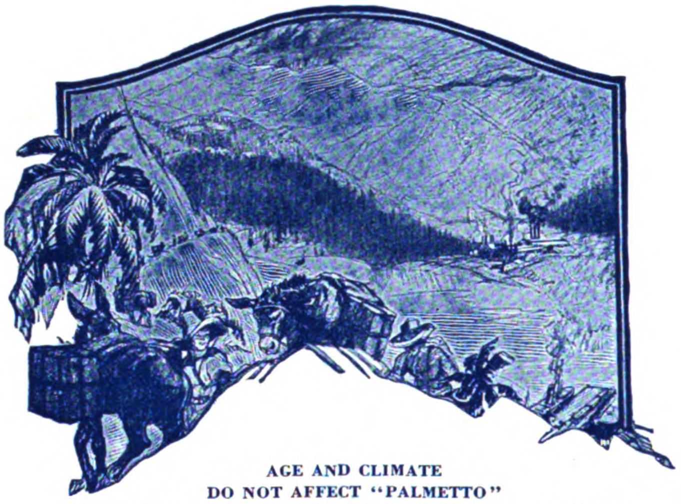
"PALMETTO" IS THE MOST ECONOMICAL PACKING ON THE MARKET BECAUSE

It lasts so long, not so much of it is required.
It contains no rubber, therefore climatic conditions do not affect it—its quality is the same in the tropics as elsewhere.
The quality of "PALMETTO" is always the same as the materials of which it is made are not affected in any way by age.

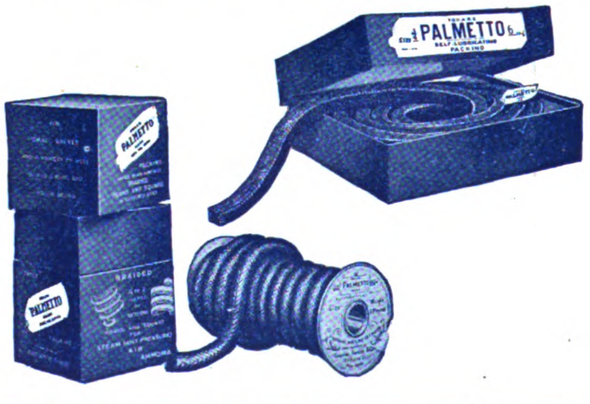
"PALMETTO" is made to give economical service, not to effect frequent sales.

For steam, especially high pressure, superheated steam and compressed air "PALMETTO" is without an equal.

Free working samples sent to prove the economy of "PALMETTO'S" long service.



AGE AND CLIMATE
DO NOT AFFECT "PALMETTO"
as it contains no rubber or other substance that can be so affected



GREENE, TWEED & CO.

Sole Manufacturers,

109 Duane St., New York, U.S.A. Stocks carried by

China, Shanghai — E. W. Langdon & Co.
Japan, Tokyo — Horne Co., Ltd.

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum

VOL. XXI JANUARY, 1925 NO. 1

CONTENTS:

	PAGE
"UP CLOSE"	*1
SPILLING THE SIBERIAN BEANS	3
THE BRITISH BOXER INDEMNITY	5
A "DAWES PLAN" FOR CHINA	5
THE ROOT OF ALL THE TROUBLE	*6
IS CHINA TURNING RED?	8
UNIFICATION BY MEANS OF INTERNAL FREE TRADE	9
PERFECTLY SOUND AMERICANISM	10
HAVE FAITH IN COOLIDGE!	*11
INDIAN RAILWAY MAKE DRASTIC CHANGES	13
NEW FIREFLOAT FOR THE HONGKONG GOVERNMENT	13
GREATER OSAKA	*14
TEST OF THREE-CYLINDER LOCOMOTIVE FOR THE SOUTH MANCHURIA RAILWAY	*16
MOTIVE POWER DEVELOPMENT ON THE PEKING-SUIYUAN RAILWAY	*20
BRITISH CONTRACTS FOR THE FAR EAST	22
A BIG ENGINEERING PROJECT FOR FAMINE RELIEF	*23
NEW HOME OF THE MORRISON LIBRARY	*25
VALVES FOR IRRIGATION WORKS	*26
RESTORATION OF THE WORKS OF THE NIPPON ELECTRIC COMPANY, LTD.	*27
NEW MOTOR SHIPS FOR THE O. S. K	*28
THE TOBACCO INDUSTRY OF CHOSEN	*31
IRRIGATION AND RIVER CONTROL IN THE N.E.I.	*35
DOES AGRICULTURAL IMPROVEMENT PAY?	40
WORTHINGTON LOCOMOTIVE FEED WATER HEATER	*41
BANGKOK'S TRAMWAYS AND LIGHTING	*43
GAS PRODUCER POWER PLANT WITH PHILIPPINES	*45
MALAYAN COLLIERIES, LTD.	*46

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allen & Co., Ltd., Edgar 11
American La France Fire Engine Co., Inc. 31
American Locomotive Sales Corp. 25
American Tool Works Co. 1
Associated British Locomotive Manufacturers for China 49
Attwater & Sons 48
Avery, Ltd., W. & T. 11

Babcock & Wilcox, Ltd. 31
Baldwin Locomotive Works 65
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 5
Bethlehem Steel Export Corp. 73
Bliss Co., E. W. 19
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Browning Co., The .... Cover
Bucyrus Company 7
Buhler Brothers .... (Text) 48
Butterfield & Swire 44

Canada Carbide Co., Ltd. 70
Chambers Scott & Co., Ltd. 14
Chartered Bank of India, Australia & China 48
Columbia Ribbon & Carbon Mfg. Co. 70

Daido Electric Power Co., Ltd. 28
Dai-Ichi Ginko 62
Dai Nippon Brewery Co. 34
Diamond State Fibre Co. 15
Dixon Crucible Co., Joseph 70
Dodge Brothers 3
Drewry Car Co., Ltd. 13

Electricity Department, S. M. C. 4
Escher Wyss & Cie. 16
Etchells Congdon & Muir, Ltd. 14
Evans & Sons (Wolverhampton), Ld., Joseph 2

Fairbanks Co. 35
Fairbanks Morse & Co. 34
Fuji Gassed Spinning Co. 10

Gas & Fuel Plants, Ltd. 14
General Fireproofing Co. 41
Gleniffer Motors, Ltd. 13
Goodbrand & Co., Ltd. 6
Goodell-Pratt Co. 35
Green Island Cement Co., Ltd., The 20
Greene, Tweed & Co. .... Cover
Greenfield Tap & Die Corp. 21

Hasler Telegraph Works 36
Heinemann, A. G., Gebr. 19
Hongkong Rope Manufacturing Co. 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co., Ld. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. 58
Ingersoll-Rand Co. 75
International Banking Corporation 55
International General Electric Co., Inc. 51

Japan Sugar Co., Ltd. 6
Jardine Engineering Corporation, Ltd., The 12
Jones & Lamson Machine Co. 63

Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. 10
Kawasaki Dockyard Co., Ltd. 33
Kellogg Switchboard & Supply Co. .... Under Index
Kelvin Bottomley & Baird, Ltd. 27
Kitchen & Wade 62
Kjellberg Successors, Ltd. 74
Kokusai Kisen Kaisha 45

London Directory Co., Ltd. 61
Louisiana Planter & Sugar Manufacturer, The 62

Manning, Maxwell & Moore, Inc. 14
Mather and Platt, Ltd. 2
McConway and Torley Co. 74
Mills & Manning, Inc. 52
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd. 38
Mitsubishi Marine & Fire Ins. Co., Ld. 38
Mitsubishi Shoji Kaisha 18
Mitsubishi Warehouse Co. 38
Mitsubishi Zosen Kaisha, Ltd. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. 18
Mitsui Bussan Kaisha 26
Motor Rail & Tram Car Co. 5
Mustard & Co. 74

Nippon Menkwa Kabushiki Kaisha 50
Nippon Yusen Kaisha 46, 47
Nipponophone Co., Ltd. 63
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. 24
One Hundredth Bank, Ltd., The 59
Osaka Shosen Kaisha 42

Pooley & Son, Ltd., Henry 4

Redpath Brown & Co., Ltd. 15
Reyrolle & Co., Ltd., A. 27
Ridgway Dynamo & Engine Co. 17
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 5

Sale & Frazar, Ltd. 8
Shanghai Dock & Eng. Co., Ltd. 32
Shanghai Municipal Council 4
Siemens China Co. 36
Smidth & Co., F. L. 72
Smooth On Mfg. Co. 15
South Manchuria Railway Co. 64, 68, 69
Standard Oil Co. of N. Y. 29
Standard Underground Cable Co. 36
Stewarts & Lloyds, Ltd. 16
Sturtevant Co., B. F. 63
Sulzer Bros. .... (Text) 48
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd. 60
Superheater Co., The 27

Thornycroft & Co., Ltd., John I. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 7

United States Steel Products Company .... 23, 37, Back Cover

Walworth International Co. 72
Westinghouse Electric International Co. 78
Williams & Co., J. H. 7
Worthington Pump & Machinery Corporation 71

Yarrow & Co., Ltd. 21
Yokohama Dock Co. Ltd. 34
Yokohama Specie Bank, Ltd. .... Cover

KELLOGG RADIO SETS

KELLOGG RADIO PARTS

Kellogg radio parts have long been recognized as of the highest standard in radio equipment. We carry complete stocks of parts from which the amateur and professional radio fan may select and build his own set.

We also carry complete stocks of the famous "Symphony" radio receiving sets, A and B radio batteries and radio equipment.

"USE IS THE TEST"

Sets $30.00 and up

Kellogg Switchboard & Supply Company

Head Office and Factory, Chicago, U.S.A.

62 KIANGSE ROAD — SHANGHAI, CHINA

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

Vol. XXI SHANGHAI, JANUARY, 1925 No. 1

"UP CLOSE"

A Close-up Picture of the Great War Comedy Entitled "Slipping the Skids Under America" as Thrown on the Screen by "Upton Close" in "The Land of the Laughing Buddha" Published by G. P. Putnam's Sons

LITTLE by little the truth is coming to light concerning the origins of the great Japanese war scare of five years ago. Each new writer on Far Eastern affairs contributes evidence which reveals the existence of a wide-spread organized movement to railroad the United States into war with Japan over China. The facts connected with this movement were so clear that The Far Eastern Review several times called for a congressional investigation in order to open the eyes of the American people to the ramifications of a campaign which derived its impetus from a group of misguided fanatics holding office under the Wilson administration. The proofs which the American authorities were reluctant to face are now being retailed through the confessions and admissions of facts by various participants in the movement and it is only necessary at this time to sum up the evidence and arrive at a proper verdict. If the American people ever understand just how close they were to being plunged into war with Japan by this utterly irresponsible group working in close co-operation with propagandists and professional agitators in the pay of China and Germany they will appreciate how difficult was the task of averting a catastrophe which confronted President Harding when he came into power. In this, they will be assisted by the testimony of Mr. Josef Hall, who under the pen name of "Upton Close," contributes several missing links in a chain of evidence which only needs a few more facts to close the case.

The ramifications of the movement and the complete evidence upon which a verdict must rest are so scattered and voluminous that it would require a special book in itself to describe its workings. In order, however, to arrive at a full understanding of the value of Mr. Hall's testimony, it is necessary to invite attention to the high points of a campaign which culminated in the resignation of Dr. Paul S. Reinsch from the American diplomatic service in a letter to President Wilson demanding an immediate "show-down" with Japan, followed by his acceptance of the post of high-adviser to the Chinese government. With a minister at Peking imbued with pro-Chinese ideas, an organization was perfected in which the usefulness, loyalty and standing of Americans was measured by their readiness to espouse the cause of China.

Reinsch surrounded himself with men whose minds worked in harmony with his own; men obsessed with the idea that their country must fight Japan in order to save China. Long before the termination of the great war, preparations were made in Peking to indict Japan before the world as soon as peace was declared, evidence of which is seen in the activities of the Anglo-American Association of Peking and in their confidential literature handed out to every prominent American visitor. We have the confession of "Putnam Weale," a British adviser to the Chinese government, of the existence of a secret treaty of alliance between China and America providing amongst other things that China would hand over her ports and naval bases to the American fleet and keep the Japanese occupied in the Gulf of Chihli until the arrival of the American expeditionary forces.

The remarkable thing about this alliance, was that the American government, the American legation, American residents and American members of the Anglo-American association of Peking were maintained in the most profound ignorance of the part they were expected to play in this great war conspiracy. On the other hand, the inside facts were so fully known to a British adviser to the president of China that he was able to reveal even the text and detailed plan of campaign to the prime minister of Canada, publish them in his book and in a series of articles in a North-China daily newspaper without even a denial or challenge on the part of the American authorities or residents in Peking. This provided the Japanese government with the opportunity to request the American ambassador at Tokyo for an explanation. After cabling to Washington and making a categoric denial of America's knowledge of or participation in this secret war alliance, Ambassador Warren took the next train to Peking, where, we understand, he conveyed the sentiments of an outraged administration to interested parties.

Here we had a military and naval attaché tireless and ceaseless in uncovering every scrap of evidence that might convict Japan of aggressive designs upon China, yet right under their very nose they were being made the dupe of another group who had the plans of a campaign drawn up in advance for the benefit of the American army and navy in a war with Japan. The facts which have since come to light fully convict these men of gross partiality and inability to properly represent their country in such a grave crisis.

We have the evidence in the published reports of the Senate committee on foreign relations of Mr. Thomas F. Millard's efforts to break the Versailles peace treaty over the Shantung decision, in which he was aided by a group of Chinese who accompanied him from Paris for this particular purpose. We recall that he publicly declared that war with Japan was the only way to restore China's sovereignty over this territory. We also recall that this appeal echoed the sentiments of the chief Far Eastern expert of the American delegation to the peace conference, who exclaimed on learning of the Shantung decision, "This Means War"!

Just after America entered the war against Germany in 1917, Mr. Thomas F. Millard established a new weekly newspaper in Shanghai in which he was associated with Mr. J. B. Powell, who in due course became secretary of the American chamber of commerce of China, in full charge of its correspondence, official and otherwise. In fact, this representative body of American business men during and for two years after the war became an adjunct to *Millard's Review*, the most fanatically anti-Japanese newspaper ever printed.

While Mr. Millard was in Washington advocating war with Japan over Shantung, his associate, representing the American chamber of commerce, was sending circular letters to firms at home urging them to write to their congressmen and senators to demand from the state department the secret reports on Japan's activities in Shantung and have them read into the congressional record; a frank incentive to hostilities. The inference was that the chamber of commerce had full knowledge of the contents of these reports. The secretary of the American chamber of commerce at Tientsin also sent similar letters to American firms at home,

stating in effect that only armed force could drive the Japanese out of Shantung; another open invitation for America to tackle the job.

THE FAR EASTERN REVIEW subsequently proved from the consular records that some of these reports were false and misleading and was able to correct the statement that Japan had discriminated against American trade in Shantung. All this is a matter of record. Now comes Mr. Josef Hall, who confesses that he was the investigator who for two years (1917-1919) journeyed through Shantung dressed in Chinese clothes and flooded the state department with reports about conditions in that province. Let us quote Mr. Hall (see page 31 of his book):

"Sometime previously I had decided that reams of reports filed in the state department would have less influence in saving Shantung to China than a few stories in American newspapers. I sent some articles secretly to my friend, J. B. Powell, editor of the Shanghai *Weekly Review*, the same Powell who was a prominent American captive in the kidnapping (Lincheng) case. Under the stories I put the words 'Up Close' as an indication of where I was. Powell ran them as the author's name under the title. They evolved into 'Upton Close' and the name has stuck to me since."

Mr. Hall fails to enlighten his readers as to his connection with the state department or who authorized and sent him into the interior of Shantung to save the province for China. In the opening sentence of Chapter IV., Mr. Hall mentions the name of a Chinese friend and trusted fellow investigator thus revealing that others were colaborating with him, and that reports of Chinese investigators were being forwarded to our state department. We are assured, however, on the highest possible authority, that Mr. Hall was not an accredited agent of the state department, that the voluminous reports he refers to, were not only officious but a piece of downright impertinence, in which many Americans indulged as a patriotic pastime during the war. Now, if the state department did not employ Mr. Hall, who did? This is a pertinent question, for if Mr. Hall was not employed by the state department there is reason to believe that he was one of the volunteer agents of the military or naval intelligence service and that his confidential reports to these officials were duplicated in whole or in part to a newspaper whose publisher and editor were distinguishing themselves as leaders of the anti-Japanese campaign. Recalling the circular letter sent by the secretary of the American chamber of commerce in which the attention of American firms was called to the existence of these secret reports and Mr. Hall's admission that he was sending his stories through Mr. Powell, whose chief was at Washington agitating for war with Japan; recalling that the American minister at Peking was strongly urging President Wilson to provoke a "show-down" with Japan and that a secret Sino-American military alliance had been carefully drawn up in Peking in preparation for the conflict, the admission of Mr. Hall permits us to view a very clear close-up picture of the forces that were operating to precipitate a crisis.

There are other interesting revelations in Mr. Hall's contribution to recent Far Eastern history. The Lincheng train hold-up is still fresh in the memory of our readers. One of the kidnapped passengers was the same Mr. J. B. Powell, referred to above. Mr. Powell did his utmost through newspaper correspondence to connect the Japanese with the Shantung bandits, offering as proof of his accusation, the allegation that they were armed with rifles made in Japan and marked with Japanese characters. His co-worker, however, makes the following startling admission on page 20 of his new book:

"Most noticeably was this in the case of the famous train hold-up in Southern Shantung, which was not without its sardonic aspect. America took arms to Vladivostok to fight the Russians, then withdrew and left them in the care of the Japanese. A Japanese officer allowed 'White' partisans to ship the arms to Chang Tso-lin, independent ruler of Manchuria. He, in turn, desiring to embarrass the leaders south of the great wall who had recently defeated him. permitted a quantity of these good American rifles to be smuggled along the Shantung coast. Shantungese brigands used them to kidnap and rob American and other tourists!"

In other words, Mr. Hall consigns his intimate friend to a very prominent place in the Annanias club. Yet is was on the strength of such conflicting testimony that the American people were prodded to a point where the Washington conference alone saved them from the horrors of an Asiatic war.

There are many other interesting revelations in Mr. Hall's book. The reader is left somewhat in doubt as to who really drove out the Anfu and Chang Tso-lin cabinets. The impression remains that although Wu Pei-fu was a great general he was fortunate in having Mr. Josef Hall as his chief of staff and adviser. At any rate it is now quite clear why Wu Pei-fu lost the recent war. "Up-Close," unwittingly perhaps, has performed a patriotic duty, making it possible for the intelligent public to get a close-up picture of a game that can never again be played in the life-time of this generation.

Notwithstanding Mr. Hall's confession of impartiality and admiration for Japan, there is nothing in his book to justify such an asseveration. Whatever the Japanese did was wrong. The book is replete with instances which prove this. Mr. Hall waxes wroth over the erection of a *yoshiwara* in Tsingtao but speaks rather nicely of the sing-song girls who travel on the Chinese railways to cheer the Chinese soldiers "without other pass than their long black braids." He goes into hysterics in describing how a Japanese officer beat a coolie with the flat of his sword, how the Japanese gendarmes took baked sweet potatoes from confectionary stores without paying for them and ogled the Chinese girls. He describes his adventures with the Japanese passport officer at Tsingtao, whose only offence as far as we can gather was his habit of sucking in his breath. Its a good thing for Japan that her officials in China did not take kindly to the favorite North-China vegetable, for had they done so and exhaled their breath on Mr. Hall, nothing could have stopped a war between their country and the United States. Hall lived up-close to the Shantung coolies for over two years and was immune to their garlic laden exhalations. He evidently liked it, but would never have stood it from the Japanese.

Mr. Hall very carefully refrains from enlightening his readers as to the results of his investigations in Shantung nor does he give us an insight into these wonderful reports filed with the state department, but he does give us the inside history of the salt rebellion in Shantung where the salt workers in a certain district armed with "Japanese" rifles closed up all the revenue agencies and chased the tax collectors out of the country. Like his co-worker, Mr. Powell, he jumps to the conclusion that possession by the Chinese of a rifle made in Japan is conclusive evidence that Japan is behind any movement in which such rifles are employed. He overlooks his former statement about the use of American-made rifles by the bandits who held-up the train at Lincheng. That was merely a "sardonic" coincidence. He also ignores the very important fact that the Japanese group in the consortium is equally interested with its partners in preserving intact this security for the reorganization loan. The following extract will indicate the curious working of Mr. Hall's mind:—

"I sent the story of the salt rebellion to the press. Then I traveled with Weston to Chefoo where he put the situation before his superior, a big-hearted but bluff Britisher named Pearson.

"My interview with this upholder of British prestige in Asia was one of the most interesting I have ever had. The first fifteen minutes Pearson did all the talking and all his words were bloody cuss-words. It was outrageous in his opinion for me to give publicity to an incident so damaging to the prestige of the foreign (British?) salt gabelle. And how, I asked him, after the torrent of abuse had run out, did he propose to meet the emergency?

"He had arranged for a Chinese war-ship to come and blow Gold Harbor, one of the largest native ports, into fragments as a warning to the Chinese people of the dangers of listening to Japanese seduction or holding out for the prerogatives given them by a mediæval emperor.

"The upshot of the matter was characteristic of the British genius in dealing with the Oriental.

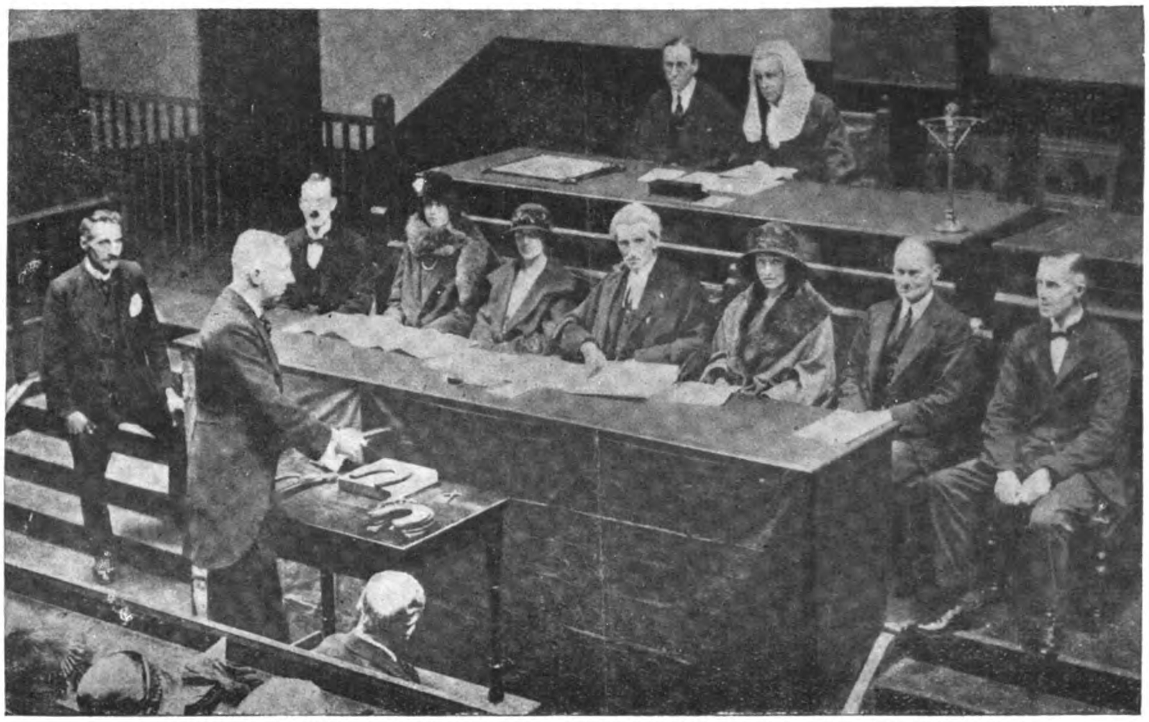
"Gold Harbor was laid in ruins and armed resistance thoroughly suppressed. Then, with a hearty expression of appreciation for the honesty of the mistaken natives whom it had been necessary to subdue, the salt inspectorate royally offered the Shantungese salt makers a compromise. To-day there are none of its revenue more sure than those it derives from Shantung."

Note that the British official responsible for this crime against the Chinese people is described as "big-hearted, bluff individual characteristic of the genius of his countrymen in dealing with the Oriental." In no place in Mr. Hall's book does he produce any

satisfactory or conclusive evidence that the Japanese mistreated the natives of Shantung, nothing that compares in sheer brutality and horror with blowing a town off the map because its inhabitants refused to surrender the rights of tax-emption conceded to them five centuries ago. Mr. Hall tells us their story.

"Far back in Chinese history," he says, "the throne got possession of the salt industry as its principal source of revenue. These men became in a sense the business assistants of the emperor, who levied a tariff on their output. About the time Columbus discovered America, a minister of state who had risen from poverty in Shantung through the civil service saved the career of a Ming emperor. Asked what he would have as a reward, he requested tariff immunity on the output of the Shantung salt-makers, so that the people of his native province might have cheap salt. This arrangement continued through the Ming dynasty and was respected by the alien Manchu dynasty which followed. Then came Yuan Shih-kai and his foreign loan, secured upon the imperial salt revenue. As a result, foreigners—largely Britons—were put in charge of the revenue collections. These men had no respect for the old Ming emperor's concessions. They were determined to enforce the impost equally upon all salt-producing regions."

And to do this, according to Mr. Hall, they blew a Chinese city off the map! As we transcribe the above story, our eyes wander to an illustration in the *Mid-Week Pictorial* of the *New York Times* of November 13, and rest on a ceremonious farce in which a bewigged judge is supervising the counting of six horse shoes in a London court, legal tender for rents of crown lands within the city which has been paid in this manner for 700 years! "The King's remembrancer," it is called, supposedly, in return for some favor to the king by the lessee of the lands. British justice recognizes the validity of this concession after all these centuries even at a great loss to the revenues of the city of London. Is it possible that this same broad sense of justice and honor as interpreted by a "bluff, big-hearted" British collector of the Chinese salt revenues, would take the form of blowing a Chinese port to pieces for insisting on the validity of a similar right?



WHERE A HORSESHOE IS LEGAL TENDER: THE KING'S REMEMBRANCER.
Sir T. Willes Chitty Supervises the Counting of Six Horseshoes in the Law Courts in London, Rent for Grants of Crown Lands in the City Which Has Been Paid in this Manner for 700 Years.

Mr. Hall wrote his book to make out a case against Japan. Instead, he places the British community, the consortium and the salt-gabelle in a most embarrassing position. If his story of the salt rebellion is true, a grave injustice has been done to the Shantung salt-makers and justice demands that immediate amends be made by a restoration of their ancient privileges. The salt surplus is more than sufficient for the service of the reorganization loan and the remission of the Shantung taxes will not affect the value of the security. Is his story false? Then it is squarely up to the head of the salt-gabelle publicly to denounce it. It is equally incumbent upon the group leaders of the old consortium to clear themselves of any participation in such an outrage.

It is just such incidents which have undermined foreign influence and prestige in China, consolidated the opposition of the Chinese people to any further foreign loan secured on revenues collected under foreign superivsion and provided leaders like Dr. Sun Yat-sen with the only platform that will unite the country under one leadership. We leave Mr. Josef Hall to the tender mercies of our British colleagues and pass on to another close-up picture of the same period.

G. B. R.

Spilling the Siberian Beans

Another Close-up Reel of the Great Japanese-American War Drama in which the Author and Hero gives to the World an Intimate Picture of the Anti-Japanese Movement in the Siberian Campaign

"Siberia's Untouched Treasure" by C. G. Fairfax Channing, D.S.C., Military Cross, etc. Published by G. P. Putnam's Sons

AT the height of the anti-Japanese campaign of five years ago the Far East swarmed with American army officers and soldiers who had seen service in Siberia. The stories they told about the conduct of the Japanese troops and the cruelties practiced by them on their Bolshevist prisoners were seized upon and magnified by the war-mongers in order to further incite American hatred against Japan. We recall one of these stories which went the rounds until it became a classic. The story concerned the beheading of five Bolshevist prisoners by a Japanese army officer and the bayonetting of the bodies after decapitation. We heard this story from several different sources and when passing through Tsingtao in 1921, told it to Dr. Akiyama, the Japanese civil administrator at that port. Dr. Akiyama is one of Japan's foremost jurists and authorities on international law, the author of the military code which now governs her army. He was amazed, dumbfounded and indignant that such a story should be circulated. He requested the exact information that would identify the place, and the troops concerned in the execution, and said that if these were placed in his possession he would resign his post at Tsingtao,

proceed to Tokyo and Siberia and not rest until the honor and good name of the Japanese army had been vindicated by the punishment of the guilty parties. It was impossible, however, to obtain the exact information at that time from those responsible for the circulation of the story.

The facts are now revealed in another new book, entitled "Siberia's Untouched Treasure" by C. G. Fairfax Channing, published by G. P. Putnam's Sons. Channing was an American army officer, who has evidently "spilled the beans" about the Siberian campaign. He describes the execution of these five Bolshevists prisoners and arraigns the Japanese nation as barbarous, vicious and uncivilized for the actions of one Japanese officer who played the part of executioner. His book is filled with the accounts and illustrations of Bolshevists atrocities and bears testimony to how hard it is to keep from beating them to death when captured.

To give way to such impulses is barbarous, but he thinks it is quite jolly and sportsmanlike to conceal one's bloodthirsty instincts behind the "*ley de fuga*."

"There is hardly a soldier in the ranks," Channing says, "who does not want to do away at once with an enemy he knows has killed one of his friends. To that soldier the sweetest words you can say are: 'Take this prisoner to gather some wood. If he attempts to escape, shoot him.' Soon off in the distance a shot will be heard—perhaps two—nothing more.' Then about dusk the soldier guardian of the prisoner will walk up, salute and report, 'Sir, that prisoner tried to escape.' That is all. Feigning sleep while the prisoner worked, the sentry waited for his quarry to turn and bolt. That is all he wants. *The rest is play and fun and is entirely within his rights and those of humanity, and is covered by international law.*" (The italics are ours.—Ed.)

Lieutenant Channing admits that the Bolshevists did the same with every Japanese they captured and the Japanese only retaliated by meting out similar treatment when the Bolshevists fell into their hands. Now it is just possible that the American soldiers in Siberia would have showered kindness upon their Bolshevist prisoners if the latter had coldly tortured and put to death every American prisoner taken by them. Again, it is just possible they would not. At any rate, it is difficult for us to draw a mental picture of such generosity, notwithstanding that we returned good for evil in the handling of German prisoners during the great war. Conditions were somewhat different in Siberia. The Japanese soldiers may "have looked upon their dead" as others before them have done, and with the same result. It is difficult to indict a nation for the acts of some of its soldiers sorely provoked by an unscrupulous enemy. It is still more difficult in the case of Japan to wipe out the wonderful record for chivalry established by its army in the Boxer troubles and in the war with Russia by accusing it of barbarity in a conflict where honor was conspicuous by its absence in the Red forces of Bolshevism.

We are noticing Mr. Channing's book at length as it is the first story by an American giving the inside facts about a campaign in which the American army was employed against the advice and wishes of President Wilson's highest military advisers. The book is replete with first hand testimony revealing the mental attitude of the average American soldier towards the Japanese. It is filled with glaring and unpardonable inconsistencies which help us to understand something of the mob psychology of an element whose stories were accepted by the people at home as international wisdom of a high order.

There is a special reason for inviting attention to this book at this time. In the early part of last month, three Americans, one of them an attaché of the embassy in Tokyo, were traveling on the night express from Tokyo to Kyoto. After dinner in the dining car they proceeded to match dollars to see who would pay for the repast and were told by the train attendants that gambling was not allowed. Whether they understood or not is beside the question, but at the next station they were unceremoniously bundled off the train with their baggage by the local police and kept in custody for several hours before being permitted to proceed on their journey. Naturally, these young gentlemen were highly indignant and as the story became known to the public, all foreigners in Japan and throughout the Far East sympathized with them.

Now the Japanese are avid readers of all new foreign books about their country. Mr. Channing's book devotes at least half of its pages to Japan and the Japanese army in Siberia. It arrived in Japan some time in October. Imagine the feelings of the Japanese reader when he comes to this passage on page 102-103:

"While many of the Japanese are very shrewd there are many whom the traveler encounters, entirely the contrary. On the trip from Shimonoseki to Kioto on the little toy-like railroad train, an American officer and I happened by accident to get into the private compartment of some royal dignitary, a prince as I remember; and as the coaches were rapidly filling we closed the door and prepared ourselves for a very enjoyable journey through the terraced farm country of the island. After a few miles a young-looking train attendant discovered our presence in his highness' coupé and began a rapid but meek series of expostulations which, although it all went over our heads, we understood to mean:

"'You must not ride here, please, because this is only for my, or rather his highness, the 'so-and-so-of-such-and-such." I happened to have bought a Japanese dictionary of self-instruction and conversation with the expressions needed by the traveler, and being reluctant to give up our illegal possession of his highness' comfortable cushions I took it out and began asking him funny questions from its pages while my partner in the crime began to give him choice cigarettes and spearmint gum to chew. This gave me time to look up the next remark to spring. I asking him, 'Are your ears cold?' 'Press the button and drinking water comes from the pipe.' 'Is your wife in America now?' At these he laughed and closed the door lest the train conductor see him hob-nobbing with us on forbidden ground. After a few moments he gave us up as rocks and left us to our comfort. Luckily, at the next station we reached out of the window and bought some fruit and some of the tasteless Japanese candy; for as soon as the train started again in walked the conductor and the boy together. We said to each other: 'Lay on McDuff,' and started the same tactics again, with similar success. Not, however, before we had led them into an undignified game in which the four of us sat on one side of the compartment and snapped orange pits across at a picture of the Mikado on the opposite wall. We let the zealous little fellows excel us in this strange marksmanship. Finally we were given up by the two natives as immovable, and they surrendered the compartment to us. Later in the day two other sight-seeing Americans— secretaries at the embassy in Tokio—boarded the train and spying us in the ultra-first-class coupé asked laughingly: 'How low must we bow before entering here?' We assured them that we had joined the crowned family only for the trip and that we had left all our bodyguard behind so that it was safe for them to come in. We finished the trip with a card game and tiffin in the dining-car at which I, not relishing the rice *a la nicotine*, partook of several pieces of fruit from the heaping bowl; at which the attendant threw up his hands in horror and, counting the tangerine peelings, charged me five *sen* (two and one-half cents) for every piece of fruit over one that I had taken."

"At every station the entire populace bowed to the royal coat of arms on the side of our car; and then when they saw our American faces appear at the windows instead of their prince they fell back in disappointment."

Had this happened in any other country but Japan the gay young army officer and his companions would have been ejected bodily from the car, yet Lt. Channing seizes on this characteristic exhibition of Japanese courtesy as an opportunity to lampoon and insult them. Now the Japanese may not all understand English, but they are not fools. That Mr. Channing and his friends were permitted to outrage all their finer sensibilities, insult their emperor and get away with it, was due solely to the fact that they were American army officers. Even the Chinese would never have stood for this flagrant abuse of traffic regulations and insult to their rulers. The Japanese had just about finished reading this book and given the necessary instructions to their railway police when the young man from the American embassy and his friends started their dollar matching game on the Tokyo-Kyoto express. They have no kick coming to them. The wonder is that they were not punished to the full extent of Japanese law. That they were liberated as soon as their identity became known is one more proof of Japanese courtesy and friendliness towards the people of the United States.

The British Boxer Indemnity

The federation of British industries has once more invited the attention of the secretary of state for foreign affairs to the need for industrial representation on the committee appointed to consider the objects to be financed out of the Boxer indemnity payments. The letter, which is signed by Sir Eric Geddes, president of the federation after, directing attention to previous correspondence regarding the constitution of the committee, continues as follows :—

" I need hardly say that the federation were keenly disappointed at the decision reached by Mr. J. Ramsay MacDonald that industrial interests should not be represented on this committee, more particularly in view of the definite assurance previously made by the Marquis Curzon of Kedleston in his letter to the federation of 16th May, 1923.

" The federation feel most strongly that the question of the application of these funds is directly of the greatest importance to industry in this country, and they cannot help feeling that the committee provided for in the China indemnity bill, as amended by the late government, is not sufficiently representative of all the important interests involved to give adequate and impartial consideration to the various schemes which will doubtless be put forward for the allocation of these funds. Moreover, there exists, in the opinion of the federation, a serious danger that a committee including two representatives of education without the presence of representatives of other important interests would tend to prejudice the important questions of principle involved in the allocation of the funds.

" The federation attach the greatest importance to the desirability of the committee being able to give the fullest consideration to all suggestions which may be put forward, whether educational or otherwise, and they maintain that such consideration cannot be given except by a committee on which industry and commerce are adequately represented.

" I sincerely trust, therefore, that you will see your way to reconsider the decision reached by your predecessor, and will make the necessary provision for the representation of industrial interests on the committee, in accordance with the original intention indicated in the Marquis Curzon's letter."

* * *

A "Dawes Plan" for China

Another Blunder

IT was a foregone conclusion that the proposal of a "Dawes Plan" for straightening out the finances of China would be rejected by the Chinese government and meet with the disapproval of the consortium. As soon as a government comes into power which holds out some promise of stability and some prospect of paying its obligations there will be no difficulty in devising a practical plan to place China on a satisfactory financial basis. The situation was summed up tritely two years ago by one of the group leaders in the following words : " If the Chinese would only stand still long enough, we might find as security that would justify us in lending them some money, but just as soon as we have a plan all figured out and are ready to slip a few millions into their pockets, a new crowd edges its way in between and with hands outstretched demand that the coin be paid over to them." This situation has not changed. It is chronic. There is nothing therefore to get excited about and a committee of business men would only make a bad matter ten times worse. The proposal which has received so much publicity loses sight of the following facts.

At the Paris peace conference, a new financial consortium was created for the purpose of assisting China to get on her feet. With the exception of the American delegates, the representatives of the other groups were experts in Chinese finance, contributing their store of accumulated knowledge to the American chairman in order that the new venture might work out for the benefit of all concerned. Conditions in China were chaotic. There was no government worthy the name. Every available and conceivable source of revenue had been hypothecated. China was bankrupt. As most of the bonds would have to be floated on the American market, the chairman of the consortium after careful consideration, selected the best bond lawyer in the United States to represent the group in Peking. He was instructed to make an exhaustive survey of conditions in co-operation with the other group representatives and in the event any honorable way could be found to lend money to China, to devise an iron-clad bond that could be sold to the American investor. This gentleman, Mr. Frederick Stevens, duly arrived in Peking, where it did not take long to ascertain that a Chinese loan could not be offered to the investing public without committing a crime that would have permanently ruined the standing of the issueing banks and landed the group leaders in a federal jail. Mr. Stevens, therefore, sat tight, waiting for a turn of the political wheel which might have provided an opening for the consortium to discharge its functions. All this time he was besieged by interested parties with inpossible loan schemes, until it became necessary for him to practically withdraw from the social life of the capital in order to escape their importunities. When these loan promotors finally understood they could not influence this uncompromising guardiam of the national honor, they resorted to innuendo and billingsgate in order to discredit him.

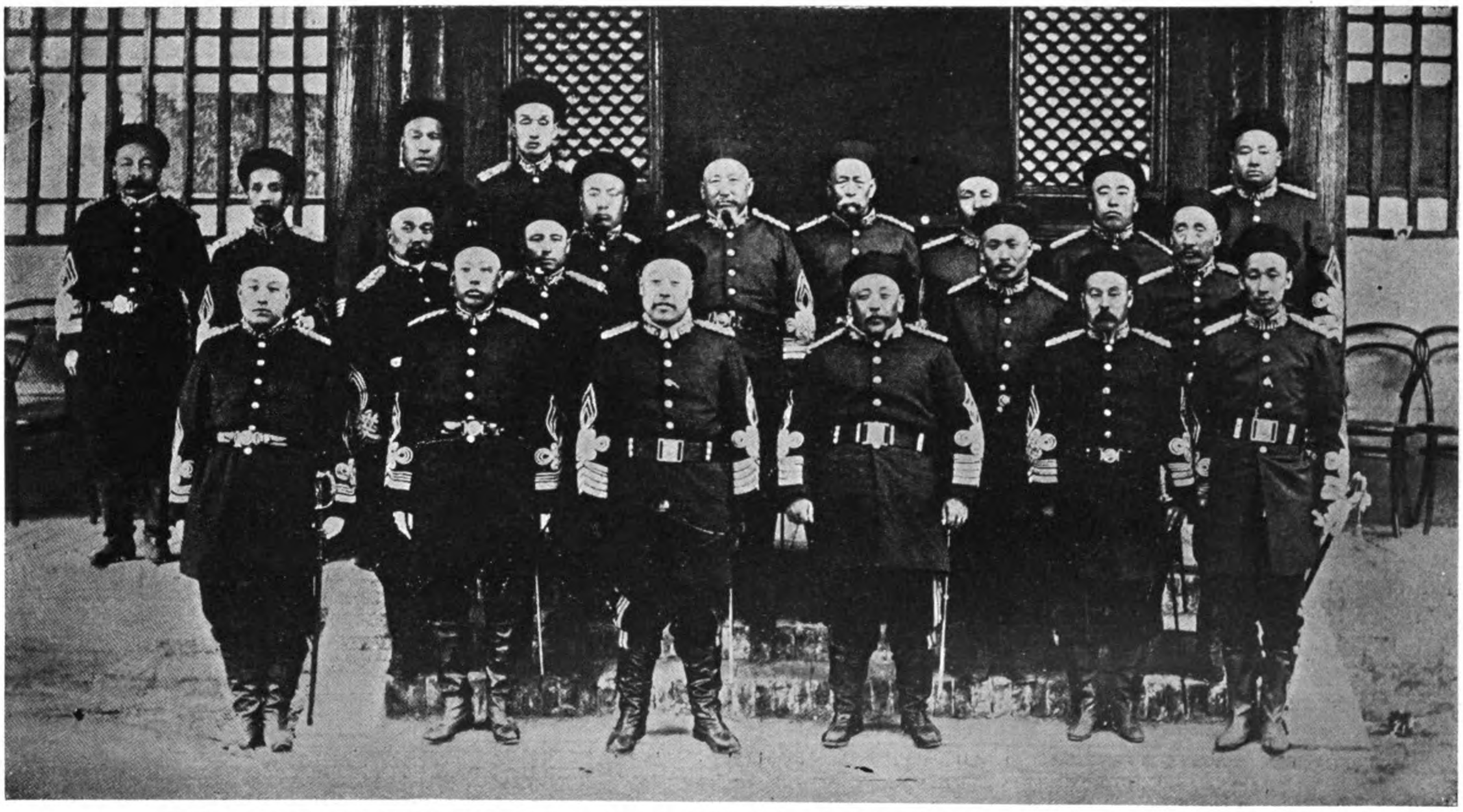
Americans had loaned money to China without security and for no particular purpose. American merchants had sold millions of dollars worth of materials to the Chinese government and could not collect. Some of these men, not all, faced serious financial difficulties as a result of China's lapse from honesty. In the main, they were willing to endorse any plan that would transfer this load to the pockets of the investor, forgetting that the nationals of other countries represented in the consortium were equally entitled to some sort of settlement of their just claims against the Chinese government. Faithful to his trust and loyal to his colleagues in the other groups, Mr. Stevens rejected all loan proposals pending unification of the country and the reorganization of China's finances under guarantees that all outstanding indebtedness would be taken care of. A campaign was then started to eliminate him and hand over the American leadership in China to others.

Other foreign commericial communities in China accept the heads of their respective financial groups as their leaders in all matters connected with finance. Americans alone refused to accept such leadership. Greater than Mr. Frederick Stevens, greater than J. P. Morgan & Company and the thirty-seven banks in the American group, greater even than the state department who created this instrument to carry out its policies in China, stood a little group determined to run things their own way. If J. P. Morgan & Company and the group refused to accept its leadership " pressure must be brought to bear to compel them to modify their viewpoint." American financiers were publicly advised to ignore the consortium and enter into independent negotiations with the Peking government. The self-imposed leaders of American interests in China determined to ignore the usual channels of communicating with the state department by going over the heads of the legation and consulates and appealing direct to congress and the public. Something happened about that time. For nearly a year there has been no further attempt to dictate the Far Eastern policy of the American government from the outside until the success of the Dawes plan for financing Germany provided an opening for advocating the application of a similar remedy to China.

It is immaterial who originated this idea. It is only necessary to point out that after using all the strength of its diplomacy and the financial power of the nation to create the consortium, the state department could not with honor or propriety make it lose face by requesting a body of business men to draw up a plan for it to work to, especially at the very time when its experts were actively engaged on the same task. For over a year the consortium has been conducting a most careful survey of China's indebtedness and her general financial and political condition on order to be prepared to carry out the object of its existence as soon as conditions are favorable. This report is nearly completed and will be in the hands of the group bankers within the month.

It is entirely natural that China's American creditors should make every legitimate effort to have their claims settled. They have carried the load a long time with little prospect of being relieved. So have the nationals of ther countries whose legitimate claims against the Chinese government have also been ignored and in some cases repudiated. The consortium was called into being by the American government for just such a situation. It cannot set aside this instrument without destroying its own prestige not only in China but with its three partners. In suggesting a scheme that relegates the consortium to a back seat, somebody blundered.

The Root of all the Trouble



THE ORIGINAL PEI YANG ARMY CHIEFS. PHOTOGRAPH TAKEN IN 1907

Front Row, from left to right: Colonel Yen Tun-yuan; Colonel Chao Chung-san; Tieh Liang, War Minister (only photo of the War Minister in Foreign Uniform); Yuan Shih-kai, Commander-in-Chief; General Feng Kuo-chang; General Wang.
Middle, from left to right: Surgeon-General Hsu Hua-ching, Director of Peiyang Army Medical College; Paymaster-General Lu, Director of Peiyang Treasury; General FengYu-mun; Colonel Lo Lang-tsai; General Tien Tsung-yu; General Hsu Kou-chung; General Sha Sin-yu; General Tuan Chih-kuei; General Tuan Chi-jiu; Colonel Chun Hsu-feng: General Ma Ling-piao.
Back, from left to right: Pan Ching-san; Colonel Yun Yu-tsun; Brigadier-General Chang Huai-chih

CHINESE politics can concern the foreigner only from two standpoints : first, in this period of the aftermath of the European war, it is unfortunate that the international relations of the whole world are further complicated by the altogether unwarranted disorders in China ; secondly, because the disorders here result in a stoppage of the modernization of the means of production and distribution of commodities, which means that trade relations and financial co-operation on a large scale between China and the industrial nations are impeded.

In both instances, more harm is done to China than to the foreign nations. For, when the officials of China conduct themselves like so many children in a gang fight, the rest of the world at first looks on somewhat amused and afterwards turns away in disgust. No one can afford the time or expense of helping to bring order to China. The great powers are too concerned with more vital questions to give this secondary problem any consideration. As for the stoppage of development enterprises, which has resulted in the boycotting of China by the financial markets of the world, big business naturally suffers a certain loss, but China suffers more, for her credit is impaired, her good name as a customer is lost, the possibilities for the future are not bright. At this moment China could not borrow a dollar even for a first-class proposition on any market without an intermediary such as the consortium guaranteeing the account, which is disgraceful for a nation of the size and wealth of this country. When the Chinese government defaulted on the payments of accounts for supplies for such commodities as locomotives, cars, steel, lumber, candles and kerosene oil, she cut herself off from the great commercial centres of the world. And until China pays these debts, not out of additional loans, but from her enormous revenue, which is now being frittered away in civil wars and corruption, there is little hope of any of her natural resources being developed as they should.

The question often arises, *What is the cause of China's troubles ? What should China be in this condition ? Why cannot China have the standing in the world equal to such small countries as Rumania and Latvia ?*

To these questions there can only be one answer :

When Yuan Shih-kai organized the model army of China on the Machang training camp he bequeathed to China a monster which has consumed the wealth of the country, brought famine and disorder, killed millions of human beings, destroyed crops and villages and made the land a prey to every selfish and predatory interest.

China to-day suffers from militarism, not the form of militarism which was so bitterly denounced during the war, not militarism which seeks national aggrandisement, the enlargement of frontiers, the seizure of the colonies of other nations. But militarism which attacks its own country, which makes its own people suffer, which brings within its own boundaries a veritable reign of terror. This is the curse of China's army.

A conservative estimate of the size of China's army is one million men. To this must be added approximately one million armed bandits scattered throughout the country. These two groups are really of the same personnel, because bandits are usually defeated soldiers, while soldiers are usually former bandits in regular employment. These two million men work under commanders whom they trust and who arrange for their employment. The commanders are usually men like themselves, graduates of the bandit camps, often from the provinces of Chihli and Shantung. These commanders make arrangements for employment with a scholarly type of soldier known as the division commander, *tuchun* or *tupan,* that is, the

soldier-politician who holds territory. The soldier-politician holds his territory by virtue of the support given him by these fighting mercenaries whom he must clothe and feed and whose chief must be given a opportunity for self-enrichment by being placed in a position where he can either "squeeze" the people or make a profit by the large but illegal trade in opium. When the fighters lose confidence in their soldier-politician, they sell out either to his enemy or to a subordinate in whom they have greater confidence. In the case, for example, of Wu Pei-fu, they sold out to his enemy. In the case of Chi Hsieh-yuan, they sold out to a subordinate.

It will be seen from this brief sketch of the military organization of China that no principle is involved in all this fighting: it is simply a matter of mercenaries preferring soldiering to banditry and seeking for a master who can supply clothes, food, quarters and the tools of their trade, arms and munitions. As long as a soldier-politician divides with his commanders, they fight for him and bring him revenue. When his exactions become so great that the people rise against him, they desert him, since his capacity to provide him with necessities has ceased. Should his political program be such that he cannot succeed, they desert him because his poor judgement gets them no profit. Should his conscience be superfine, they desert him because they regard his foolish scruples are harmful to their interests. If the history of republican China is judged from this standpoint, it will be found that every political and military event fits clearly into the picture.

The originator of this system of soldier-banditry was Yuan Shih-kai, often extolled by foreigners as a great and strong man, but in the light of history, as harmful and miserable a creature as ever any country produced. During the Taiping rebellion, it became necessary for China to organize a force capable of putting down the disorders. One force was organized in the Yangtze valley under the leadership of the Viceroy Tseng Kuo-fang, who preferred rich and scholarly men, fine looking young fellows of good families, who could not fight but who talked heroically. In the north, an army was organized under Li Hung-chang, who took farmers and bandits and the riff-raff of the north, hard, husky individuals, capable of learning the game of war and keen for power. This northern group eventually became the Peiyang army, the model army of China, under the leadership of Yuan Shih-kai.

A short history of this army was recently given in the *North-China Daily News* in an article by George E. Sokolsky, a correspondent who specializes in such matters:

"When Yuan Shih-kai was creating a model army he was assisted in his efforts by Feng Kuo-chang, Wang Shih-tsen and Tuan Chi-jui. And when some years later he was forced to retire to Honan after the death of the empress-dowager, Tszu Hsi, and the Emperor Kuang Hsü, his model army was nominally under an appointee of the throne, but it was actually commanded by Feng Kuo-chang and Tuan Chi-jui.

"Yuan Shih-kai was recalled in 1911 to save the tottering Manchu dynasty. He was re-appointed by imperial decree to assume the position of commander-in-chief of the model army, then known as the Peiyang army. At this time Feng Kuo-chang was engaged in suppressing the revolution at Hankow, while Tuan Chi-jui was in command of the troops in Peking and its vicinity.

"When the revolution had begun to show its teeth, Yuan Shih-kai obtained the assistance of Tuan Chi-jui in calling upon the Manchus to abdicate, and simultaneously ordered Feng Kuo-chang to prevent the rebels from advancing. At the same time, it is known that Yuan did not wish Feng Kuo-chang to gain a decisive victory over the revolutionists as it was his plan to impress the Manchus with his difficulties in overcoming the forces under Hung Hsin and Li Yuan-hung.

"The Manchus were forced to abdicate and, after a threat of invasion of the Yangtze by Yuan Shih-kai, the revolutionary government at Nanking abdicated in as graceful a manner as possible. This gave Yuan Shih-kai control of the situation and he was formally elected provisional president of the republic of China.

"Yuan Shih-kai had been out of touch with the officers and troops of the model army which had become accustomed to taking its orders from Tuan Chi-jui and Feng Kuo-chang. To prevent these two from combining against him, Yuan Shih-kai set about stirring up dissensions between them. Tuan Chi-jui was made minister of war in Peking, while Feng Kuo-chang was given the less important office of *tutuh* of Chihli.

"It was not long before these two military leaders were quarrelling, but unfortunately for Yuan Shih-kai neither Tuan nor Feng trusted him and their differences became a three-cornered fight. Yuan Shih-kai used mercenaries such as Lu Yung-ting, Chang Hsun, Lung Chi-kuang and Hsu Pao-shan to strengthen his position. He sought to reorganize the model army so that it might become his organization. Tuan Chi-jui, at the same time, was bending every effort to have the original Peiyang army maintained as a national organization—as an indivisible unit. Feng Kuo-chang was doing his utmost to take as much of the Peiyang army as possible away from Tuan Chi-jui, so that it might become his personal army to be used as he thought fit.

"In 1913 Feng Kuo-chang took advantage of the second revolution to come south and, after its suppression, he became *tutuh* of Kiangsu, the strategic point for any militarist in China. He at once began to extend his influence, his subordinates being appointed to important positions in the various provinces along the Yangtze. His military faction came to be known as the Chihli party because he was a native of Chihli. Tuan's faction came to be known as the Anhui party.

"After the death of Yuan Shih-kai, Li Yuan-hung, who was considered an outsider by the Peiyang militarists, became president. Although the constitution provided that the vice-president was to succeed the president under certain circumstances, military men regarded such succession as accidental when it interfered with the normal seniority within their own ranks. Li Yuan-hung was never permitted to gain control over any part of the Peiyang party. He became dependent upon the two chiefs, Feng Kuo-chang and Tuan Chi-jui. Since neither of them liked him, he failed as president and was finally ousted from office during the Chang Hsun *coup d'état*.

"During the *coup* Tuan Chi-jui was at Tientsin. He was persuaded by his subordinates to take command of the forces opposing Chang Hsun. He gained the credit of restoring the republic. After capturing Peking, Tuan Chi-jui found himself in an awkward position. Feng Kuo-chang, vice-president and his personal enemy, was at Nanking in command of the Yangtze, while he was in Peking without any authority to act. As premier, he was compelled to make whatever appointments Feng Kuo-chang required before the latter would come to Peking to assume the presidency. These appointments left Feng Kuo-chang in complete command of the Yangtze.

"Matters would perhaps have run smoothly, had it not been that the south again rebelled. This time, Tuan Chi-jui decided that the revolutionary element in the south had to be suppressed and the country unified by force. Feng Kuo-chang allowed him to send expeditions into Hunan and elsewhere, lending him some of his own troops for the purpose. But Feng Kuo-chang was treacherous, giving secret instructions to his own troops not to fight the southerners, thus placing Tuan in an impossible position. Tuan Chi-jui's followers now decided that the only thing to do was to wait for the expiration of Feng Kuo-chang's term as president. Large sums were raised to elect a president whom they could control. An illegal parliament was arranged, which made Hsu Hsih-chang president of China. This is known as the Anfu parliament.

"Tuan's followers soon found that Hsu Hsih-chang was not to and be trusted, that his policy was to keep himself in power by intrigue and unscrupulous politics. He played the Chihli and Anfu parties against each other.

"Wu Pei-fu now comes into the picture as the protagonist of the Chihli party against the Anfu leaders and his nominal ally is Chang Tso-lin. Tuan's Chi-jui's armies were defeated (1920) and he retired to private life. Chang Tso-lin did everything possible to control Peking and its government, to lessen the influence of Wu Pei-fu, the rising star on the horizon. Hsu Hsih-chang then began to play off Chang Tso-lin against Wu Pei-fu, his policy leading to another war and the defeat of Chang Tso-lin who retired beyond the wall."

Since 1920, it has been the same old story. Members of the old Peiyang party fight each other to retain the positions they hold, while others fight them to get them out of their jobs. Hsu Hsih-chang ceased to be president and Li Yuan-hung was again given that post by the military men. Feng Yu-hsiang drove Li out and Tsao Kun was placed in office, only to be made a prisoner by Feng Yu-hsiang and Tuan Chi-jui. And so it goes!

Meanwhile, China is the sufferer and the foreigners living in China witness the unending ugly spectacle of the masses of the people trying their utmost to keep the country in a healthy condition, while their governors, all soldiers, all military men, are destroying what they build, are eating up what they produce, in these wars for jobs.

Is China Turning Red?

FOREIGNERS in China have found cause for considerable worriment over the prospects of China becoming a bolshevik state. The relations between Dr. Sun Yat-sen and General Feng Yu-hsiang with Mr. Karakhan, the Soviet ambassador, have been widely advertised and have led to a supposition that these leaders together with all the Chinese who are associated with them or who follow them, are convinced bolsheviks and that once in power, they will adopt a bolshevik economic and social program.

Le Matin particularly lost its temper on the subject, the news agencies carrying a telegraphic item from that newspaper which received a very wide circulation in China :

The "Le Matin" Telegram

"PARIS, December 23 (Kokusai)—*Le Matin* foreshadows the proclamation of a Soviet republic in South China by Dr. Sun Yat-sen.

"The paper declares that the new Soviet, when established, will be essentially nationalist, and emphasizes the value of French expert opinion to the effect that, in spite of the suggestions from America, the powers must show a solid front in China.

"*Le Matin* declares that it will not be reasonable to permit an increase of the customs for the benefit of a government which does not meet its obligations, and will, if it has a full treasury, be able to subsidize the Chinese bolshevists and enable them to extend their power all over China.

"*Le Matin* further asserts that the attitude of Japan will be the deciding factor.

"According to the French experts' opinion, says *Le Matin*, the Powers must show towards the Chinese disturbances a common front and great firmness. This policy, it adds, is contrary to the suggestions that emanate from America.

"Further events in China will depend on Japan's decision, adds the paper."

The Hongkong press, impressed by the unfortunate situation in Canton, has been foretelling the probability of the establishment of a Soviet state in China for some time To Hongkong, Dr. Sun is usually anathema, whether he is on friendly terms with Russia or with no one and the possibility of attacking him presents itself to the Hongkong editorial writers as a joyous occasion, although they sometimes forget that much of Dr. Sun's popularity among the Chinese has been due to the antagonism toward him of the foreigners in China, the Chinese regarding unfavorable foreign comment as a proof that he is defending his country against predatory foreigners who have only ulterior motives with regard to their country.

Bolshevism Not Possible in China

Bolshevism is a phase of socialism which has to do with certain economic and social theories developed in Russia. The basis of bolshevism is the Marxian doctrine of the class struggle between capital, labor and the peasant. The strength of bolshevism lies in its insistence that the laboring class shall control the means of production and distribution and shall establish a governmental control over everything in the country with a view toward protecting one class of the population, labor. It makes certain concessions toward the peasants, but none toward capital. It premises its whole doctrine upon the existence of a highly organized industrial state in which capital and labor are in constant conflict for the returns on production. It ignores the middle class, which is not a participant in such struggles, and usually terms such men the tools of the capitalist class.

Such a state as outlined above does not exist in China. China is an agricultural country, more than eighty per cent. of the population being actually engaged in farming and similar industries. The labor population is only slightly industrialized, according to the modern economic sense of the term. The remainder still labors under the medieval handicraft system under which craftsmen, journeymen and apprentices have almost a family relationship. Except in the large cities, particularly the treaty ports where foreign enterprise has brought in the modern factory and mill, there are no modernized industries and there is no class struggle. Every apprentice expects that in due course, he will become the owner of a shop in which the goods he has learned to make, will be made and sold. Every owner of such a shop expects that his apprentices will eventually leave him to start out for themselves. The system is primitive, simple and similar to that which existed in Europe before the 18th century. Such a system can in no way be utilized for the establishment of a bolshevik state.

Russia's Part

The Russians apparently understand that. For their activities have been centred, not on the laborers, but on the student class. They have appealed to the intelligent, articulate elements, not to participate in a class struggle, but to join Russia and China in a nationalistic, highly patriotic contest with the Anglo-Saxon international financiers, who, according to their theories, are trying to dominate the world and to subject all non-Anglo-Saxon peoples to their will. This argument has met with a certain success because there is always in China a very noisy element which is opposed to the presence of the foreigner in the country and which is jealous of the enormous success of the Anglo-Saxon, particularly the British, in the development of trade and industry.

This element has unfortunately been supported by certain university professors who have been chagrined to see their own schools closed because of civil war and the ineptitude of China's officialdom while the American and British supported universities and schools have been open and full and have attracted the best elements among the students. These professors have started a movement to force such mission schools to become part of the governmental educational system of the country which would force them into the unfortunate politics of China and which incidentally would give China's educationalist-politicians a hold over them.

This movement is not bolshevist: it is anti-foreign. But it is not as anti-foreign as it is a selfish attempt to utilize the enormous resources of the mission schools for educational politics in China and to force the foreigner to turn over the best educational institutions to men who have failed to keep their own schools open and efficient during the period of civil war. The movement is unfortunate, but inevitable under conditions as they are and nothing will avail of mistaking and misunderstanding it to satisfy a European propaganda with regard to bolshevism.

Dr. Sun's associations with Mr. Karakhan is purely political and opportunistic. Dr. Sun has always maintained that he has the right to accept whatever assistance comes to him from whatever source in his efforts to carry out his ideals in China. He has at times accepted assistance from Japanese and from Frenchmen. He has been aided by Chinese born in the United States and in British colonies. He has taken refuge in Japan, Britain, the United States, Annam and other places. His present association with Russia, as reported, cannot mean that he will sell China to Russia any more than he has sold China to other countries. He is not that kind of a man.

We must then ignore the general cry of bolshevism. We must rather study the trend of opinion which makes the general anti-foreign movement so important and so sinister to foreigners living in China and to foreign businesses which have interests in China. The initial error which led to the damaging of the prestige of the foreigners in China was the expulsion of the Germans in this country after the armistice. The Germans were a highly respected people in China and their physical might was duly impressive. Their collapse and the picture the Chinese saw of Europeans being herded like cattle and driven from their country had altogether a different result from that intended. It gave them to believe that all Europeans might some day be dealt with in that manner. It caused them to assume that if such an end might come to Germany, it might come to any European nation. It is known that some of the keenest British and American minds in China, men of prescience and foresight were opposed to such an act. But they were outvoted in the general cry for action against the Germans.

And the Chinese theory that the same might be done to other Europeans soon found proof in the fall of Russia. Thousands and thousands of Russian refugees wandered about China begging food. Unfortunate Russian women sold their bodies and souls to wealthy Chinese to keep from starvation. Russia's treaty rights in China were annulled, as were the rights of Germany and Austria-Hungary. In a word, the mighty Bear was no longer mighty, but a beggar. Another European monster had been slain, according to the Chinese view. Of the western powers, only two remained important in China, Great Britain and the United States. France and Italy trailed along, trouble-makers for China and for their allies. Japan was the one Eastern power with which China had to deal.

Then came the anti-Japanese boycott in 1919, a movement which was regarded with favor by most of the Americans in China and by large numbers of Britons. This movement gave an impetus to Sino-American friendship of the sort which flower-girls offer at midnight. In the course of that movement the Chinese found that by hampering trade, by embarrassing individual firms, by propaganda abroad and noise at home, they could bring about certain political results favorable to themselves. Having learned that lesson they turned their weapons on those who forged them. They turned on their teachers. They asserted that they would break all treaties, denounce the rights of all foreigners, destroy the fundamental relationships between Chinese and the European nations and do unto the Anglo-Saxons as they did unto the Russians and the Germans. The Soviet saw value for themselves in such talk and encouraged it. If this is bolshevism, then there is a bolshevik movement in China. If this is an anti-foreign movement and only that, it is much more sinister in its aims and ideals and is worthy of the most careful consideration by the foreign powers.

One of the Chinese who is reputed to be a bolshevst recently published a statement in *La Revue Bleue* on bolshevism in China. Tsai Yuen-pei is chancellor of the Peking national university and has been minister of education in China. He is a keen mind and exercises an enormous influence over the youth of the country. His statement is here partly reproduced because of its inherent importance and because of the significance of the man :

Dr. Tsai's Opinion

Confucius says : " If the people of other lands are unwilling to become subject to you, improve your culture, perfect your institutions, and thus win their hearts and judgment." Mai Tzu, a philosopher of the age of Confucius, taught that while it is well to have a strong army to defend the country, it is criminal to pursue imperialist policies, and compared nations that did so to hordes of common brigands. In the seventh century B.C. a whole philosophical school sprang up to propagate the doctrine of anti-aggression. Mencius says that " whatever boasts of his skill as a soldier is a criminal and those who excel in war ought to be put to death."

" These pacifists and anti-militarist doctrines have never lost their hold upon Chinese thought. Since that time our writers and poets have always depicted war as horrible and have sung the blessings of peace.

" Let us next consider communism and relations between classes. Antagonism between capital and labor is one of the most serious problems of our epoch. The Russian revolution sent a thrill of fear through the entire world. Some people think that China will follow in the footsteps of the bolsheviks. Let me hasten to say that a ' terror,' whether it be red, white or any other color, has little chance of finding favor among the Chinese. We did, at one time, have a Communism of a much pleasanter kind in China. According to the philosopher Mencius and later which one was cultivated directly for the profit of the government and the eight others distributed to eight families or clans. Each family tilled its own land, and all joined together to till the land belonging to the state. When a citizen became 20 years old he received a holding, which he returned to the government when he reached the age of 60. Those below the age of 20 and above the age of 60 were supported by the state. Efforts were made to restore this system in the first, fifth and eleventh centuries A.D., but without success ; yet even to-day it has many partisans, especially among the educated classes.

" There is a very old adage in China which says : ' If a man does not labor, one person goes hungry ; if a woman does not spin, one person goes cold.' To work is the duty of every citizen. In the fourth century B.C. we had an odd philosopher in China—he might be called a labor radical—named Hsun Tzu, who taught that the monarch himself ought to cultivate the land in the same way as his subjects, in order not to be supported by them.

" Confucius said : ' We should not be distressed if the citizens are few, but we should be distressed if each does not receive an equal share of what all produce ; we should not be disturbed because the citizens are poor, but because they are discontented on account of the inequality of riches.' He has also said : ' It is not well for wealth to be left buried in the ground, but it is not necessary that it should belong to you. It is not well if you neglect to use your strength in productive labor, but it is not necessary that you should work for yourself alone.' Throughout the whole philosophy of China the principle is recognized that excessive wealth and excessive poverty are wrong. Primogeniture does not exist. The estates of the parents invariably descend equally to all the children. Thus great fortunes are subdivided within a few generations. Immemorial custom requires the rich to maintain their needy relatives and friends, to assist them to earn their own living, to establish charitable foundations, such as setting aside land the revenue of which shall be used to support the aged and the poor, to found free schools, hospitals and orphanages, and in some cases to build bridges and highways, and to erect shelters for travelers.

" In China the wealthy usually live almost as simply as the poor. For that reason the poor have seldom hated the rich. Although within the last dozen years or so great corporations and modern industrial establishments have grown up in China, the antagonism between capital and labor is not as yet strong. Measures developed in Europe and America for the protection of the working people are being adopted, and most of the new corporations are owned by a great number of shareholders. A concentration of capital in the hands of a few great magnates is hardly to be feared.

"If we are to have communism in China, it will be a pacific communism, without the relentless class-struggle preached by Karl Marx."

Unification by Means of Internal Free Trade

"PUTNAM WEALE," otherwise Mr. Lennox Simpson, editor of the *Far Eastern Times* and sometime advisor to the Chinese government, in an interesting New Year proposal for China, suggests that the most feasible method for unifying China is to abolish the internal customs barriers, particularly the archaic inter-port dues, which impedes the progress of trade developments.

He criticizes an article by Sir Francis Aglen, the inspector-general of the Chinese maritime customs, in which the latter favors the immediate convocation of the proposed customs conference, so that China might have additional revenue and every one be benefitted thereby. Mr. Simpson says in part :

" Although we are at the dawn of the year 1925, a system such as exists at Chinese ports to-day, of charging export duties for everything going out of a port to another port and import duties on everything coming in from a brother port—this system is not even mentioned although it is archaic, harmful, anti-nationalistic, subsersive and astounding. Coast trade duties, which have been unknown in any other part of the world for centuries ; which make it impossible for people to carry on home-trade legitimately ; which necessitate masses of greasy documents in two languages, heavy staffs and unending delay ; which retard development,—these are to be left. The thing which would kill likin automatically, i.e., being able to move goods by water tax-free from Hankow to Tientsin, from Newchwang to Canton, or from anywhere to anywhere else in China, is not touched, upon. Three years ago I myself insisted on the point to Dr. Wellington Koo at Washington and suggested that it should be China's central argument ; for it would touch the public as much as the fact that foreign nations maintained their own post offices in China. His answer was characteristic :—' It is easy enough to abolish taxes, but it is hard to impose new taxation.' A Daniel come to judgment indeed ! Yet coast-trade duties give China something to bargain with. She could offer their immediate abolition for an immediate import tariff increase which would bring as great a revolution as the few existing railways have brought."

There is much in Mr. Simpson's argument, except that he, like Sir Francis Aglen, overlooks the fact that the remedy for the international difficulties of China, as well as for the chaotic condition of China's finances, lies not in the handling of this or that item of the problem, but of the whole. The customs revenue, the salt revenue, the loans, internal and external, the revision of archaic treaties, the abolition of extraterritoriality, the retrocession of concessions, the recognition of full sovereignty, cannot be discussed as separate items without sacrificing the general position of the foreigners in China. Of course, there are those who do not care anything about the position of the foreigners in China, who maintain that because treaties were written sixty years ago they have invalidated themselves by old age, that China can abrogate these treaties by simply denying their existence, as Russia did. But such a view can be of no benefit to China, for there is no govern-

mental agency in the country which is prepared to handle any new situations which might arise out of the changes. Were China a modern state, unified and with an effective government, there would be no problems. The wealth of resources, the man-power, the size of her territory would in themselves solve the outstanding international problems. But China has no government, China knows no unity, China is incapable of creating agencies to handle her internal, much less her international problems. How then can one expect at this moment to find a formula for the rectification of wrongs on both sides ?

The status of nations is constantly changing. Every European war had seen such changes. The war of 1914 saw the fall and disappearance of the tremendous Hapsburg empire. Germany ceased to be a dictator of policies and became an problem. Russia ceased to dominate a phase of European affairs and became an outlawed nation. The United States, which for a century or more, had avoided European entanglements, became an active participant in European affairs. And so it went. But China has more or less remained static. China's international position remained unchanged, except as her affairs became affected by the changing conditions of the other nations. China's passive participation in the great war entitled her to a seat at Versailles, but the internal and international situation of China was altogether unaffected by the events which brought the Versailles conference into existence. The Washington conference was called not because the situation in China required any change in her status as much as because the relations between the United States and Japan required readjustment. In short, China is as much surrounded by a great wall to-day, so far as international relations are concerned, as in the most gloomy days of isolation.

To all the powers, particularly such as are deeply concerned over China, whether for sentimental or selfish reasons, this unimpressionability of China is a serious problem. For nothing can be done for a nation which does nothing for herself, or to put it in other terms, which does not change her status in accordance with the general trend of political progress in the world. The creation of a new source of revenue or the increase of existing revenues in no way solves the problem. For the mental attitude of the governors of the country is medieval and they regard all revenues as personal, to be utilized for the enhancement of personal power and the increase of personal wealth. This view is altogether out of harmony with the political period in which we live, when national states are regarded as the suitable units of peoples and when the soverignty of states rests with the people thereof. At a time when national states are so well organized that they seek international relationships with a view toward minimizing the conflicts arising out of differences, China has not yet become a national state, but is attempting to function feudalistically. And what makes the condition more disturbing is the fact that feudalism is becoming strengthened by the march of events.

The Washington conference offered a plan which might have helped China were the Chinese people in a receptive mood for such assistance. The nations of the world, having interests in China and having treaties which the modernized Chinese (a handful) regard as umbrageous, would meet to consider the revision of such treaties if China undertook to reorganize herself on the basis of a modern national state. No provision was made that China was required to follow a model in the west, but rather was it hoped that China would evolve out of her political consciousness some form which could make it possible for the other national states to regard her as an equal. That opportunity was altogether missed, as Turkey did *not* miss it. China was willing to accept the benefits of the Washington conference without assuming any of the responsibilities or obligations arising from such an agreement. As a matter of fact, since the Washington conference, the process of feudalization has become more accentuated and the international position of China has become worse.

In such a situation to attempt to solve isolated problems is simply to bring about further complications. One or two lines of activity present themselves : the first is that the powers ignore all suggestions of change and wait until China has evolved a national state before any changes are made. The other is that the powers meet independently of China and draw up definite and concrete proposals suggesting what they would do if China made certain specific improvements in her own situation. Such a course would throw the onus of failure upon the governors of the country, who must in time realize that in accordance with current political ideals, the habited portion of the earth must be regarded as a unit and that the disturbed condition of any area affects the whole, that the better organized and therefore more powerful nations cannot ignore the disturbance of life throughout the world by the more poorly organized and unprogressive nations and that China's failure to keep pace with the political progress of mankind is not an internal but and international problem.

Perfectly Sound Americanism

IN a striking editorial on migration and world policy, *The Chicago Tribune* says :

"Japan wants to send 5,000 agriculturists to Mexico. That is a detail. It is a minor incident of human restlessness. It will have consequences. A mission has been sent there to establish industries and settlements on the Mexican west coast. There was a treaty signed October 8, of amity, commerce and navigation. Japan with France, Japan with Italy, Japan with Russia, Japan with Mexico, Japan with China and others is building up a structure of relationships that may serve her well when she comes to the showdown on immigration. She will try to extend her sovereignty with her emigrants . . .

"For modern immigration is neither tribal nor state supported in the form of colonies. It is individual, and the controls put on it are laid there by the receiving land. That right of the recipient is still questioned. Japan questions it, and well nigh brought the league of nations to her view. Italy questions it. The majority of nations who export immigrants question it. They stake their present necessities against the future needs of younger, underpopulated lands. They are prevented from collecting those necessities only by implicit force. That is Monroe doctrine.

"Such is the Singapore base. It is frankly force to defend the potent emptiness of Australia, New Zealand, Canada for future white men. Pearl Harbor is a force to defend the naked coasts of America for a culture and a stock that we have chosen to perpetuate. Without implied force those relatively empty lands would straightway be overwhelmed by yellow peoples whom we have taught through science and modern industry to preserve their populations and to increase. The danger is of our own arousing. It could not be otherwise. We had to start it. We must check its drive on us."

Correct. But must the United States also constitute itself into a bulwark against the silent but irresistable pressure of the Japanese on other parts of Asia ? Must Americans carry their ideas into this continent and say to the Japanese, " you may not enter into or own lands in the Philippines : you may not enjoy the fruits of your hard won victory over Russia and China in 1905 : you may not send your surplus population into Manchuria or Mongolia : you may not seek an outlet in the vast uninhabited wastes of Siberia stolen from the yellow man by Russia : you may not acquire any preferred position in the trade or development of China that will enable your people to exist at home : you may not defend yourself against " the menace from the direction of Urga," for, if you do, you must reckon with us. American rights to equal trade opportunity in these regions are vastly more important than Japan's right to exist. That is the Open Door doctrine. That is America's conception of her rights in Asia as written into the consortium agreement. Perfectly good Americanism.

Japanese Electrical Equipment

AN order for power plant machinery and equipment, valued at more than $1,000,000 (gold), has been placed by the Nippon Denryoku Kabushiki Kaisha (Japan Electric Power Company) of Osaka, Japan, with the Escher-Wyss Company for turbines and the condensers. Siemens-Schuckert Company has been awarded the contract for the generators, and Babcock and Wilcox (through Mitsui & Co.) will build the boilers. The motors necessary to operate the auxiliary pumps are to be built by an American firm.

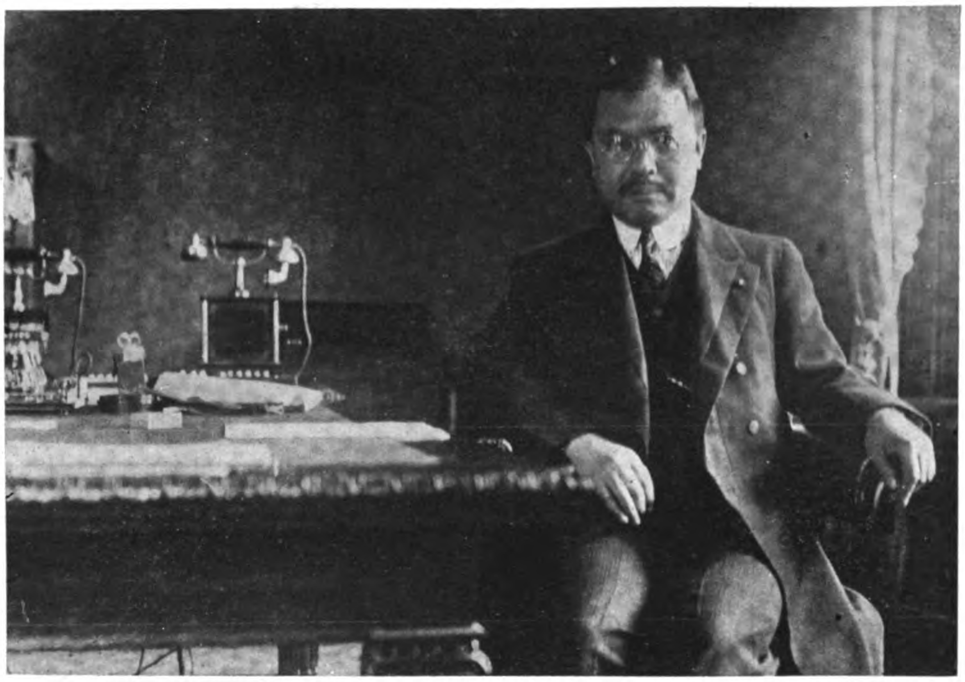
The prices quoted by American companies were approximately 40 per cent. higher than those quoted by foreign competitors. The terms of credit granted on these orders will cover a period of three years.

It is also reported that Mitsui & Co., Ltd., has awarded the contract to William Cramp & Sons, Ship and Engine Building Company, for three 13,000 horse-power turbines with governors, intake pipe and pen-stock valves, to be installed in the Aso River station of the Cifu Electric Power Company. The contract represents the first order for hydraulic machinery to be placed with Cramp by Japanese interests and will constitute part of the extensive superpower developments of Japan.

Have Faith in Coolidge!

ADMIRAL Okada, commander-in-chief of the joint Japanese naval squadrons, has taken upon himself full responsibility for declaring that the Japanese navy is not in the least concerned about the American naval manœuvrs in the Pacific. If he had announced that the Japanese were delighted to learn that the American program coincided with their own intention to hold the annual Japanese manœuvres based on the Caroline and Marshall Islands against a possible attack by the combined Chilean, Peruvean and Patagonian navies, it would have effectively silenced the jingoes of both nations and given the world something to laugh about. Japan has a perfect right to hold her 1924 war-game in that section of the Pacific simultaneously with the American navy with some South American country as the hypothetical enemy. Such explanation would be just as logical as that advanced by the American authorities.

The Japanese in our opinion are unduly alarmed about America's ambitions in the Pacific. If the real truth was permitted to leak out, it would reveal that the United States is intent upon extending its shadow over the Elysian playgrounds of the South Seas discovered by that great American voyager, Frederick O'Brien. Nothing has so stirred American imagination and the strong red-blood of the adventuresome pioneer than the glowing descriptions of these lands of flaming youth, burning desire and September mornings brought home by O'Brien and the navigators of the *Kawa*. In order to mislead the rightful owner of these open-air gardens of delight, Americans are advertising Japan as the imaginary enemy. We dislike to be unpatriotic and divulge national secrets but the acquisition of the Marquesan Eden is now the cardinal feature of our Pacific policy, the real objective of our naval strategy. At least, we submit that this is just as plausible as any other explanation.



Baron Shidehara, Japan's Minister of Foreign Affairs, at his Desk in the Gaimusho. A Brilliant Diplomat whose Close Intimacy with Secretary Hughes and Sympathetic Understanding of America's Policies Contributed Largely to the Success of the Washington Conference and Paved the Way for American-Japanese Co-operation in Finance and Business

Let us explore this hypothesis along more serious lines. American jingoes may feel that their best interests are served by co-operating with Great Britain and Australia and making use of the Singapore naval base in the event of war with Japan. Great Britain may encourage this idea and endeavor to bring about an *entente* with America that will cover Pacific and Far Eastern questions, but as long as France is left on the outside all such scheming will result in failure. The real key of the south Pacific is held by France, whose strategical position in Oceania constitutes an effective checkmate to Anglo-American co-operation in these waters.

If the British naval base at Singapore is to be construed as a menace, it is as great a menace to France as it is to Japan. Also, and to a greater extent, to the Philippines. French publicists are fully alive to its significance. The best naval harbor on the east coast of Asia outside of Japan is Camranh Bay in Indo-China, with the well-equipped ports of Saigon and Haiphong as secondary bases, all three connected by a coast railway. Add to these the harbors of Tahiti and Mangareva and the hundreds of isles that could serve as secret submarine bases amongst her Polynesian possessions, the strategical position of France is such that her friendship and neutrality is essential to any power entertaining serious thoughts of waging a Pacific war.

France has no naval force in the Far East of sufficient strength to adequately defend these possessions. Should France permit their use by the Japanese navy in return for Japan's protection to these very vulnerable possessions, it would impair, if not effectively nullify, any Anglo-American pact covering this part of the world. The position of France in any test of naval strength in the Pacific would at some particular juncture decide the issue should she place her colonial resources at the disposition of either side. There are indications that Japan and France fully appreciate the new trend of affairs, and have arrived at some understanding or " agreed memorandum" in the event the other line-up should develop into a certainty.

As long as France holds the key to Pacific peace there will be no war without the would be beligerants knowing exactly where she stands beforehand, and as she has everything to lose and nothing to gain, her possession of the key is a quarantee of peace.

* * *

As to the wisdom of providing the Japanese with further cause for alarm about American policies in the Pacific there can be no two opinions. The Japanese do not forget how on a previous occasion the American battle-ship fleet was sent into the Pacific with the avowed purpose of impressing them with our strength. Neither do they overlook the military significance of the recent round-the-world flight which brought American army aviators across the Pacific to their shores and provided them with the data on which to base further operations. At a time when relations between the two countries are not as cordial as they should be because of Japanese resentment against our exclusion laws, American jingoes have prevailed upon the navy department to repeat the former blunder. As in the case of our immigration law, there is no question of America's right to hold her annual war-game in the Pacific with Japan as the imaginary enemy. It is simply a question of tact, the avoiding of another error providing the jingoes of both nations and those outsiders anxious for reasons of their own to see Japan and America come to grips, an opportunity to redouble their pernicious activities.

That the opportunity was seized is attested to by the fresh outbreak of war-talk indulged in by the excitable elements of both nations. In America, Secretary of the Navy Wilbur, supported by Admiral Bradley A. Fiske, Captain William Shealer and other highly placed experts, asserts that it is a self-evident fact that Japan will one day become America's enemy, while congressman Britten started a campaign for a union of the white nations against Japan. What Japan would gain by waging war with the United States is not quite clear. If she wins, she loses. The same applies to the United States. There is nothing to be gained by a war between Japan and America but loss to either side. If American jingoes could glimpse with their own eyes the depressing poverty of Toyko and Yokohama with their miles upon miles of temporary thin, matchboard shacks doing service as houses and grasp something of the

tremendous, heart-breaking, up-hill fight confronting the Japanese in restoring their ruined homes and places of business, they would understand perhaps how grotesque it would be for such people to indulge in war-dreams with a super-power like the United States. Forces of nature inflicted upon a Japan a loss far in excess of any defeat she might have suffered in a modern war and with the lesson of the great war still fresh in their minds, the rulers of Japan are not curting complete ruin by wantonly provoking hostilities with America.

Admiral Okada frankly recognized the real spirit behind the American naval manœuvres and sympathized with the efforts of the American authorities to be prepared against all emergencies in the Pacific, while Premier Viscount Kato told the members of the Seiyukai party that

"The American government notified us some time ago of a desire to remove misunderstanding in Japan caused by the proposed naval manœuvres. America declared her willingness to let all the American war vessels taking part in the manœuvres, visit Yokohama after they were over, so that distrust about the motives of the manœuvres might be erased.

"We told the United States that such a visit was not necessary and declined acceptance of the offer. From this, it is evident that the United States is anxious to secure the understanding of the enlightened classes of Japan."

This incident illustrates that although the thinking men of Japan are not worrying about the American naval manœuvres and accept America's frank expression of friendly sentiment, they realize the danger that might be created by the visit of the American fleet to Japan and the misunderstandings that might arise when a large body of men were granted shore leave in a port and capital city ill-prepared to receive them.

Secretary Hughes, departing from all precedents, administered a well-merited and severe rebuke to the American jingoes in a statement welcoming the appointment of Mr. T. Mastudaira as ambassador to Washington, in which he received the endorsement of President Coolidge. The statement, so faithfully reflecting the policy of the present administration, is one of the most important documents bearing upon the relations between Japan and America. Mr. Hughes said in part :

"The authorities of the United States find the inflammatory movement respecting the relations of Japan and the United States incomprehensive. The American authorities in Washington are unable to point out clearly who the instigators are, though it is true that certain publications and speeches have engendered misunderstandings between the two countries. So long as any incendiary propaganda is allowed to be carried on, the governments of Japan and the United States will be put to very great enbarrassment. The American officials are of the opinion that the relations of the two countries are to-day unprecedentedly well. Starting from the naval disarmament question, Japan is not only respecting and living up to the spirit and the decision of the Washington naval treaty but is taking every opportunity of showing her sincerity to put in force all the agreements entered into at Washington concerning China and the Far East. The American government also recognizes the fact that the Japanese government is exercising the greatest efforts for the reconciliation of the feelings of the peoples of the two countries.

That Japan has specially appointed such a great statesman as Mr. Matsudaira to be Japanese ambassador to Washington is sufficient to endorse the above fact.

Furthermore, the withdrawal of Japanese troops from Siberia, the retrocession of Tsingtao to China, the announcement of the open-door policy vis-a-vis of China, the abandonment of Japan's special sphere of influence in China as a result of the abrogation of the Ishii-Lansing agreement, and the cancellation of the Anglo-Japanese alliance, coupled with the attitude Japan has taken in connection with the American immigration question and others are all fair and just, which shows how Japan is endeavouring to maintain her co-operation with the United States for the solution of various Pacific questions. While I am fully convinced that the relations of the United States and Japan will grow more friendly than ever, I cannot but believe that Mr. Matsudaira's arrival at his new post will go a long way towards accelerating the furtherance of the friendly relations of the two countries."

Hon. Edgar A. Bancroft, American Ambassador to Japan. His Message, "HAVE FAITH IN COOLIDGE," is Accepted as an Assurance of Good-Will and the Reestablishment of Cordial Friendship Between Japan and America

This splendid declaration of American trust in Japan was made the keynote of a nation-wide protest against further anti-Japanese agitation. Senator Owen (democrat) of Oklahoma, sternly rebuked the Japanophobes and jingoes on the floor of the senate and supported the administration by saying :

"Japan is entitled to the respect and good will of the American people. The Japanese people are about as brave, as any peo'le on the earth, and they are patriotic and emotional. They are entitled to the admiration and good will of the United States, and certainly should enjoy our universal respect.

"Japan co-operated with us and with our allies in the world war ; she restored the Shantung peninsula which she had taken from the Germans to China ; she entered the Washington disarmament conference and signed the naval limitation treaties ; she dropped the aggressive twenty-one demands on China ; she withdrew troops from Siberia ; and she abrogated the Anglo-Japanese alliance.

"So when a courteous and considerate discussion of the exclusion question is being held, no man in congress is justified under these facts in abusing the Japanese government. If he does so he is invading the rights and functions of the executive branch of the government and is not doing service to his own country."

* * *

At the height of this agitation, Mr. Edgar A. Bancroft, the new American ambassador, arrived in Tokyo and delivered his message to Japan at a dinner given in his honor on December 12 by the Japan-American society. "My message to you and to all friends of Japan and of America is : "HAVE FAITH IN JAPAN. HAVE FAITH IN THE UNITED STATES AND IN PRESIDENT COOLIDGE!"

This message held out a promise that was not long in being lived up to.

The declaration of American friendship for Japan as voiced by Secretary Hughes and endorsed by President Coolidge was followed almost immediately by one of the finest strokes of far-seeing statesmanship in the handling of our Far Eastern affairs. This took the shape of an agreement entered into last month between the Japanese and American war departments for an exchange of language officers who will be attached to regiments of the two armies for a period of six months. Nothing could be more conducive to mutual understanding and cordial friendship than this mingling of fighting men on a basis of full equality in the every day life of the garrison and camp.

In announcing the new plan, Secretary of War Weeks pointed out that it was the first of its kind with the Japanese and was "indicative of the friendly feeling that exists between the two war departments and the two armies." Japan's War Minister, General Ugaki, supplemented this in the following statement to the press:—

"I wish fully to endorse the statement of Secretary Weeks that this indicates a friendly feeling between the two armies. War talk is powerless in the presence of solid facts. Let me assure you that the year just opening certainly will bring an increased good feeling between our two peoples, and will disperse the last vestige, if there be any, of ill-feeling, born out of sheer misunderstanding on one party or the other."

This, and other signs indicate that the clouds of misunderstanding are being blown away and the present year will witness a clearing of the atmosphere. It may be difficult for President Coolidge to immediately modify or annul the Japanese exclusion clause in our immigration law and restore the deep respect and cordial friendship of all classes of Japanese for the United States but as time goes on and the American people grasp the real significance of this disaster to American diplomacy, to American business and the work of their churches in Japan and China, they will voluntarily demand action that will wipe out the uncalled for insult to a friendly people whose leaders have accepted our ideals as the guiding principles in their new outlook on international affairs. Events are moving rapidly and we can only wait and hope for the fulfillment of the promise held out in Ambassador Bancroft's message: "HAVE FAITH IN COOLIDGE!"

* * *

Indian Railways Make Drastic Changes

THE great changes now being made in Indian railway administration and finance are causing many British manufacturers, who cater to a very considerable extent to that market for railway rolling stock and materials, to follow the trend of events very closely.

The exact methods of management are very clearly set out in *The Times*, some extracts from which will be of considerable interest. The East India railway, which is to be taken over from the company management by the state at the close of the present calendar year, has been in existence over seventy years. The system is made up of some 2,480 miles of open line, and the capital outlay, including premiums paid by government in the purchase of the line, has been over Rs. 93 crores.

At present of nearly 37,000 miles of railway in India, over 7,000 are owned and worked by the state, and nearly 18,000 also owned by the state are worked by guaranteed companies. The Acworth commission of 1920-21 advised that the system of management by companies of English domicile should not be continued after the termination of existing contracts, and agreed that a system of management by a combination of English and Indian domiciled companies was impracticable. While five members of the committee, including the chairman, recommended that the undertakings of the guaranteed companies, as and when the contracts fell in, should be entrusted to the direct management of the state, five members, all of them railway experts or business men, recommended that the system of both state and company management should be continued, and that the government should not be committed to a policy of state management only for all railways. They accordingly proposed a scheme for creating Indian domiciled companies to manage the East Indian and, possibly the Great Indian Peninsula railway, the contract for which falls in next year.

Though there were noteworthy exceptions, the trend of Indian opinion has been strongly in favor of entire state management, and a resolution to this effect was passed in the legislative Assembly in February, 1923. Since then the assembly has become more strongly nationalist in composition, and the eagerness of a majority of its members for state management has been manifested in the discussion of the proposal for the separation of railway finance from the general budget.

Such separation has been urged repeatedly by commercial bodies and was recommended with great emphasis by the Acworth commission in 1921. The faults of the old system, whereby the railway department occupied the same position in financial matters as other departments of government, were indicated in the speech Lord Reading made to the railway conference at Simla early in October. The viceroy said that in spite of the possession of special powers and of the theoretical advantage of treatment on a commercial working basis, in practice the department was crippled for development purposes by the restrictions inherent in the system. The railways depended for finance upon money voted each year, and the net earnings of the railways went into the general exchequer.

The inevitable tendency was to expect railways to contribute more than their just share to the general revenues, and to class the powers of recovery through railways as a potentiality for adding to revenue from taxation. This tendency, as the viceroy said, killed incentive to economy in working and continuity in railway policy, and definitely operated to discourage initiative in commercial management and real increase in efficiency in serving the public. A step in advance was made when, with the approval of the legislative assembly, a capital programme was guaranteed to the railways over a period of years.

After a depressing succession of large deficits, Sir Basil Blackett was able last March to introduce a balanced budget, and to include therein a scheme for the separation of railway finance. The consideration of the scheme had to be postponed, owing to Indian criticisms, to the September session. The committee to consider the scheme at first made acceptance conditional on the adoption by the government of principles of an irrelevant character, such as the Indianization of the railway service in the higher ranks, purchase of stores in India, and the giving of a pledge by the government that no state railway should be handed over to a company without the approval of the Assembly

As the viceroy pointed out, the purpose of a number of amendments proposed was to subject the change to conditions wholly unconnected to the principle involved. Had these conditions, which included the complete subordination of all initiative in executive action of the government to the legislature, been pressed, government, he said, would have been obliged to abandon the project.

The resolution as finally framed and passed represents, on the chief point involved in the debate, a compromise.

The railway contribution to the general budget under the original scheme was to be five-sixths of 1 per cent. on the capital at charge of commercial lines, with participation of profits after meeting all working and interest charges. The amount of contribution to the general revenues has now been fixed at 1 per cent. on the capital at charge, equal to a net payment during the present year of about £3,460,000. So far as surplus profits go, the considerable leeway to be made up in respect of renewals and repairs payable out of revenue will be absorbent for some years to come.

New Firefloat for the Hongkong Government

THE Hongkong & Whampoa Dock Company, Ltd., are building at their Kowloon works a most interesting fire-fighting float for the harbor service of the Hongkong government. This vessel will have a length overall of 101' and 95' between perpendiculars. The moulded breadth is 23' and depth, 9' 6". She will be built of steel throughout, constructed to scantlings equal to Lloyd's highest class for craft of this type, with one steel deck sheathed fore and aft, over which for 70-ft. is a wood deck, on which are placed the fire-fighting appliances and navigation bridge ford. The hull is to be divided into six watertight compartments by five watertight bulkheads, fresh water being carried in fore peak and feed water in tanks at sides of boilers, and oil fuel in tanks at sides of boiler room.

The rudder will be controlled from the bridge by hand steering gear, rods and chains to quadrant tiller in rudder stock. A steam windlass will be fitted forward for working anchors and cables. The vessel will have accommodation for one European, saloon-bath and W.C. being in house ford, and galley W.C. and store for fire hose in house at after end of engine casing. The crew will be berthed in forward hold, and captain and engineer in after hold.

The machinery will consist of one set of triple-expansion engines —12"—20"—33" by 21" stroke, working pressure 180-lbs. per square inch, capable of propelling the vessel at a speed of 10 knots. An independent air and circulating pump of Merryweather's make, a bilge and general service pump, two Weir's direct-acting feed pumps, one 5 k.w. generator, oil fuel pump, heaters, filters, etc., one Howden's fan and two Merryweather latest pattern double cylinder "Greenwick Gem" vertical stationary fire and salvage pumps will be installed in the machinery space. The fire and salvage pumps will be together capable of delivering 4,000 gallons per minute, at a delivery pressure of 150-lbs. per square inch.

Steam will be supplied by two Babcock & Wilcox straight tube express water-tube boilers, having a working pressure of 200-lbs. per square inch, reducing valves being fitted between boilers and all machinery. The boilers will be oil fired with Howden's enclosed duct undergrate type of forced draught, fitted with Babcock & Wilcox's oil fuel sprayers pressure type.

The vessel will be equipped with two gunmetal swivelling monitors, and one water-tower of angle steel framework, supporting a working platform nine feet above the deck level. In the interior of the delivery pipe a telescopic steel tube will be fitted, at the upper end of which will be fixed a Merryweather 5" monitor, operated by steel chains from the level of the platform, and which when fully extended will be 29' above the upper deck.

The vessel will be electrically lighted throughout, and in addition will have one searchlight 18" diameter, projector with mirror, dispersion lens and gas filled filament lamp, 2,000 candle-power.

Greater Osaka

OSAKA, called the Manchester of the Orient, because of its popularity as a cotton manufacturing centre of Japan and the Orient, will shortly become the largest city in the Orient and fifth in rank of the largest cities in the world, in point of area. When the proposed plan of annexing the two adjoining "gun"—Higashinari and Nishinari—on the north-west of the present city, the total area of Greater Osaka will become 65.75 square miles, and the population 2,030,000; at present the city's area is only 20.82 square miles and its population 1,390,000. Osaka will beat Manchester then.

Higashinari and Nishinari-guns comprise 44 towns and villages, covering a total area of 42.93 square miles and possessing a population of 642,000. By far the greater part of the area to be consolidated into Greater Osaka is at present devoted to farming. Therein lies the significance of the proposed plan of consolidation, for the Manchester of the Orient keenly feels the need of open space to build factories, and the two guns which have afforded space for that purpose in the past will do so in future, with modern improvements added by the efforts of the municipality of Greater Osaka.

The present city of Osaka is divided into four wards: Kita, Higashi, Nishi, and Minami; or north, east, west and south. According to the plans made for Greater Osaka, these four wards are to be sub-divided, creating in all eight wards, namely: Kita, Konohana, Higashi, Nishi, Minato, Tennoji, Minami and Naniwa.

Kita-ku, north ward, is to comprise the greater part of the present Kita-ku, with the exception of the Ashiwake and Ajikawa school districts, and adding the Miyakojima, Sakuranomiya, Saibi and Sonezaki districts.

Konohana-ku is to comprise the original Kita-ku, including the Kami-Fukushima, Shimo-Fukushima, Nishi-Noda, and Ashiwake school districts, and adding the Kujo and Kasugade districts of the present Nishi-ku.

Higashi-ku is to comprise the original Higashi-ku, and adding the Tamatsuri and Kiyohori districts and a district formerly known as Higashi-Hirano.

Nishi-ku is to comprise the original Nishi-ku, with the exception of a district formerly known as Iwasaki-machi in Taisho-dori.

Minato-ku is to comprise the Kujo, Sangenya, Izuo, Ichioka, and Chikko districts in the present Nishiku, and adding a district formerly known as Iwasaki-machi in the Taisho-dori and Ajikawa district.

Tennoji-ku is to comprise the Higashi-Hirano district, with the exception of a district formerly known as Higashi-Hirano, and Tennoji district in the present Minami-ku.

Minami-ku is to comprise the original Minami-ku.

Naniwa-ku is to comprise Namba district, in the present. Minami-ku, and adding the Kizu, Imamiya, and Nishihama districts.

Five New Wards

In addition to the foregoing eight wards, five new wards are to be created in the part to be consolidated into Greater Osaka, namely: Higashinari and Nishinari. The five wards are to be known as: Himejima, Nakajima, Higashinari, Sumiyoshi, and Nishinari.

Himejima-ku is to comprise Dempo, Sagisu, Utajima, Chibune, Hiejima, Fuku and Kawakita.

Nakajima-ku is to comprise Nakatsu, Toyosaki, Nishi-Nakajima, Toyosato, Omichi, Shinjo, Nakajima, Kita-Nakajima and Kamitsu.

Higashinari-ku is to comprise Ikuno, Tsuruhashi, Nakamoto, Kamiji, Shoji, Joto, Enomoto, Namazue, Enami, Johoku, Furuichi and Shimizu.

Sumiyoshi-ku is to comprise Tennoji, Hirano, Kizure, Kita-Kudara, Minami-Kudara, Tanabe, Yosami, Nagai, Sumoyoshi, Suminoe, Auryu and Shikitsu.

Nishinari-ku is to comprise Imamiya, Tamade, Kohama and Tsumori.

From the point of view of the present Osaka city, there are two reasons for which the consolidation of the outlying districts into Greater Osaka was considered absolutely necessary; readjustment of the streets and sanitary improvement of outlying districts to prevent diseases. These two problems are not easy to solve, as their solution will require a considerable outlay of funds and a deal of inconvenience spread over a long period of operations. Nevertheless, they must be solved, for, should the present irregular development of the outlying districts continue, Osaka city will be literally choked by menacing diseases and by inconvenience in communications. As an organic community, Osaka must break through these walls to preserve its health. These considerations have led to the proposed plan of consolidation.

As for the districts to be consolidated into Greater Osaka, they will naturally get the benefit of the municipal improvements extended to them after they are consolidated. These self-governing communities are now requested by the home office, through the Osaka prefecture government, to reply as to whether they care to be consolidated into Greater Osaka and on what conditions they will join. Very little dissension is expected.

As soon as these districts make their reply, the home office will give formal consent to the plan of consolidation and preparations for creating Greater Osaka will be made at once. It is believed that, from April, 1925, Osaka will announce its expansion into Greater Osaka.

There are several interesting facts which should be noted here in connection with the creation of Greater Osaka. Greater Osaka will have within its limits 5,132 *chobu* (a *chobu* is equal to 2.45 acres) of rice fields and 1,912 *chobu* of track gardens. The city will not only be a manufacturing and commercial centre, but eill be an agricultural city as well. About 8,000 farming families will live in the city. About 86,000 *koku* (a *koku* is equal to about 40 bushels) of rice and 9,000 *koku* of wheat will be produced. Being adjacent to Osaka city, the outlying districts produce a considerable amount of vegetables, chickens, eggs and other farm produce There will, therefore, be 6,600 families engaged in chicken raising, with 240,000 chickens, yielding annually 6,430,000 yen. These farming districts will be converted, in a space of five or ten years, into city streets or manufacturing sites, according to how fast Greater Osaka develops.

Residence Quarters

According to the plans in the minds of the promoters of Greater Osaka, purely agricultural districts in the highlands, east of Osaka city, are sites for future residence districts, as a way of relieving the present crowded and insanitary condition of residence houses in the city.

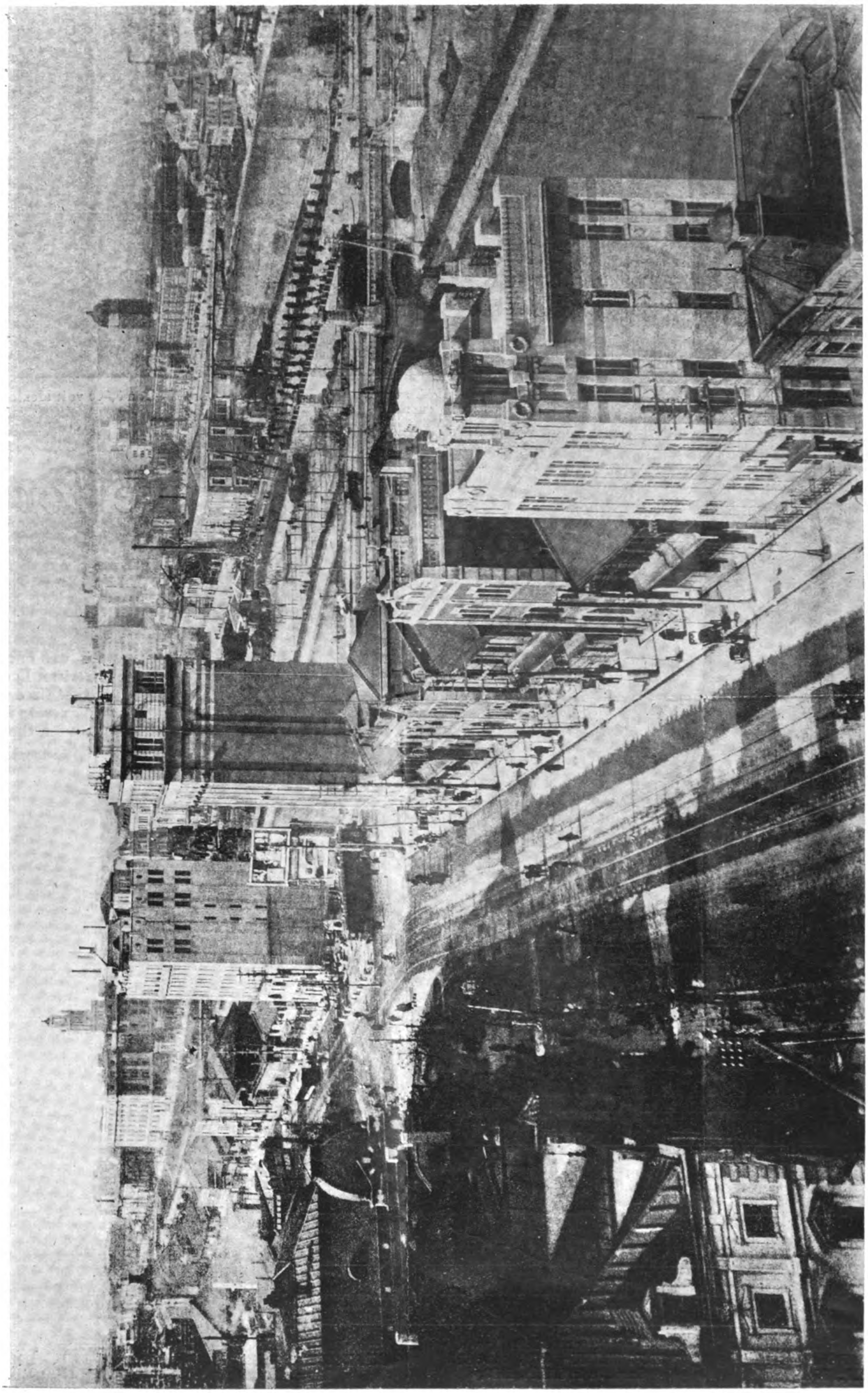
The regions along the Yodo and Kizu rivers are especially selected as sites for big and special factories which will be removed from their present sites within the present city limits, thereby increasing the efficiency of the factories and at the same time safeguarding the lives of the people of the city, who are at present tormented by the smoke, noise and malodours of the factories.

Improvement of sanitary conditions in the city was one of the objects for which Greater Osaka was planned. Osaka's death rate is beyond description. Its rate of 22.32 per thousand of the people of Osaka is the highest of the six largest cities in Japan, except Nagoya. The rates in some of the outlying districts are extraordinary. In Ikuno-mura, it is 57.03, in Toyosaki-machi, 33, and in Imamiya-machi, over 38.

An example of improvement is shown by Imamiya, where the rate in the part of Imamiya which was incorporated into the present Osaka city some years ago is smaller by 11 than that of Imamiya-machi, which was left behind, but which is now to be consolidated into Greater Osaka. In Tennoji, the difference is 1.4. By rates similar to these examples, the sanitary and health conditions of the outlying districts will be improved.

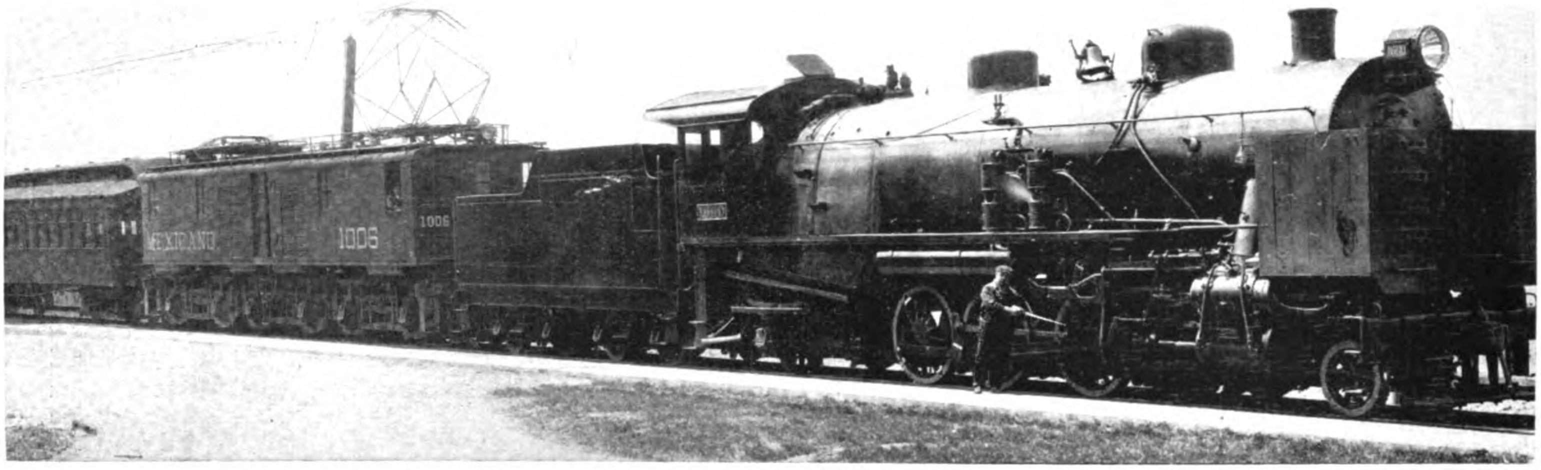
All these and other improvements which may be enumerated can be brought about only by the people of the city and of the districts to be incorporated into Greater Osaka addressing themselves seriously to the great task before them. The increase of

(Continued on page 19.)



BIRD'S-EYE VIEW OF THE CENTRE OF GREATER OSAKA

Large Buildings Shown in the Photograph Are: From left: Bank of Japan, Nakanoshima, City Hall, Nadaman Hotel, Kitahama, Mainichi Building seen behind Nadaman, Central Public Hall, Nakanoshima, seen next to Mainichi Building, Kitahama Building, Dojima Building, Oye Building, seen far beyond, Bankers' Club in Nakanoshima, Appellate Court across Dojima River, Shizuka Company seen in front on the right, and Kitahama Share Market in front on the left.



American Locomotive Co.—General Electric Co. Test of S.M.R. 190-Ton 3-Cylinder Locomotive Using 150-Ton 3,000 volt Mexican Locomotive for Regenerative Load

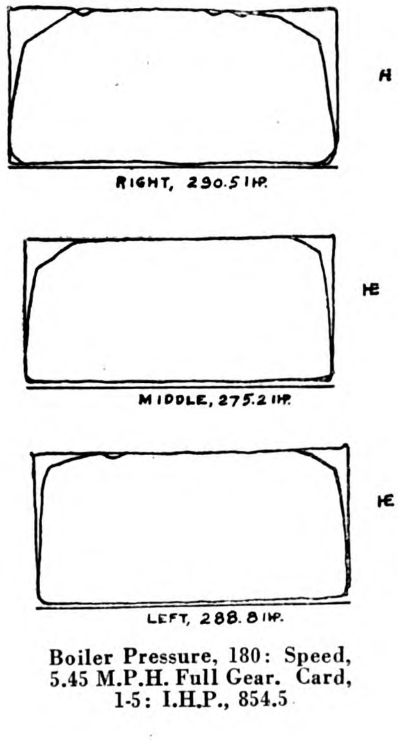
Test of Three-Cylinder Locomotive for the South Manchurian Railway

An account of recent tests on a three-cylinder locomotive for the South Manchurian Railway, conducted on the test track of the General Electric Co., at Erie, Pa., with interesting data relative to the performance of these engines. It includes also a brief description of these locomotives.

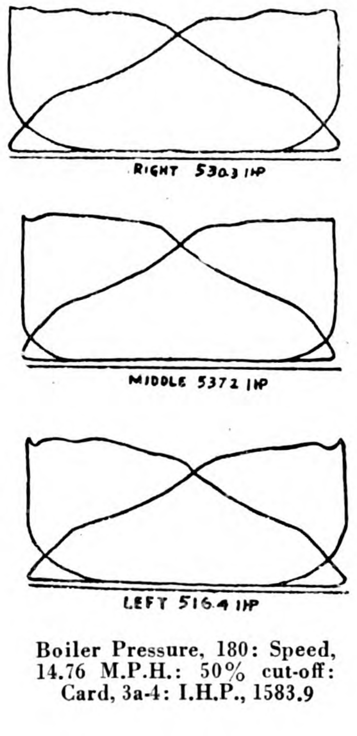
The American Locomotive Co., recently completed five locomotives of the three-cylinder mikado type, for the South Manchurian Railway. Before the new engines were shipped abroad, they were tested in the novel manner recently introduced by the General Electric Co., and the American Locomotive Co., using an electric locomotive equipped with the regenerative braking feature as a means of registering the data of the performance. The tests were conducted on the test track of the General Electric Co., at Eire, Pa.

The electric locomotive used in the tests was one of ten units built by the General Electric Co., and the American Locomotive Co., for the Mexican Railway Co., Ltd., which at that time was ready for shipment. This locomotive was designed to operate from a 3,000-volts, direct-current trolley and was equipped with the regenerative braking feature for the purpose of holding back trains on the 4 per cent. grades between Mexico and Vera Cruz.

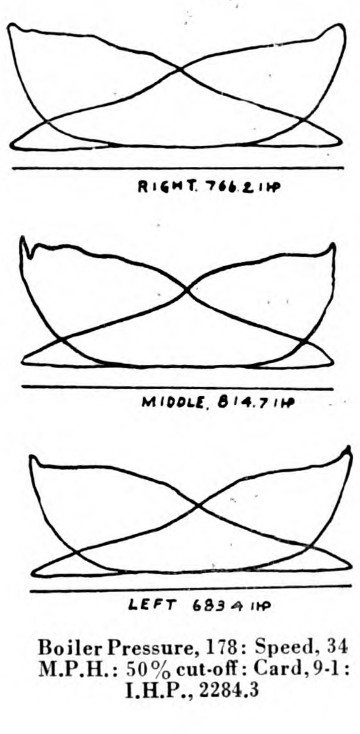
Because of the accuracy of electrical instruments, it was possible to determine the drawbar pull exerted by the steam engine much more accurately than by the use of mechanical measurements. In order to calculate the load for each run, recording and indicating instruments were used reading the total line current, speed and volt-



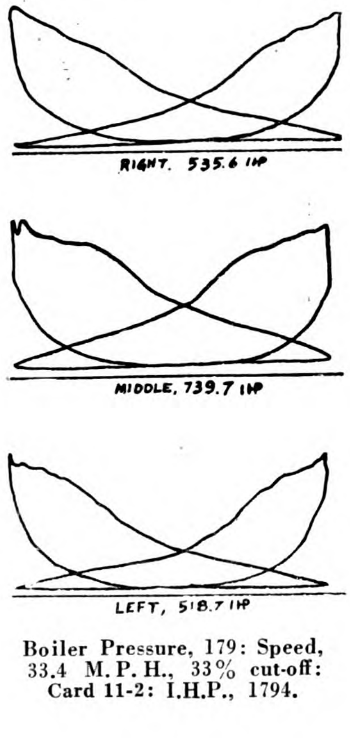
Boiler Pressure, 180: Speed, 5.45 M.P.H. Full Gear. Card, 1-5: I.H.P., 854.5



Boiler Pressure, 180: Speed, 14.76 M.P.H.: 50% cut-off: Card, 3a-4: I.H.P., 1583.9



Boiler Pressure, 178: Speed, 34 M.P.H.: 50% cut-off: Card, 9-1: I.H.P., 2284.3



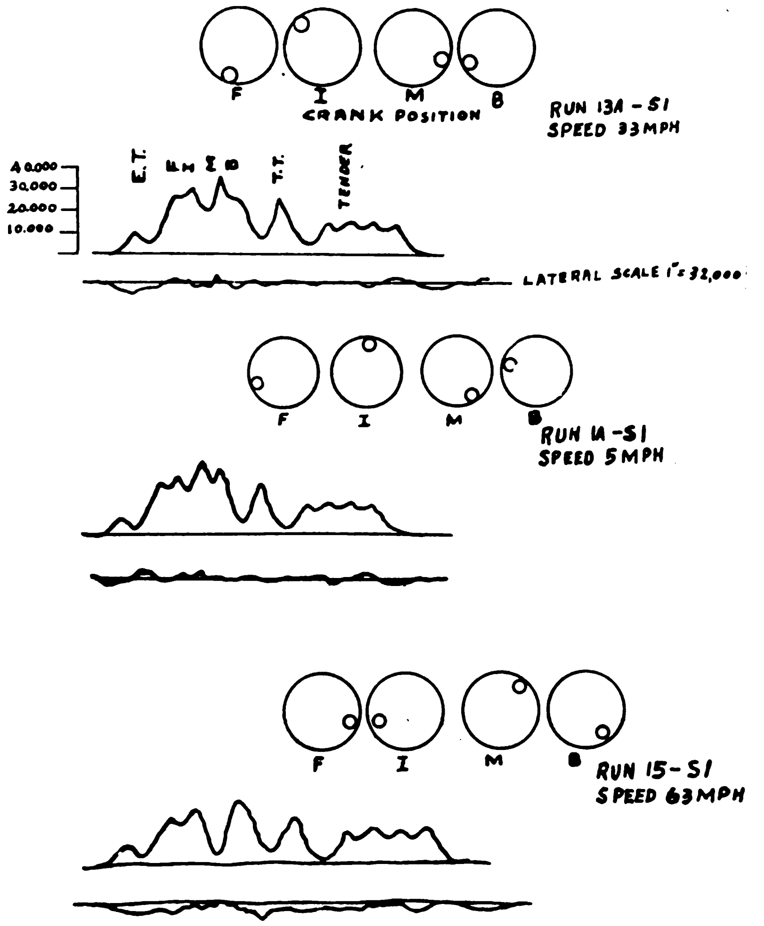
Boiler Pressure, 179: Speed, 33.4 M.P.H., 33% cut-off: Card 11-2: I.H.P., 1794.

3-Cylinder 190-Ton Locomotive Built by the American Locomotive Co. for the S.M.R.

ages. Speed was indicated on the tachometer in the cab and was also checked by an electrical instrument recording wheel revolutions. From the characteristic curve of the motors it was possible to calculate accurately the electrical losses in the locomotive. The friction losses of the locomotive were obtained by experimental runs. Corrections were also made for grade and curvature.

An interesting check was made on the calculations by using one electric locomotive motoring and the other regenerating giving in effect a pump-back test in which the sub-station supplied the losses. A number of runs were made at between 5 and 28 miles per hour. By means of voltmeter and ammeter readings, the total output of the locomotive when regenerating was calculated, and making allowance for known losses and compensation for friction and curve losses, the actual drawbar pull was determined.

Although the engine was tested without the customary "breaking in," there was no indication of heated bearings at any time, even when the speed was forced up to 63 miles per hour, which is equivalent to a piston speed of 1,700 feet per minute. At this



Otheograms

speed there was no indication of rough riding in the cab and the records of the otheograph indicate remarkable lateral steadiness, or freedom from nosing, a maximum lateral thrust of 5,000-lbs. being observed. The accompanying otheograms illustrate the track reactions of 5 to 33 miles per hour, from which it may be noted that the lateral rail thrust at 33 m.p.h. is 3,000-lbs., indicating that the 5,000-lbs., obtained at 63 m.p.h. represents that the engines have great lateral steadiness at this speed.

The rapid acceleration of the engine as compared with the two-cylinder type was just as much in evidence in this engine as in the previous three-cylinder engines built, the full stroke cards showing admirable starting conditions.

A slight irregularity in the valve setting of all the cards will be noted, but it must be remembered that these cards were taken with the setting just as turned out from the shop, there being no opportunity to make the final adjustments before the tests. Even so, the specimen cards show very good equalization of power under the circumstances, and there seems little doubt but that this engine is the most remarkable locomotive of its size and general proportions that the American Locomotive Co., has built both as regards power and flexibility. It is unusual to find a locomotive primarily designed for freight service, with small wheels and long maximum cut-off, able to exceed the diameter-speed, yet this engine, with only 54-in. diameter wheels, easily attained a speed of 63 miles per hour with only about two miles in which to accelerate.

By reference to the accompanying tables and charts the results of the tests will be more fully understood. One of the tables gives the weights, dimensions and proportions of the three-cylinder engines. Another table contains data compiled from the indicator cards and from other recording mechanisms. Still another chart furnishes a comparison of the tractive effort of the three-cylinder engine with that of a two-cylinder locomotive having 25½-in. by 26 in cylinders and in addition shows the indicated horsepower as compared with the tractive effort, The other charts show otheograms and specimen indicator cards at various speeds.

As previously mentioned the new locomotives for the South Manchuria Railway are of the three-cylinder mikado (2-8-2) type. They operate on a track having a gauge of 4-ft. 8½-in. and use bituminous coal for fuel. The cylinder are 22½-in. by 26-in. and are arranged like those of locomotive No. 5,000. The three piston

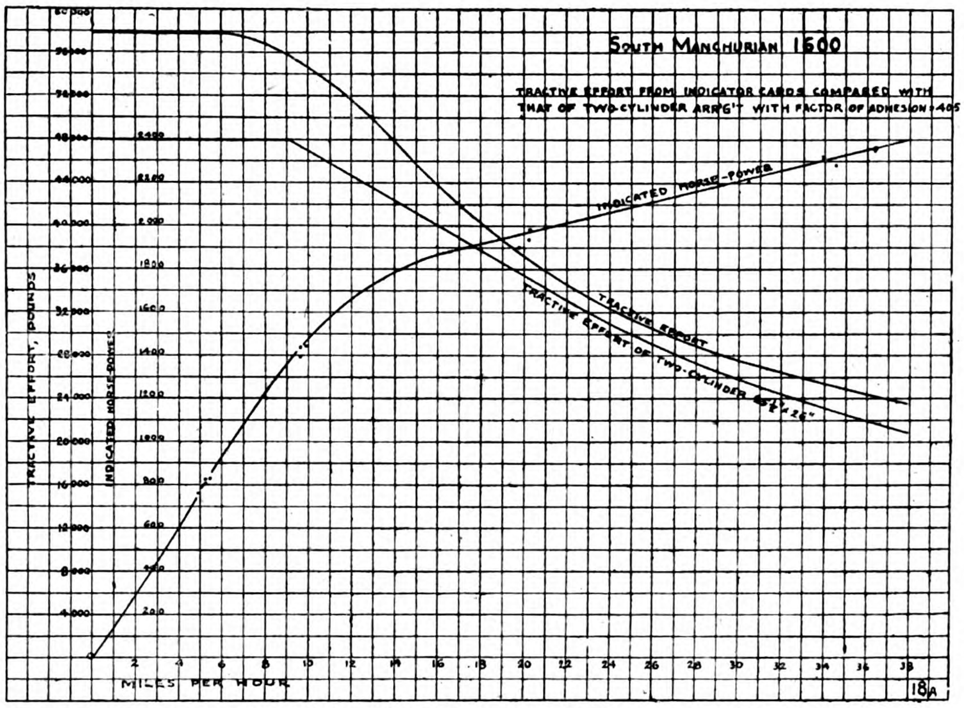


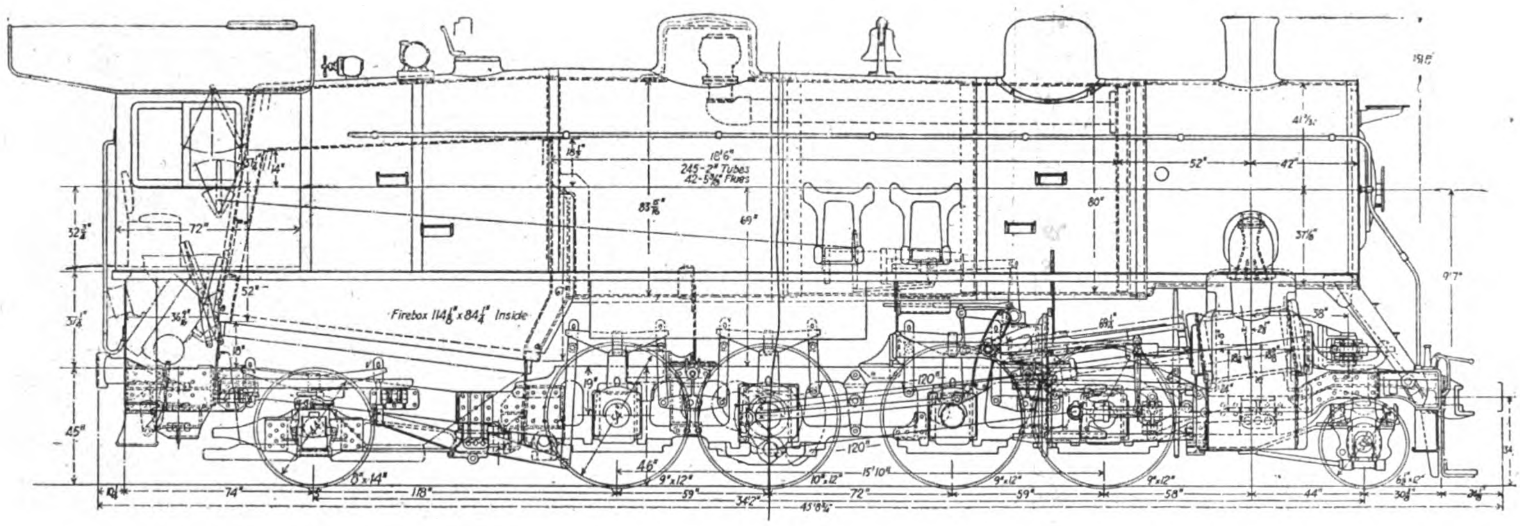
Chart Comparing Tractive Effort of South Manchuria Railway Three-Cylinder Locomotive with that of a Two-Cylinder Engine

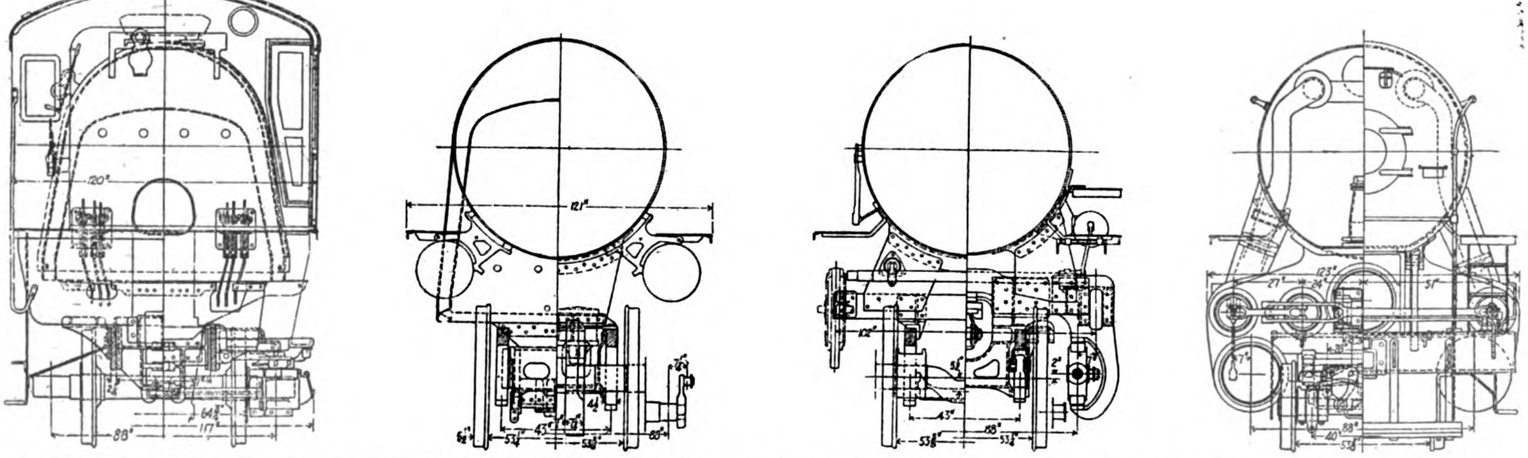
valves are 12-in. in diameter with a maximum travel of 6-in., a lead in full gear of $\frac{3}{16}$-in., an outside lap of $1\frac{1}{8}$-in. and no exhaust clearance. The two outside valves are operated by Walsehaert valve gear which through interconnecting levers also operate the third, or inside piston vale.

The engines weight 268,000-lbs. in working order, 25,000-lbs. being carried on the engine truck, 48,800-lbs., on the trailing truck and 194,200-lbs., on the driving wheels. The tenders weigh 135,-000-lbs., making the total weight of engine and tender, 403,000-lbs. With a tractive effort of 56,000-lbs. the factor of adhesion is 3.47. The driving and the rigid wheel base is 15-ft. 10-in. and the total wheel base of the engine alone is 34-ft. 2-in., that of the engine and tender being 62-ft. $7\frac{1}{4}$-in.

The boilers are of the straight top type with wide radial stayed fireboxes. The diameter of the first ring is 80-in., and the steam pressure carried is 180-lbs. They are fitted with 245 2-in. tubes and a superheater having 45 $5\frac{3}{8}$-in. flues, the length of the tubes and flues being 18-ft. 6-in. and the spacing $\frac{3}{4}$-in. The fireboxes are $84\frac{1}{4}$-in. wide by $114\frac{1}{8}$-in. long, with a grate area of 66.8 sq. ft. They are fitted with sectional brick arches supported on arch tubes. The total heating surface of the boiler is 3,695 sq. ft., that of the tubes being 2,361 sq. ft., flues 1,088 sq. ft., firebox and arch tubes 246 sq. ft. and the superheating surface is 945 sq. ft.

The driving wheels are 54-in. outside diameter with 10-in. by 12-in. journals for the main wheels, the others being 9-in. by 12-in. The engine truck wheels are $33\frac{1}{4}$-in. in diameter with $6\frac{1}{2}$-in. by 12-in. journals, and the trailer truck wheels are 44-in. in diameter with 8-in. by 14-in. journals. The engine truck is of the Player type and the Cole-Scoville trailer truck is used. The main and side rods are of chrome vanadium steel and the driving boxes, engine truck and trailer truck wheel centers are of cast steel.





Sections and Elevations of South Manchurian Railway Three-Cylinder Mikado Type Freight Locomotive Built by the American Locomotive Co.

In addition to the above the engines are equipped with Viloco bell ringers, Viloco double sanders, Franklin power grate shaker, and Elvin mechanical stokers. They are also fitted with Franklin pneumatic fire doors, Franklin unit safety drawbars and radial buffers, Pyle National electric headlight equipment and the Chambers outside connected throttle valves. Some of the other equipment includes Okadee blow-off cocks, blower valves, tender hose couplings and water gauges, Also staybolts, Ever-lasting safety valves and Simplex injectors. The Ashcroft steam gauge is used with Nathan lubricators, Elvin grease cellars, Paxton Mitchell piston rod and valve stem packing, and the valves are operated by means of Alco power reverse gears. Gibson retaining rings are used and one engine is fitted with a Superior flue blower.

The tenders are of the eight-wheel type with arch bar trucks and rectangular water bottom cisterns having a capacity for 6,000 gallons of water and 12 tons of coal. The tender frames are built of steel channels, and the cabs are of the same design as those used in this country.

Dimensions, Weights and Proportions of Three-Cylinder Locomotives for South Manchurian Railway

Gauge	4-ft. 8½-in.
Service	Freight
Type	Mikado
Fuel	Bit. Coal
Cylinders, three, diam. and stroke	22½-in. by 26-in.
Valves, piston, diam	12-in.
Max. travel	6-in.
Lead in full gear	3/16-in.
Outside lap	1⅛-in.
Exhaust clearance	0
Weights :	
On drivers	194,200-lbs.
On engine truck	25,000-lbs.
On trailer truck	48,800-lbs.
Total engine	268,000-lbs.
Tender	135,000-lbs.
Total engine and tender	403,000-lbt.
Wheel base :	
Driving	15-ft. 10-in.
Rigid	15-ft. 10-in.
Engine	34-ft. 2-in.
Engine and tender	62-ft. 7¼-in.
Wheels, diam :	
Engine truck	54-in.
Driving	33¼-in.
Trailing truck	45-in.
Journals, diam. and length :	
Main	10-in. by 12-in.
Others	9-in. by 12-in.
Engine truck	6½-in. by 12-in.
Trailing truck	8-in. by 14-in.
Boiler :	
Type	Straight top
Pressure	180-lbs.
Diam. first ring	80-in.
Tubes, number and diam.	245 2-in.
Flues, number and diam.	42 5⅜-in.
Tubes and flues, length	18-ft. 6-in.
Spacing	¾-in.
Firebox :	
Length	114⅛-in.
Width	84¼-in.
Grate area	66.8 sq. ft.
Heating surface :	
Firebox	217 sq. ft.
Arch tubes	29 sq. ft.
Tubes	2,361 sq. ft.
Flues	1,088 sq. ft.
Total	3,695 sq. ft.
Superheating	945 sq. ft.
Tractive effort	56,000-lbs.
Factor of adhesion	3.47
Tender :	
Type	Eight wheel
Capacity coal	12 tons
Capacity water	6,000 gals.
Wheels, diam.	33¼-in.
Journals	5-in by 9-in.

An Useful Propeller Publication

Having regard to the number of enquiries which are constantly being received by the Editors of yachting, motor boating and other periodicals dealing with steam or motor craft, from owners who for one reason or another are dissatisfied with their propelling gear, it is extremely interesting to note that a most useful pamphlet has recently been prepared on the subject by John I. Thornycroft & Co., Limited.

This firm having had years of experience in the design and manufacture of propellers for all classes of service in various parts of the world, is in a position to offer advice of a distinctly reliable nature. The booklet covers in a clear and concise manner the more common causes for dissatisfaction on the part of owners who, rightly or wrongly, have reason to think that they are not getting satisfactory results from their craft.

GREATER OSAKA

(Continued from page 14)

area alone will not make for a great city. There must be modern civic improvements carried out in order to make Greater Osaka worthy of its name.

Broader Streets

Side by side with the proposed plan of Greater Osaka, the city has a plan to construct broad streets which will run in four directions, in order to relieve the present congestion of traffic. The narrowness of the streets in Osaka, as in other cities in Japan, has been an obstruction to the proper development of modern enterprises in industry as well as in other lines of human activity. Moreover, if a natural accident, such as an earthquake which would shake the city from its foundations, should visit the city followed by a big fire (Osaka is famous for fires), the present condition of the streets is entirely unsatisfactory in affording the people sufficient right of way to escape to places of safety.

Already plans have been mapped out by the city authorities for the construction of wide streets, which will be carried out as soon as the funds needed is secured. With the wealth and latent economic and financial strength of the city, there is no reason why the plans mapped out cannot be carried out, if the people address themselves seriously to the problem.

Rapid-Transit Means

There is also a plan of constructing rapid-transit means of travel in the city, either elevated or underground, in order to relieve the present street car congestion. The suburban electric car lines, such as the Hanshin, Hankyu, Nankai, Keihan and others in existence as well as those planned, are contemplating improving their service by reconstructing the lines in the city. Their plans have not progressed very fast as yet, due to legislative difficulties presented by the municipal assembly, but as soon as these and other natural impedimenta are overcome, means of locomotion to and from Osaka will be greatly improved.

The last, but not least, thing to be noted is the fact that the imperial railway office is now carrying out the plan of rebuilding Osaka station at Umeda into the finest railway station in the Orient. Acres of property adjoining the present station at Umeda have been purchased, the buildings standing thereon are being demolished, and engineering work is fast progressing. Within a few years Osaka's front gate will be decorated with a first class railway station worthy of the largest city in the Orient.—*Osaka Mainichi.*

Motive Power Development on the Peking-Suiyuan Railway

By J. K. Wong, Peking-Suiyuan Railway

THE Peking-Suiyuan railway was formerly known as the Peking-Kalgan, and it is not unlikely that its name will be again changed as the line is further extended. This line represents the first piece of work in railway construction carried out under exclusive Chinese engineering supervision. It was well done. The following tables, 1 and 2, show respectively the development of the main line and its branches for facilitating the promotion of local and mining industries:—

TABLE 1.

Sections.	Construction Commenced.		Completed.		Length in Miles.	Traffic Opened.	
Peking-Kalgan...	... Oct.	1904	Sept.	1908	134.0	Sept.	1908
Kalgan-Fengchen	... Sept.	1908	Sept.	1915	135.0	Sept.	1915
Fengchen-Suiyuan	... Aug.	1919	April	1921	149.0	May	1921
Suiyuan-Paotow	... Jan.	1921	Dec.	1922	91.5	Dec.	1922

TABLE 2.

Sections.	Construction Commenced		Completed		Length in Miles	Traffic Opened		
Peking-Mentoukou	... Mar.	1907	Sept.	1908	16.7	Sept.	1908	Coal
Round-Peking City	... June,	1915	Dec.	1915	9.5	Jan.	1916	
Tatung-Kouchen, Shansi	April	1917	July,	1917	12.3	Sept.	1917	Coal
Shuanhwa-Shuimo	... Oct.	1917	Dec.	1917	5.4	Jan.	1918	Iron ores

Thirty-three miles from the Peking station is the Nankow-Pass, 12 miles long, which represents typical mountain construction work with sharp curves of 600 feet in radius, steep gradients of 1 in 30 and tunnels built on incline and with curvatures. The operation of traffic through this pass necessitates the use of powerful locomotives.

Mallet locomotives of the 0-6-6-0 type, with a maximum tractive power of 46,407 pounds, built by the North British Locomotive Company were put into operation on the pass in 1908 and the following year Shay geared engines with a maximum tractive power of 44,115 pounds, built by the Lima locomotive works were introduced. As traffic was fast increasing more Mallets built by the Baldwin locomotive works with 2-4-4-2 wheel arrangement and with a maximum tractive power of 27,400 pounds were purchased in 1911 for pushing passenger trains up grade.

As the line was further extended into the rich north-eastern plateau, hitherto isolated from other parts of the country for lack of transportation facilities, great cargoes of grain, wool, hides and coal found easy access to the world's market, resulting in a rapid increase of passenger and freight traffic which has continuously demanded larger motive power capacity for pushing heavier and longer trains over the mountain pass. In 1914, Mallets built by the American Locomotive Co., of the 2-8-8-2- type with a maximum tractive power of 54,375 pounds were purchased and in 1922 more Mallets also built by the American Locomotive Co., of the 2-8-8-2 type, but with a maximum tractive power of 92,500 pounds were added.

The last named represent the largest locomotives in operation on Chinese railways to-day. They were built by the American Locomotive Co., to meet the exacting requirements of the Peking-Suiyuan line and are equipped with modern appliances for economical operation and utilization of comparatively low grade of bituminous coal. These huge locomotives require such a great amount of steam to develop their full power that coal has to be burnt at a terrific rate which is considered hardly economical to be done by hand firing and, therefore, the Elvin underfeed mechanical stoker have been installed. For guiding the engine drivers to run these heavy engines at safe limitation of speeds upon the difficult track condition and structures at the mountain pass, automatic speed recording devices are employed. These engines are equipped with superheaters supplied by the Locomotive Superheater Company of New York and latest type of the American Westinghouse ET No. 6 air brakes suitable for operating on the automatic system as well as straight air. Figure 1 shows this type of Mallet engines and Figure 2 shows the lighter type. The particulars of the engines so far mentioned which operate on the mountain division, are shown in table 3.

Turning to the motive power for passenger and freight service, switching engines built by the American Locomotive Co., Baldwin Locomotive Works and a few from the Tongshan Locomotive Works with tractive power ranging from 11,454 pounds to 21,360 pounds were introduced, in the years 1906 to 1909. All these engines are of the tank type. Growth of traffic required more speed for passenger trains and in 1908 to 1909 Moguls were purchased; these engines develop a maximum tractive power of 22,093 pounds with 60″ drivers. Switchers and Moguls mentioned above constituted the early source of motive power for the operation of the line which power was soon found to be inadequate to meet the growing volume of traffic. Therefore, modern engines with greater capacities have steadily taken the place of above, which until to-day are being used extensively for shunting in station yards and terminals only. Table 4 shows particulars of these engines.

In 1912, Consolidation type locomotives developing a maximum tractive power of 31,820 pounds were put into operation; in 1914,

TABLE 3.—MOUNTAIN LOCOMOTIVES.

Item No.	No. of Engines	Type of Engines.	Builders of Engines	Maximum Tractive Power	Weight in Work Order	Year of Adoption	Particulars
1	4	0-6-6-0	North British Loco. Co.	46,407-lbs.	216,000-lbs.	1908	Saturated steam. Air brakes.
2	6	Shay	Lima Loco. Wks.	44,115	176,000	1909	,, ,, ,, ,, Obsolete
3	4	2-4-4-2	Baldwin Loco. Works.	27,400	163,000	1911	,, ,, ,, ,, ,,
4	7	2-8-8-2	American Loco. Company	54,357	290,000	1914	Superheated steam. Air brakes.
5	7	2-8-8-2	American Loco. Company	92,500	446,000	1922	,, ,, ,, ,,

TABLE 4.—SWITCHING LOCOMOTIVES.

Item No.	No. of Engines	Type of Engines.	Builders of Engines	Maximum Tractive Power	Weight in Work Order	Year of Adoption	Particulars
1	4	Tank—2-6-2	Baldwin Loco. Works	11,454-lbs.	105,000-lbs.	1906-7	Saturated steam. Steam brakes.
2	3	,, 0-6-0	American Loco. Company	14,344	96,500	1909	,, ,, ,, ,,
3	2	,, 2-6-2	Baldwin Loco. Works	18,800	120,000	1909	,, ,, ,, ,,
4	2	,, 2-6-2	North British Loco. Company	11,900	83,000	1908	,, ,, ,, ,,
5	17	,, 2-6-2	Baldwin Loco. Works	21,360	111,000	4-1909 3-1920 10-1921	,, ,, Air. brakes
6	10	Mogul—2-6-0	Baldwin & Tongshan	22,093	123,000	6-1908 4-1909	,, ,, ,, ,,

AMERICAN LOCOMOTIVES ON THE PEKING-SUIYUAN RAILWAY

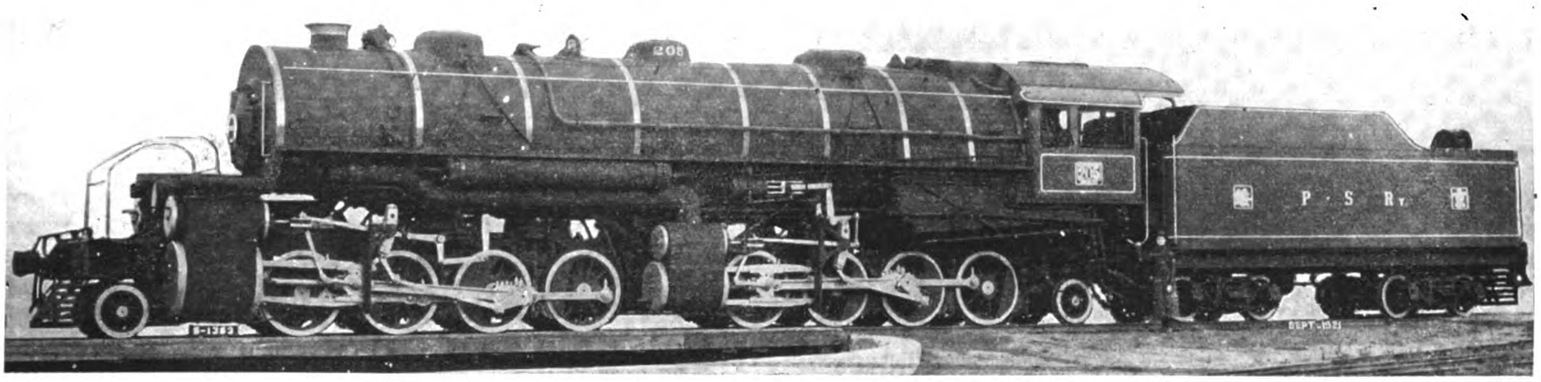


Fig. 1.—8-Wheeled Tender, Heavy Mallet Type

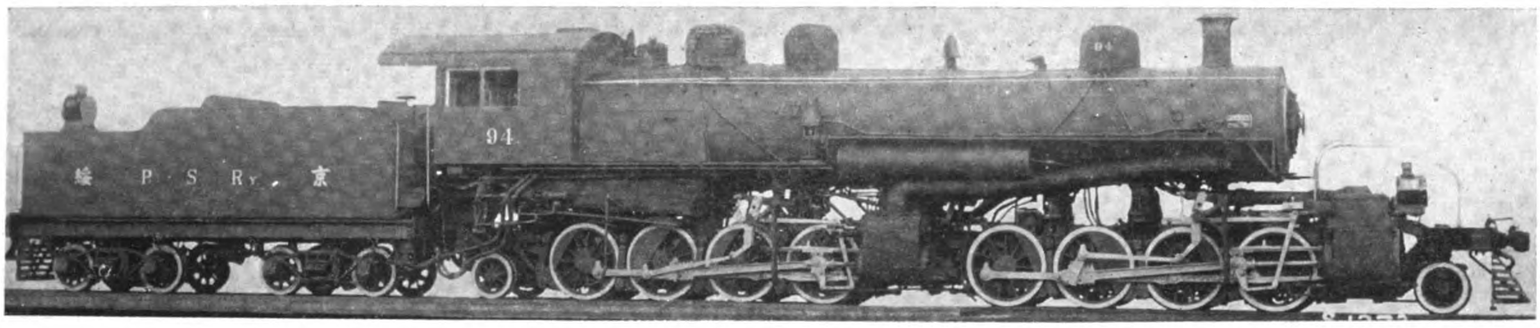


Fig. 2.—8-Wheeled Tender, Light Mallet Type

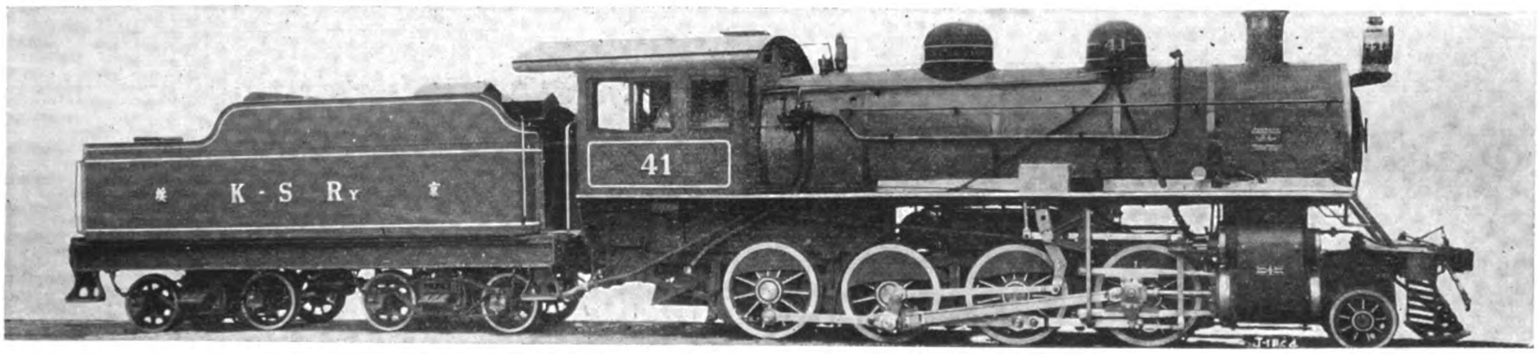


Fig. 3.—8-Wheeled Tender, Consolidation Type

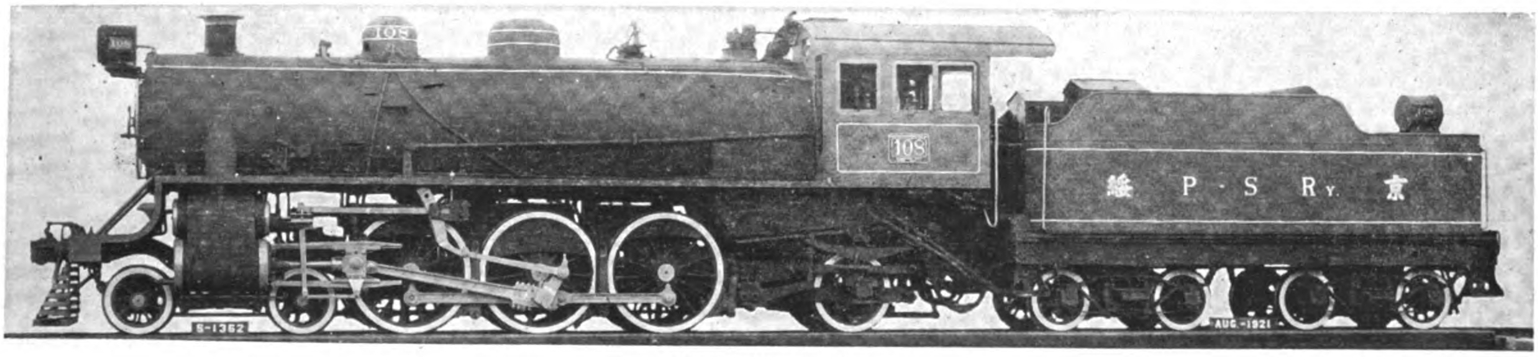


Fig. 4.—Pacific Type

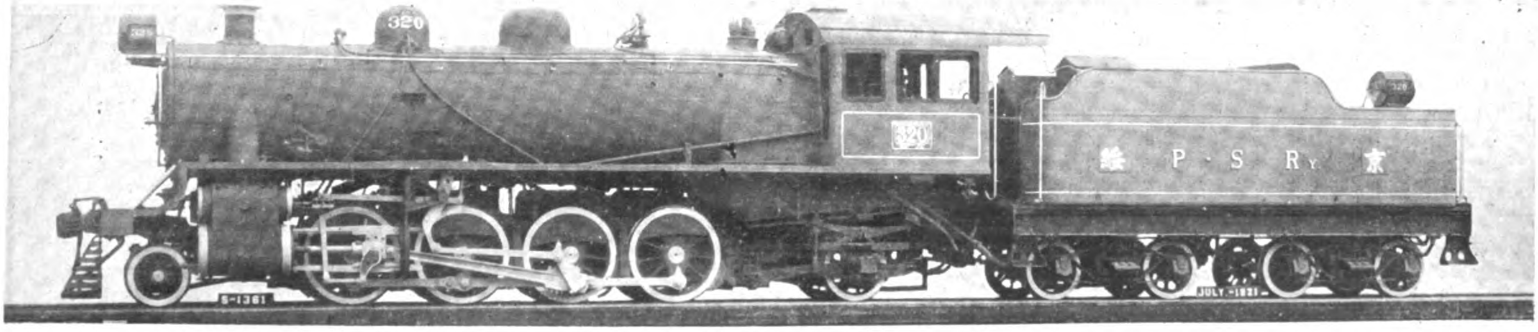


Fig. 5.—Mikado Type

1916 and 1922, Mikado types developing a maximum tractive power of 34,272 pounds were added in lots of 5, 5 and 36 and Pacific types developing a maximum tractive power of 25,664 pounds also in lots of 5, 2 and 13 respectively. Consolidation and Mikado types are used for passenger and freight service and the Pacific exclusively for fast passenger trains. All these modern engines were built by the American Locomotive Co., and are equipped with superheaters made by the Locomotive Superheater Co., of New York and American Westinghouse ET No. 6 air brakes working both on automatic and straight air systems. Most of these engines are equipped with the Franklin pneumative firedoors and a few Mikados are equipped with feed water heaters supplied by the Feed Water Heater Co., of America, serving to show what saving can be affected by this economy appliance. Figures 3, 4 and 5 show respectively the type of Consolidations, Pacifics and Mikados, further particulars of which are shown in table 5.

Another thing worthy of mention is that most of the freight wagons and all the passenger cars are equipped with the British Westinghouse combined automatic and straight air braking systems and those having not as yet installed are being considered. This installation is essential for safety in railway operation and is required by state laws in many foreign countries. In China, however, although the passenger cars are so equipped, the freight wagons are not. Among Chinese railways, Peking-Suiyuan line may be safely said to possess the most modern motive power equipment. There are 138 engines on this line among which 75, representing the most modern designs of mountain, passenger and freight engines, were built by the American Locomotive Company, New York.

TABLE 5.—PASSENGER AND FREIGHT LOCOMOTIVES.

Item No.	No. of Engines	Type of Engines.	Builders of Engines	Maximum Tractive Power	Weight in Work Order	Year of Adoption	Particulars
1	6	Consolidation 2-8-2	American Loco. Company	31,820-lbs.	183,500-lbs.	1912	Superheated steam. Air brakes.
2	46	Mikado—4-6-2	,,	34,272	188,500	5-1914 5-1916 36-1922	,, ,, ,, ,,
3	20	Pacific	,,	25,664	184,500	5-1914 2-1916 13-1922	,, ,, ,, ,,

Restoration of the Works of the Nippon Electric Company, Ltd.

(Continued from page 27.)

were narrowed or temporarily eliminated and piece parts were stored in the lumber drying kilns to provide the space required.

Thirty-four days after the quake the manufacturing branch began delivering fully repaired apparatus which had been completely assembled before the quake but injured in the wreck and three weeks later resumed regular work on No. 92 jacks, making a delivery on November 5. Other jobs were resumed in rapid succession; deliveries of No. 12 protectors being made on November 13, extension sets on November 16, and keys on November 28.

By the end of the fifteenth week all departments which had been in the wrecked buildings had resumed regular production work in temporary locations and repairing of buildings was well under way.

The concrete buildings were demolished to the level of the second floor and proper repairs made to the remainder. Trusses of light poles were erected on the second floor and covered with galvanized iron, the result being one story buildings with a garret available for the storage of certain classes of materials. None of the second floor is available for anything other than storage.

While wrecking and repairs were being carried on, the space which would be available was reallotted, a new block plan layout was made of the entire manufacturing branch and detailed layouts of all departments were made in accordance with this plan. As repairs to the buildings progressed, the departments were reinstalled according to the new layouts. This work was completed and the entire manufacturing branch was running at full capacity by June 1, 1924.

In spite of their handicap, the Nippon Electric Company secured the orders for the greater part of the telephone equipment purchased or contracted for by the department of communications and the department of railways since the disaster and to the end of June, 1924. Of the orders secured, 79 per cent., consisted of equipment not manufactured by the Nippon Electric Company but which will be supplied by its affiliated companies, 18 per cent. consisted of equipment to be manufactured and 3 per cent. was supplied from merchandise stock.

Plans for the future include the demolition of all buildings now on the compound and the erection of eleven steel frame buildings, each three stories high. These buildings will provide a total gross floor area of 370,000 square feet. By roofing over the first floor in the light courts the percentage of first floor area will be increased sufficiently to permit of the installation of nearly all machine equipment on the ground floor, reducing the loads above the ground floor and thus decreasing the danger of damage from earthquakes. On the sides and rear of the compound the public streets are narrow and here the buildings will be located far enough from the property lines to provide amply wide safety zones in case of fires near by. The plans also include the installation of a complete sprinkler system.

Detailed drawings and specifications for the first new building are completed and work will be started during August of this year.

British Contracts for the Far East

From Our London Correspondent

Railway Wagons for India

A SECOND contract has been secured by Messrs. Camel, Laird & Co., Ltd., to build at their works at Nottingham, 775 four-wheeled all steel open goods wagons, for the East India railway company. Delivery of these is to be made at the rate of 5o wagons per week.

Railway Material for China

An order has been placed by the Jardine Engineering Corporation Ltd., with the Patent Shaft and Axletree Co., Ltd., Wednesbury, for bridge material required by the Shanghai-Hangchow-Ningpo railway. The same firm has also recently placed orders with the Metropolitan Carriage, Wagon & Finance Co., for 26-68-ft. coach underframes and 23 all steel covered wagons required by the Shanghai-Nanking railway.

Tanks for India

Messrs. Vickers Ltd., are making a number of improved tanks for India, and one of them, which has just been tested on the hilly roads in the Brightside district of Sheffield, has attracted a great deal of interest. The improvement on the older models include the installation of an Armstrong-Siddeley 90 h.p. engine, air-cooled by means of fans. The tank accommodates a gun crew of four and a driver, and has a gun mounted in the turret. The motive unit is on the caterpillar principle. The machine can develop a speed of 20 miles an hour, and answers its steering apparatus with remarkable ease. It is stated that it will mount an incline of 45 degrees.

New Vessel for British India Steam Navigation

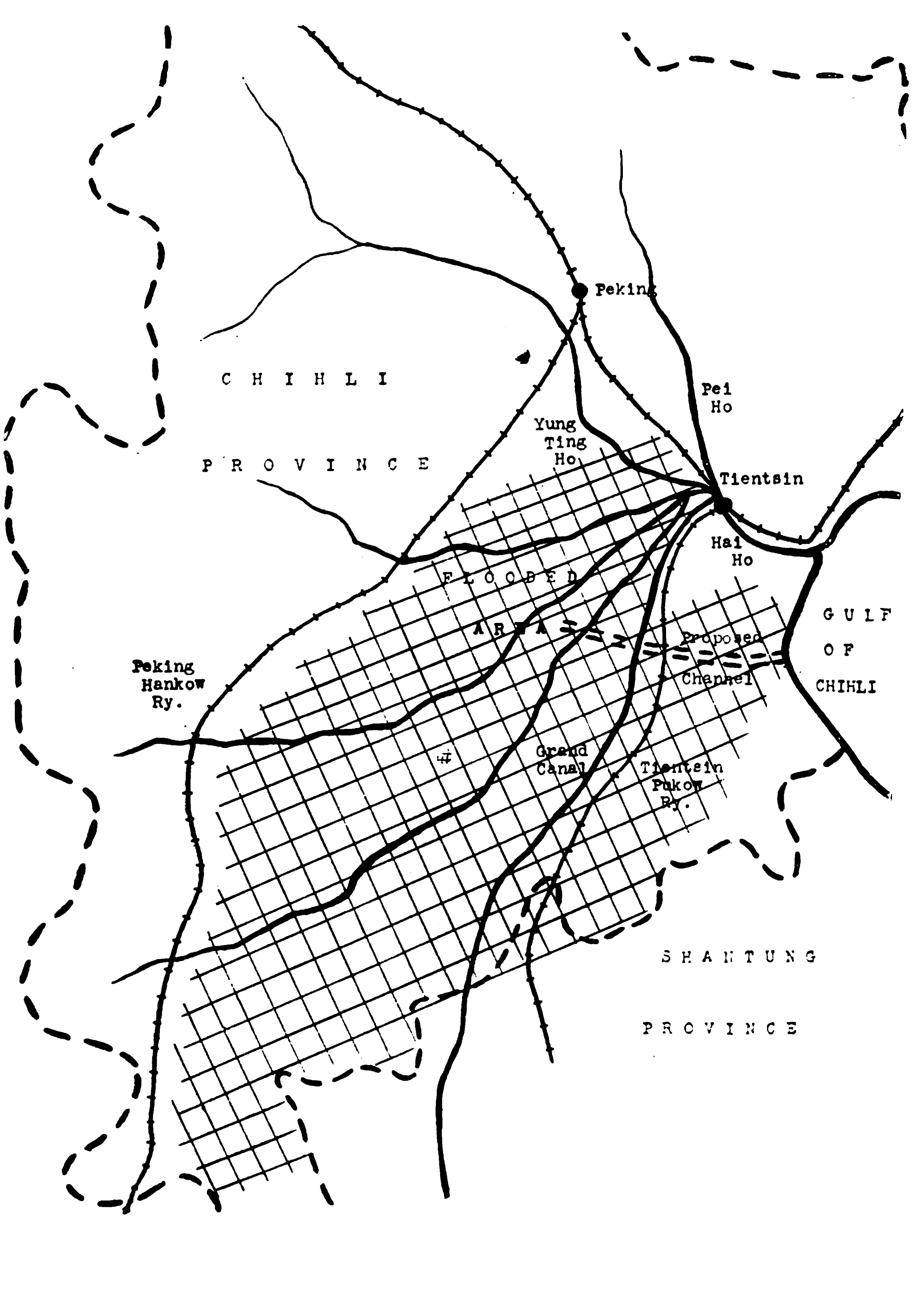
Messrs William Gray & Company, Ltd., have just secured a repeat order, to be built at their works at West Hartlepool, for a new vessel for the British India Steam Navigation Company. The vessel is to be of 7,830 gross tons register, with a deadweight carrying capacity of 12,000 tons.

A Big Engineering Project for Famine Relief

Drainage Channel to the Sea in Chihli Province

By Laurence Impey

THE recent civil war which has occurred in northern and central China has gone far towards diverting public attention from the dire catastrophe threatening as a result of the widespread and disastrous floods of last June, July and August, although in point of fact this same civil war has only greatly aggravated the pitiable conditions of destitution which are to be seen in the afflicated provinces. For not only has the internecine struggle absorbed the bulk of those governmental funds which it was hoped would be available for relief work, but it has also largely augmented the number of destitutes by reason of the military seizure of the few remaining stocks of fodder and transport animals. Add to this the fact that the defeated troops have scattered far and wide over northern and central China, to pick up a living as best they may, probably by banditry, and it can easily be realized that the problem of famine relief during the coming winter months is going to be one of the most serious that has confronted the Chinese during the past decade. So absolutely chaotic are the conditions on all the railways that ordinary traffic has been suspended for more than two months, while for the same period there has been no government worthy of the name functioning in Peking, so that there is no Chinese organization which can handle the question of relief work which is now so necessary. The only body standing ready to cope with the emergency is the China international famine relief commission, and even this institution finds itself almost insuperably handicapped by present conditions. For during a confused and widespread war such as this last has proved, it was practically impossible to send out parties in the field to carry out the necessary investigations as to the needs of the various districts affected, with the result that the situation which is best known is that one which is in the immediate vicinity of Peking itself, the reports from the outlying provinces not being fully completed even yet at the beginning of December. Then too, the financial difficulties of the commission have been increased very largely, not only because of the drain on the country's own resources, but also because foreign nations have been discouraged from rendering assistance by the sight of one faction in China busily engaged in cutting the throats of another, while a third and far larger group is on the verge of starvation. But in this attitude, natural though it may be, the writer is of the opinion that the outside world is at fault, for it seems hardly just that millions of innocent people should be thus condemned to suffering through the insatiable ambition of a few militaristic *tuchuns*, who care nothing as to the miseries of the flood victims, merely regarding them as so much cannon fodder. The commission, therefore, has made its appeal to the representatives of the foreign powers in Peking, requesting that a grant of a special customs surtax be approved, notwithstanding the chaos caused by the war, in order that some funds might be forthcoming to enable them to meet the famine conditions which are bound to ensue during the coming winter months. It appears that with the exception of the French, all the governments concerned are agreeable to the proposal, and the only reason which the writer can suggest as to why the latter have not yet given their consent is that they are using their veto as a weapon to force the Chinese to agree to a settlement of the "Gold Franc Case." As to the rights and wrongs of this there are many opinions, and this is no place to discuss them, but it does not seem as if a liberal and fair-minded nation such as the French have always proved themselves to



be should allow a financial situation such as the "Gold Franc Question" to affect their decision on a matter with which it has in reality no connection whatever. Therefore, if and when some satisfactory settlement of this difficulty is arrived at, it is estimated that some eight million dollars will become available for relief work, and it is on the basis of this hope that the international famine relief commission have outlined their program for the coming winter and spring months.

As is well known, the general policy of the commission in the past has been to provide relief by giving employment to the heads of families which are destitute and using the labor thus available on projects which will be of permanent value to the communities and areas which have been affected. With this standpoint in mind the executive committee of the C.I.F.R.C. have selected the province of Chihli as being the one which was most gravely affected by the floods, and a study of the needs and possibilities of this huge area was undertaken early in the autumn. Not less than ten thousand square miles of arable land were found to be under water, of which over six thousand square miles are still inundated at the beginning of December, so that it was obvious that a gigantic problem was placed before the engineering staff of the commission when a drainage scheme for this area was called for, both in order to employ the flood victims and also to provide a permanent solution of a danger which threatened to inundate this region and the neighboring city of Tientsin every three or four years.

The sunken area known as the Wen An Wa, stretching between the Peking-Hankow and the Tientsin-Pukow railways, is practically on sea level, and its only protection from flood has been its numerous dyke systems, particularly that one known as the "Thousand Mile Dyke" lying to the north. When these dykes succumbed to the abnormally high waters of last July and August, the whole of this region was covered to a depth of ten or twelve feet by the floods, and it seems improbable that this will ever drain off unless an outlet channel is provided to the sea. A glance at the accompanying sketch map will show what a large proportion of the arable plain of northern China is affected by the flood and how vital it is that a scheme shall be put through which will deal with the menace once and for all, for the drainage of the present river systems all tends towards Tientsin, where the channel of the Hai Ho has time and again proved its insufficiency to cope with additional flood waters. The engineers of the C.I.F.R.C. have, therefore, considered this pressing problem from all its angles, and have now put forward a scheme for the construction of a drainage canal some forty-five miles long and five hundred feet wide, to run from the Wen An Wa region across the Machang canal, the Grand canal, the Tientsin-Pukow railway and down to the sea at a point some fifty miles south of Taku. By this means it is estimated that the whole low lying south-west of Tientsin can be drained, and a large proportion of the flood water diverted from the Hai Ho during the rainy season, thus securing the regularity of its channel and the the safety of Tientsin itself. The cost of the work will be somewhere in the neighborhood of six million dollars, and it will afford employment to more than one hundred and fifty thousand workers when in full swing, so that if it is reckoned that each laborer supports a family of four or five there will be famine relief afforded to nearly one million persons on this one scheme alone.

Even this will be under the probable necessities of the province, for from the reports to hand of sixty counties it appears that nearly a million and a half people are or will be destitute owing to the floods. When the word "destitute" is used in connection with famine relief it would be well for the reader to remember what is meant by the term in China, where a peasant or coolie household ordinarily lives on less than one hundred dollars a year, "destitution" therefore indicating a state of things where the victim has neither clothes, food or firing in view for the future, and merely exists on the outskirts of some town by selling the children and feeding on the garbage dumps, until the bitter cold of a Chinese winter night completes the tragedy. These are the people whom it is hoped to save this winter if the scheme can be carried out and the channel dug, but in order that this may be done it is first necessary to secure the funds, a matter which hinges on the pressure exerted by public opinion on those in authority. It should be remembered in connection with this request for the granting of the customs surtax that it is not proposed to sink the whole of the six million dollars permanently in the province of Chihli, for as the funds thus to be raised are derived from the whole of China it is obviously only fair that China as a whole should ultimately benefit by their expenditure. It is proposed, therefore, to use this money on a loan basis first in one province and then in another, as the need may arise, and it is worth noting in this connection that the C.I.F.R.C. has already expended some hundreds of thousands of dollars in this manner in previous years, the loan always being repaid on time by the afflicted region to which it was granted.

In stressing this one particular area in Chihli as needing help it must not be supposed that the claims of others have been altogether overlooked; it is simply that the C.I.F.R.C. feel the necessity of putting through one project in full, and they have therefore gone into the matter in some detail, but at the same time engineers and investigators have visited affected regions in the provinces of Hunan, Kiangsi, Honan, etc., and schemes of relief are in course of preparation, which will be put into operation supposing that the necessary funds are forthcoming and that the ever recurrent curse of civil war does not absolutely prohibit relief workers from entering the fields indicated. Here again it is felt that the pressure of public opinion can do more than anything else to help the efforts of the commission, for the indirect influence exerted by well organized publicity in China and abroad can scarcely be overestimated.

New Motor Ships for the O.S.K.

(Continued from page 30.)

pipe, from which branches are taken to each of the separate valves. Speed control of the engine is effected by variation of the lift of the fuel valves, the arrangement being actuated from a lever at the control station, although individual valves may be cut out independently of each other if necessary.

New Engine Features

The engine is arranged in two groups of three cylinders, each group of cylinders being supported on an entablature which is bolted to the cast-iron frame. The two entablatures are connected together at the centre by means of a suitable cast-iron distance piece. Instead of having mechanically-operated starting air valves in each cylinder, a non-return valve is fitted, the compressed air being distributed to the various cylinders at the correct timing by means of distributing valves operated from the camshaft and arranged below it. Thus there are only three mechanically operated valves in each cylinder cover, namely, for inlet, exhaust and the admission of fuel. An unusual point is that the exhaust valves are water-cooled, the cooling water being supplied to and discharged from the valves by means of flexible piping.

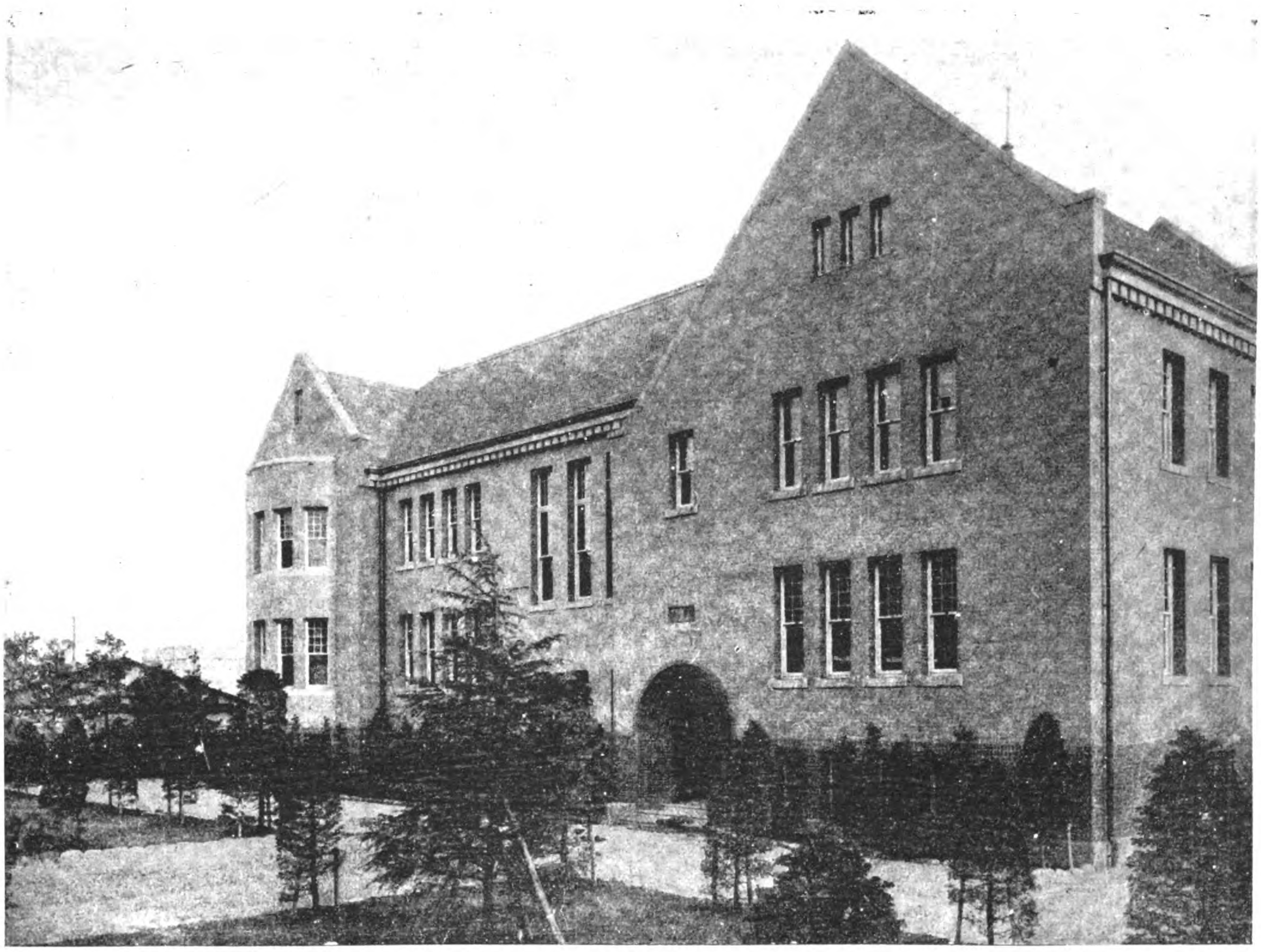
When the engine is in the stop position the fuel-valve lever rollers are out of contact with their cams. If it is desired to reverse, the reversing lever is moved, bringing a servo motor into operation which turns the manœuvring shaft on which the levers for the exhaust and inlet valves are pivoted. Thus the rollers at the ends of these levers are lifted from the cams, and the camshaft is then moved fore and aft under the influence of the servo motor, the valve levers being finally brought down on to the exhaust cams. The starting air lever is then operated, which admits air to the cylinders in a position to receive it, and finally in fuel lever is actuated, which brings the fuel-valve rollers in contact with the cams.

The engine is self-contained, the circulating, lubricating oil, bilge and sanitary pumps all being driven at the back of the propelling motor. These are of the plunger type and operate at about 60 r.p.m.

South America Liners

Orders have recently been placed by the same owners for three large cargo and passenger ships of particular interest. All of these vessels will be built in Japan at the Mitsubishi Dockyard, and will be of 430-ft. b.p. They will carry about 6,800 tons of cargo, and will be provided with a large amount of passenger accommodation. In each ship there will be installed two Sulzer-type engines developing a total of 4,500 b.h.p. or about 6,000 i.h.p. and running at 110 r.p.m. Electricity will be employed throughout the vessel, and the generating plant will comprise three 250 b.h.p. oil engines running at 300 r.p.m. and driving 150-k.w. generators in addition to an auxiliary of 47.5 k.w.

(Continued on page 48.)



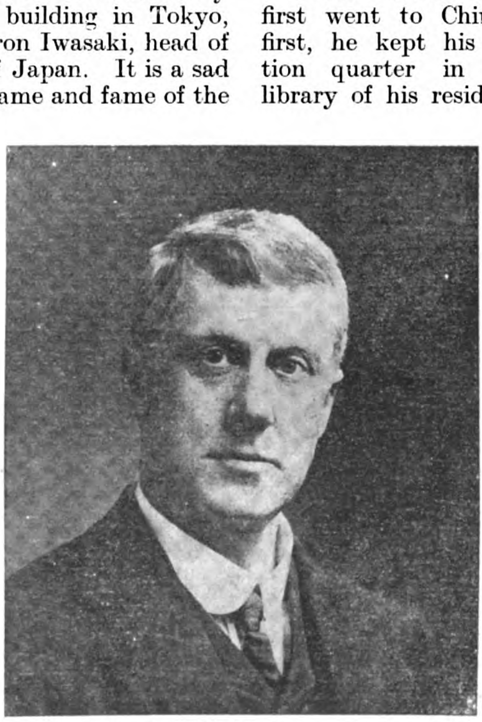
Front View of the Oriental Library in Tokyo, in which is incorporated the "G. E. Morrison Library." Erected and Endowed by Baron Iwasaki at a total cost of Yen 1,500,000

New Home of the Morrison Library

ALL book-lovers and students of Far Eastern affairs will be gratified to learn that after many adventures the celebrated Morrison library is at last safely housed in a modern fire-proof building in Tokyo, thanks to the beneficence of Baron Iwasaki, head of the great Mitsubishi interests of Japan. It is a sad commentary on Chinese public spirit that the name and fame of the man who devoted his life to advancing the higher interests of their country should be perpetuated by a monument erected in another land. The treasure-house of the rarest documents in the world dealing with the Far East and especially with China representing twenty years work on the part of the late Dr. G. W. Morrison, is now located in the Honjo ward of the capital of Japan, forming part of what is known as the Toyo Bunko or the Oriental library.

The Morrison library consists of some 35,000 volumes, mostly treating with the Orient, to which have been added many valuable works collected under the supervision of Dr. Shiratori at a total expense to Baron Iwasaki of Yen 1,500,000, including the cost for the present building.

The first edition of the travels of Marco Polo, published in 1592, one of the first books ever printed, is in the collection. A testament published in Amakusa at the beginning of the Tokugawa era and many important works covering all ages of Japanese history, which were treasured by the Iwasaki, also are included in the Oriental library.



The Late Dr. G. E. Morrison

The collection was begun in 1897 when Dr. Morrison first went to China as a correspondent of *The Times*. At first, he kept his books in his private residence in the legation quarter in Peking, but later preserved them in the library of his residence at Wangfuching Road, known as Morrison street.

But even before coming to China, Dr. Morrison had begun to buy books, when documents dealing with the celestial empire were drug on the market. After reaching China he systematically purchased every available book on China in every language. The collection includes works on China, Tibet, Mongolia, Manchuria, Kashgaria, Siberia, Korea, Formosa and a comprehensive set of works on central Asia.

There are books in 20 languages, including English, French, German, Norwegian, Swedish, Danish, Italian, Latin, Spanish, Portuguese, Turkish, Arabic, and Hebrew. Dictionaries alone number more than 400, including the early vocabulary of Mentzel, published in 1685, giving a Latin translation of the characters of the Nestorian alphabet; the MS. dictionary completed in 1724 by Fernandez Serrano, the MS. dictionary used by Sir John Barrow, who was attached to Lord Macartney's Embassy in China in 1793 and a complete list of Turkish books on

Islamism, presented to Dr. Morrison by the late Mr. W. W. Rockhill, American ambassador to Turkey.

The library also contains such a work as Oliver Goldsmith's "Citizen of the World," in its rare first edition of 1762; first edition of De Foe's second voyage of Robinson Crusœ, in which he came to Peking and passed through the Gobi desert and Siberia, printed in 1719.

The library is more complete than any other in works on the missionary history of China. It is believed to contain a complete set in French, Italian and Latin of all the controversial pamphlets written at the time of the famous dispute between the Jesuits and Dominicans regarding the ancestral worship in China in the early part of the eighteenth century.

The Boxer rebellion is represented fully, more than 100 works dealing with the siege of Peking being found on the shelves. At that time the library was narrowly saved from destruction. A chain of several hundred Chinese Christians bore the library from the legation building to Prince Su's palace and a few hours later the library building was destroyed by fire, as were nearly all other libraries in Peking. There are hundreds of maps as well in the collection. All of the books are in foreign languages.

Dr. Morrison determined to sell his elaborate library in 1916 and naturally wished it to remain in Peking but as there was no response to his invitation from the Chinese, he reluctantly invited offers from other quarters. Several handsome offers were received from American universities and the American minister, Dr. Paul S. Reinsch, but they were still far under the valuation which Dr. Morrison placed on his collection. Mr. M. Odagiri, head of the Japanese group in the consortium and one of the managing-directors of the Yokohama Specia Bank in charge of its China branches, familiar with the value of the collection through long residence in Peking and contact with its owner, interested his chief, Mr. J. Inouye, then governor of the Yokohama Specie Bank in purchasing it for Japan. After having the collection appraised by Dr. M. Uyeda, dean of literature in the Tokyo imperial university, they successfully persuaded Baron Iwasaki to acquire it for the sum of £35,000.

The books were delivered to Mr. Odagiri in August 1917 and shipped to Japan where they lay for some time in a storage godown attached to a villa belonging to Baron Iwasaki in the Fukagawa ward of Tokyo. A cloudburst followed by a flood which covered this district, damaged many of the priceless volumes in their packing cases, but after calling in experts and sparing no expense, they were all cleaned and rebound and except for a few duplicates and ordinary volumes, the library was completely restored.

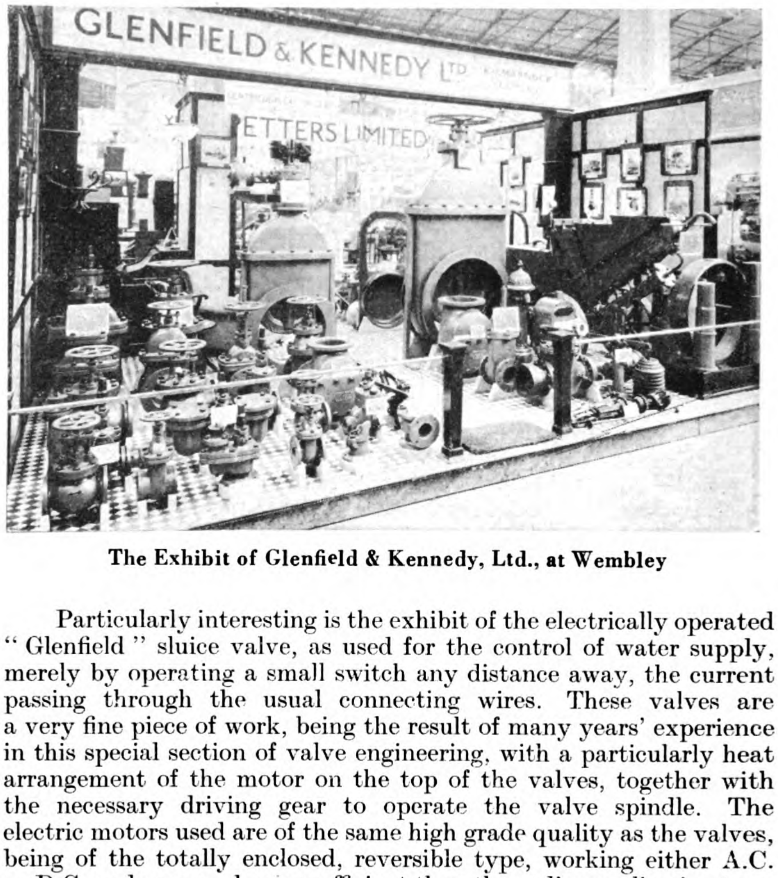
The library then found a temporary home in one of the Mitsubishi buildings in the business heart of Tokyo and in the great quake and fire which destroyed many other valuable libraries, the Morrison collection escaped without the slightest damage. In transferring his collection to Baron Iwasaki. Dr. Morrison made three conditions; first, that the collection should be preserved intact under the name of the "G. W. Morrison Library": second, he placed no objection to its being incorporated in a larger library having the same scope and purpose and third, that the collection be open to the public and students. In conformity with the desires and will of Dr. Morrison, Baron Iwasaki has purchased many old and new books for the purpose of expanding and completing the original collection, at the same time starting work on the construction of a suitable fireproof edifice to accommodate the treasures and provide rooms for study and research. This building, located at Kami-Fujimae-cho, Komagome, in the Homjo ward of Tokyo was completed in November of last year when Baron Iwasaki handed over the building site, library building, library, furnishings, fixtures and a maintenance endowment to a board of trustees to conduct it for the cause of learning. This board is headed by Mr. J. Inouye, former governor of the bank of Japan and finance minister, Mr. M. Odagiri, managing-director of the Yokohama Specie Bank, Dr. M. Uyeda, Dr. K. Shiratori and Mr. S. Kirishima.

In enlarging the scope of the library, Baron Iwasaki has wisely added a complete Chinese and Japanese section of which some 20,000 volumes are in Chinese and several thousand in Japanese, making it a most valuable aid to students of Far Eastern affairs. The trustees have made special arrangements to facilitate the use of the library by equipping several rooms for the use of those conducting a serious study and calling for the use of many reference books at one time.

Valves for Irrigation Works

FEW parts of the world are more active in developing irrigation projects at this time than the Far East. From Japan and Korea to Java many large and important plans being carried into execution for extending the area of rice lands through irrigation schemes. Several of these, located in Korea, will call for the expenditure of at least Y.100,000,000 while the governments of Indo-China, Siam, Philippines and the Netherlands East Indies are carrying out similar important projects. Of particular interest to irrigation and river control engineers is the exhibit of Messrs. Glenfield and Kennedy, Ltd. of Kilmarnock, Scotland, at the British empire exhibition where amongst their wide range of water engineering specialties are shown models of some of their larger sluice gate installations in Africa and Asia. This firm, well known for its work in India, Siam, China, and the Straits Settlements, have their own offices and technical staffs both at Calcutta and Bombay. In connection with steel sluice gate installations for irrigation work they not only supply the extensive equipment complete from their works at Kilmarnock, but, as in the case of Badlapur barrage scheme at Bombay, erect it themselves on the site.

At present they have in hand the very large sluice gate contract for the Sarda canal scheme in India on the Nepal-United provinces frontier and are exhibiting at Wembley, models of the Vaal River barrage scheme at Vereeniging for which they supplied 36 steel sluice gates, involving over 2,000 tons of steel. Their most recent contract in the irrigation field was for the Siamese government works at Nakon-Nayok.



The Exhibit of Glenfield & Kennedy, Ltd., at Wembley

Particularly interesting is the exhibit of the electrically operated "Glenfield" sluice valve, as used for the control of water supply, merely by operating a small switch any distance away, the current passing through the usual connecting wires. These valves are a very fine piece of work, being the result of many years' experience in this special section of valve engineering, with a particularly heat arrangement of the motor on the top of the valves, together with the necessary driving gear to operate the valve spindle. The electric motors used are of the same high grade quality as the valves, being of the totally enclosed, reversible type, working either A.C. or D.C. and are much more efficient than the ordinary slip ring type commonly used for this purpose.

The largest valve on the stand is a 36″ hand operated exhaust steam and water circulating sluice valve. Messrs. Glenfield and Kennedy, however, supply valves up to 144″ diameter, weighing over 20 tons each; typical of which in the Far East are those supplied to the "Tata" hydro-electric scheme, Bombay. Other items shown are the "Peebles" automatic sand washing machine, specimens of centrifugal castings, hygienic drinking fountains, and apparatus for the mechanical cleaning of the inside of water pipes, consisting essentially of an arrangement of knives and scrapers attached in the front of a piston which fits the pipe and is forced through from one hatchbox to another by the water pressure cutting out the calcerous and other deposits.

Restoration of the Works of the Nippon Electric Company, Ltd.

By A. G. Jillard, General Manufacturing Advisor, Nippon Electric Company

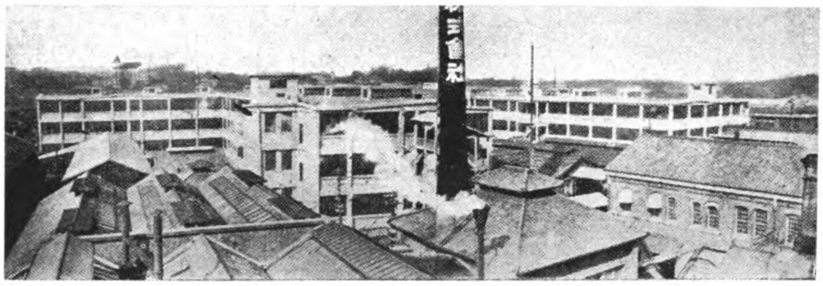
WHEN the devastating earthquake occurred on September 1st of last year the plant of the Nippon Electric Company, Ltd., included 293,750 square feet of floor area ; approximately 185,750 square feet of this being in five modern, reinforced concrete buildings. Four of these buildings were three stories high while the fifth was partly two stories and partly three stories. The remainder of the buildings were of brick construction, one, two and three stories high.

The earthquake resulted in very serious damage to the concrete buildings, consisting in general of a failure of the columns of the second and third floors ; the roofs and third floors dropping to the second floors. In some places the second floor failed and dropped to the ground floor and part of the side wall of the first floor of the two story building was badly shattered. The brick buildings suffered considerable damage in the way of cracked and broken walls but they did not fall and their occupants and contents were unharmed.

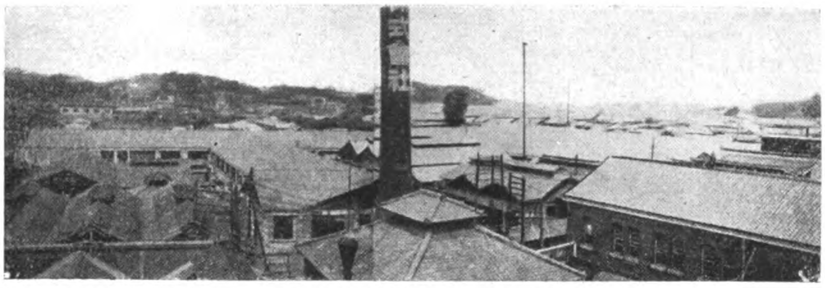
The concrete buildings were occupied almost entirely by the manufacturing branch and they represented about 73 per cent. of the area of that branch.

How badly the manufacturing branch was crippled and the magnitude of the task of rehabilitation involved may be realized from the fact that, punch press, milling, drilling, screw machine and lathe, metal finishing, wood working, meter, receiver and transmitter assembly, switchboard assembly, general assembly, and tool-making departments, with their associated inspection groups and store rooms were all in the wrecked buildings, as were the engineering and drafting departments and the manufacturing department office.

The concrete buildings as they looked before the quake



Just after the quake



As the buildings look to-day

Fortunately the plant was not reached by the fires which swept over about 60 per cent. of the city and the losses, though high, were not nearly so great as they might have been. The principal items of property loss were :

Buildings	Y. 790,685
Machinery, permanent fixtures, etc.	385,557
Material, parts and merchandise	244,582
Merchandise awaiting acceptance destroyed by fire at government compounds	251,519

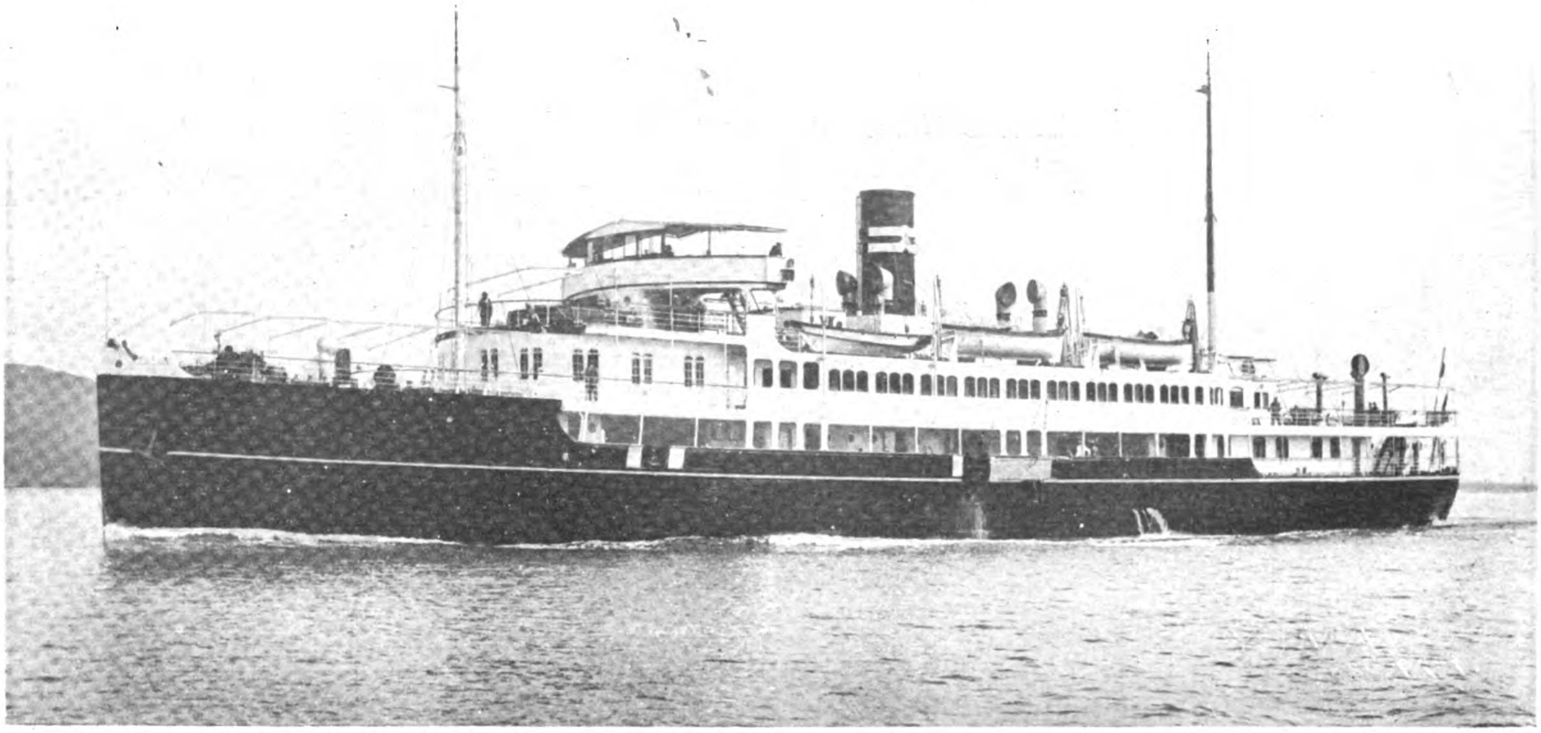
The demolition of the wrecked portions of the buildings and the salvaging of materials, parts, apparatus and machines were started simultaneously on the seventh day after the quake, the wrecking work being done by an outside contractor and the salvaging by company employees.

Machines, benches, stock racks, etc., supported the wreckage to a certain extent and formed many pockets access to which was gained by cutting holes in the floors and into which men crawled on hands and knees, passing parts and apparatus from hand to hand to improvised chutes to the ground. From the chutes the recovered parts and apparatus were transported to temporary sheds or to the less damaged buildings where other employees were at work sorting, cleaning, dismantling and repacking. At the same time accessible machines, many of which had to be partly dismantled to clear them of the wreckage, were lowered through holes cut in the floors and were taken to the other buildings where they were completely dismantled and cleaned. Undamaged machines were then reassembled while the damaged ones were classified according to the extent of the repairs required and partly reassembled or stored in their dismantled state as the circumstances warranted. As the wreckage afforded but little protection from the many heavy rains which occurred with unusual frequency for weeks after the quake, it was necessary to remove nearly all machines and stock from the ground floor of the wrecked buildings.

All wrecking was completed in three months and during that period the contractor furnished 24,581 man days of labor. For a part of the time four hundred and fifty men were employed on wrecking work. 3,536 labor days with horse wagons and 116 labor days with motor trucks were spent in removing the *débris*.

Had the problem been merely to salvage and repairs what could be recovered from the wrecked buildings it would have been amply difficult, but as the salvage was being crowded into the other buildings, it was at the same time necessary to prepare for the resumption of manufacturing, and unit by unit as they were required, emergency installations of metal finishing equipment, tool-making equipment, automatic and hand screw machines, wood-working machines, punch presses, milling machines, drill presses, etc., were set up wherever space could be provided. Machines in the brick buildings which could be spared temporarily were taken down and stored in close formation, aisles

(Continued on page 22).



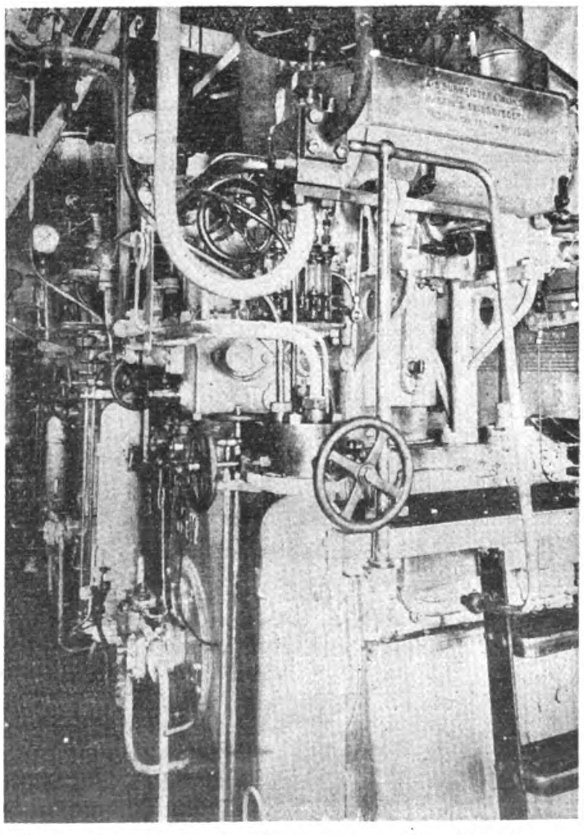
A FLOATING PALACE ON THE INLAND SEA
The New 1,550-Ton Twin-Screw Diesel Motor Passenger Ship *Kurenai Maru* built by Osaka Iron Works, Ltd. for the Kobe-Beppu Service of the Osaka Shosen Kaisha

New Motor Ships for the O.S.K.

Palatial Motor Ship for the Inland Sea

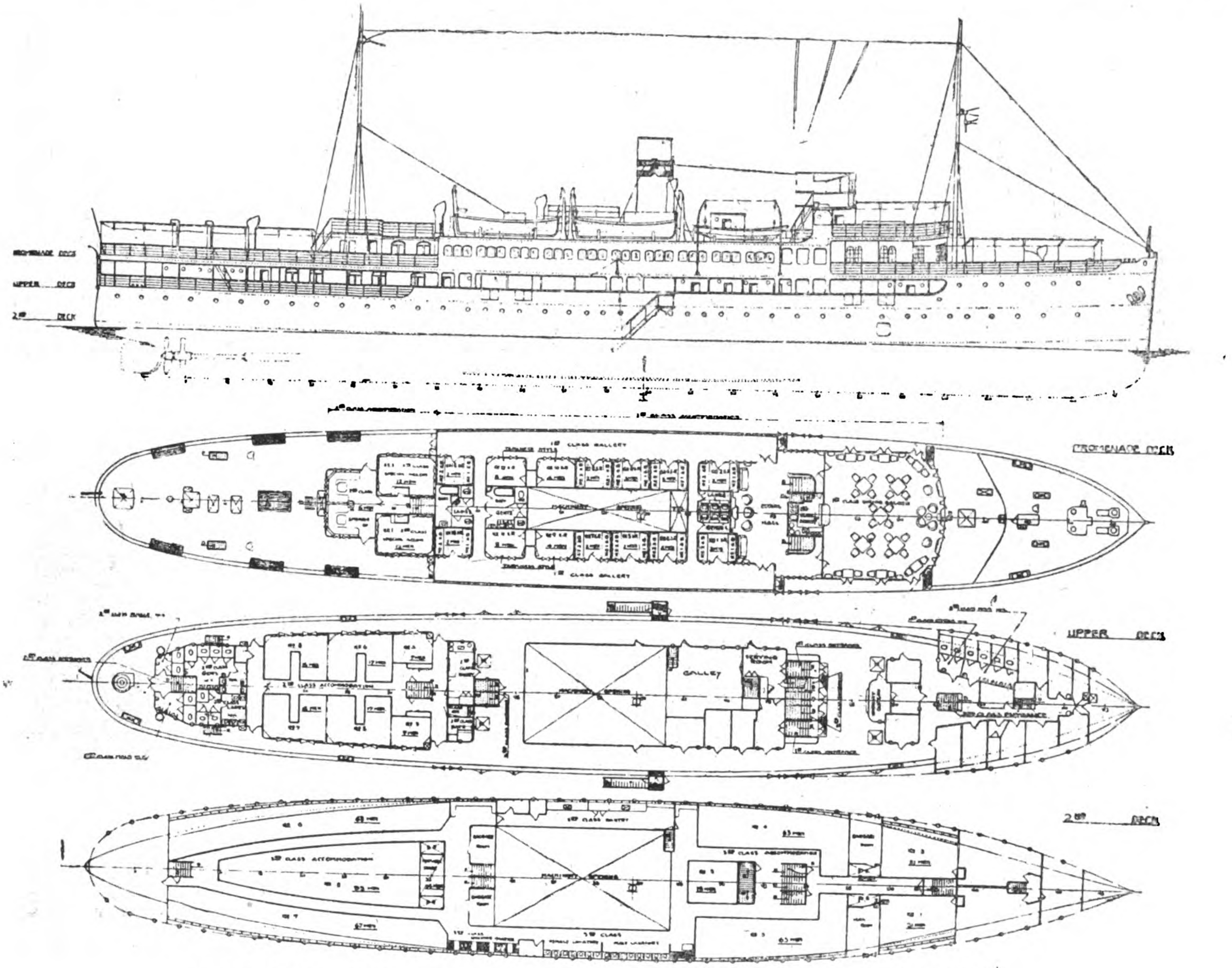
THE first of three new motorships for the Japanese coastwise trade was recently placed in commission by the Osaka Shosen Kaisha when the *Kurenai Maru* made her maiden trip on the Kobe-Beppu run. This service, one of the most popular in Japan, carries thousands of tourists and health seekers from Central Japan to the celebrated springs of Beppu on the north-east coast of the island of Kyushu. For many years the O. S. K. has maintained the finest of its coastal steamships on this scenic run through the Inland Sea, and made every effort to cater to the comforts of the traveling public by providing luxurious accommodations and the best of service. The *Kurenai Maru* has become so firmly established in the minds of the Japanese public with the Kobe-Beppu run, that in building a new and up-to-date steamer, the name of the old favorite was transferred to the new vessel, the old *Kurenai* being renamed the *Naruto Maru* and placed on another service.

The new *Kurenai Maru* has been built purely for the passenger traffic and although smaller, compares avorably with the well-known luxurious N. Y. K. Shanghai express steamers in point of accommodation and general design. The vessel is a twin-screw Diesel motorship of 1,550 tons built at the Sakurajima yard of the Osaka Iron Works, one of the most successful shipbuilding enterprises of Japan. Her length overall is 251-ft., breadth, 38-ft., depth moulded, 19-ft., 6-in. with a mean draft of 11-ft. 6-in. Although capable of making over 15 knots an hour with a fuel oil consumption of 6½ tons per 24 hours, her service speed will be restricted to 13¾ knots on a fixed schedule of 18 hours from Kobe to Beppu, or two hours less than the railway express service.



Three Burmeister & Wain Auxiliary Diesel Engines operating Generating Sets on the *Kurenai Maru*

The vessel is engined with two 6 cylinder main Diesel engines totalling 2,100 h.p. and three 1 cylinder auxiliaries totalling 150 b.h.p. These engines were made by Burmeister & Wain, Ltd. at their Copenhagen works and shipped to Japan for installation. The propellors are driven directly from the main engines, while the auxiliary engines, each driving 33 k.w. generators are used for manœuvring, lighting, etc. The cooling water, forced-lubrication, fuel oil, bilge and sanitary pumps, etc., are all motor driven. Various air reservoirs and silencers complete the Diesel machinery of the vessel. Steering is



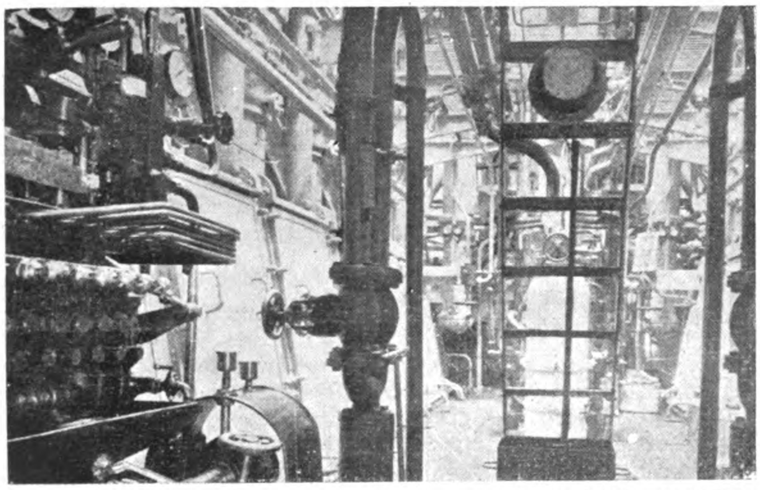
DECK PLANS AND PROFILE OF THE DIESEL MOTORSHIP *KURENAI MARU*

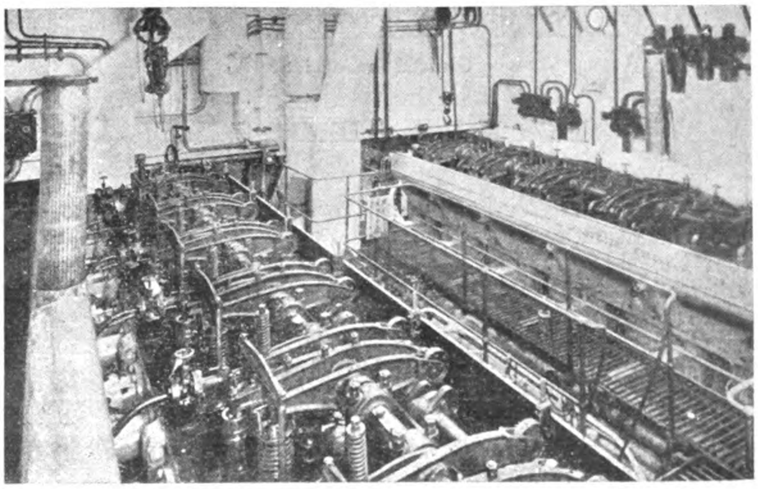
done by an electro-hydraulic steering engine with telemotor. The anchors are handled by an electric capstan of 30 tons hoisting power manufactured by Thomas B. Thrige of Copenhagen which is practically soundless in operation.

The vessel underwent its official trials on September 11 last and was found satisfactory in every detail and placed on the run between Kobe and Beppu on September 23.

Passenger Accommodation

The first-class cabins are entered from the glass-sheltered decks, and consist of 10 in European style and 4 in Japanese. The former are fitted with two broad, built-in bunks which can be used as sofas in the day time (there are no upper berths) and are richly upholstered. In the centre is a washstand with large mirror, and shelves above.





DIESEL MOTORSHIP *KURENAI MARU*

View Between Main Engines

View Across Top of Engine Room

and a steam radiator below. There is always running water. A small reading light and electric fan add to the comfort. The Japanese cabins are a replica of rooms in a well-built Japanese home, every detail being well worked out in miniature, including sliding doors and windows and mats. The fore deck is used as a promenade for first-class passengers.

The second-class is arranged in Japanese style, with mats, and has two large *cabins-de-luxe* for families or special parties. A smoking-room in European style, panelled in oak, is for the exclusive use of second-class. Third-class is also quite in Japanese style, but with benches and tables for smoking and social use. The large afterdeck is for the use of these classes.

The lavatories and bathrooms throughout are in white tile, and most modern with hot and cold running water. Flush closets are in both foreign and Japanese styles. Baths are supplied with fresh and salt running water.

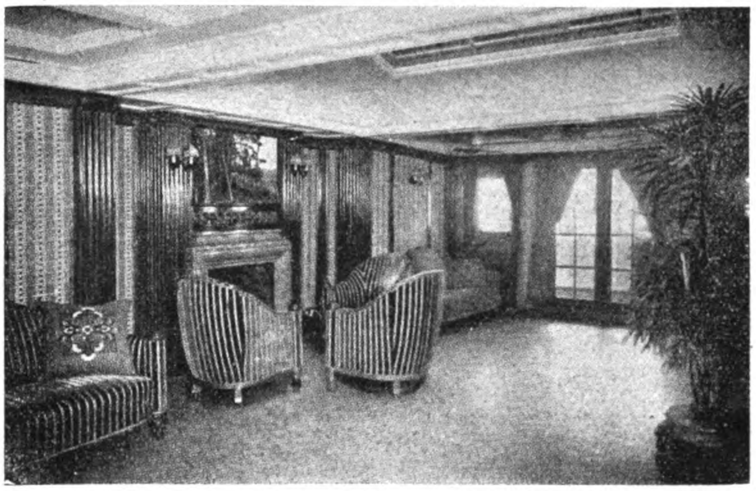
for two or four persons and the saloon seats 32 persons generaously. Ceiling fans here and in the hall make it cool in summer, and steam radiators cleverly arranged take care of the winter.

Other O.S.K. Motor Ships

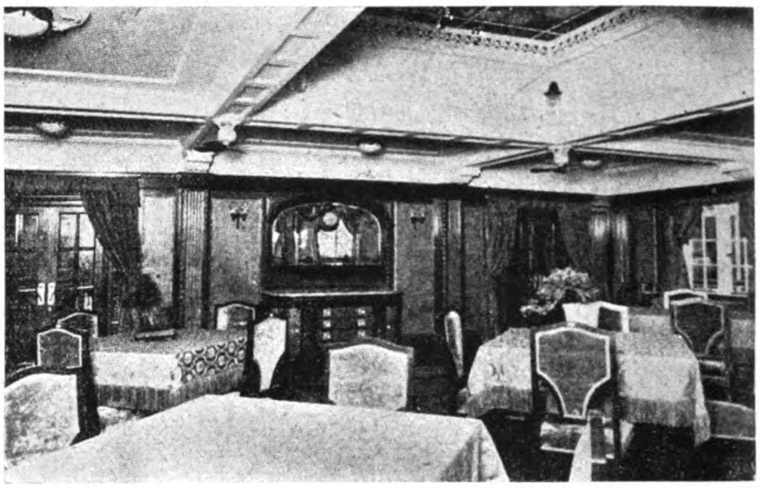
In addition to the *Kurenai Maru*, the O.S.K. is building two other small passenger and cargo coasting motorships.

The new coasters are about 170-ft. long and have a beam of 28-ft. with a depth of 18-ft. 3-in. They are designed to carry some 300 or 400 passengers, in second and third-class accommodation, the cabins being of the large open type, as is customary for traffic of this class in the Far East.

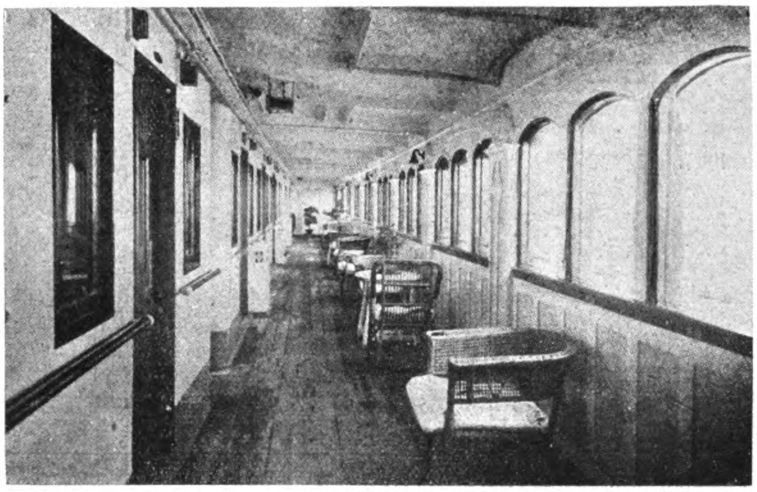
On the promenade deck are the captain's and deck officers' quarters, while on the upper deck is arranged the second-class accommodation, forward and aft of the engine room. On the deck



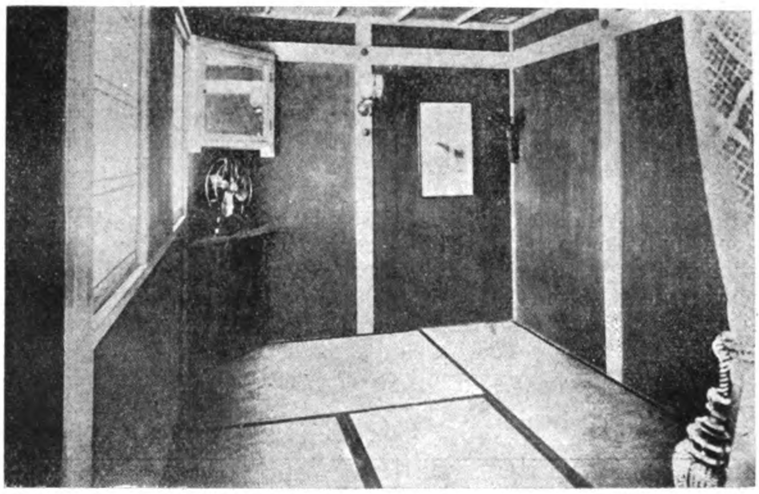
Entrance and Social Hall



Dining Saloon



Glassed-in Corridor



Japanese Style Cabin

Main Hall and Dining Saloon

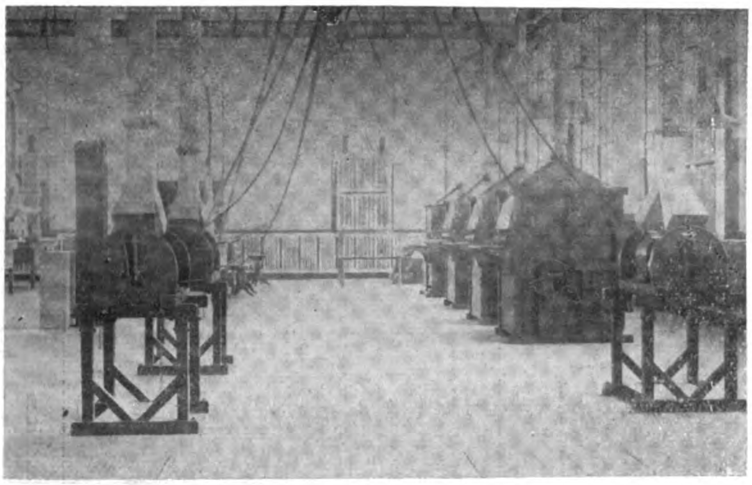
Taking advantage of the absence of dirt and smell the owners have been lavish in the arrangement and decoration of the passenger accommodation, and have achieved a success artistically as well as from the side of comfort. First-class is reached by two main stairways from the main deck, being situated on the upper deck and separated from the other classes. These stairways enter on to a main hall, which is also used for a social hall and for a smoking room. It is in Viennese style, panelled in figured linen, with overhead lights and also electric sconces. A fireplace in Italian marble, with an oil-painting of a Kyoto scene in autumn above it, makes a central point around which are grouped armchairs and sofas upholstered in velvet moquette. The dining saloon gives off this hall, entered on either side by bevelled glass doors. This is in the French Renaissance style, panelled in oak and maple, and windows in place of portholes, parquetted floor, and electric wall sconces. Tables are

below are the saloons for the third-class passengers, with the crew's quarters forward, the engine room being amidships. Below the accommodation forward and aft are the two holds for cargo.

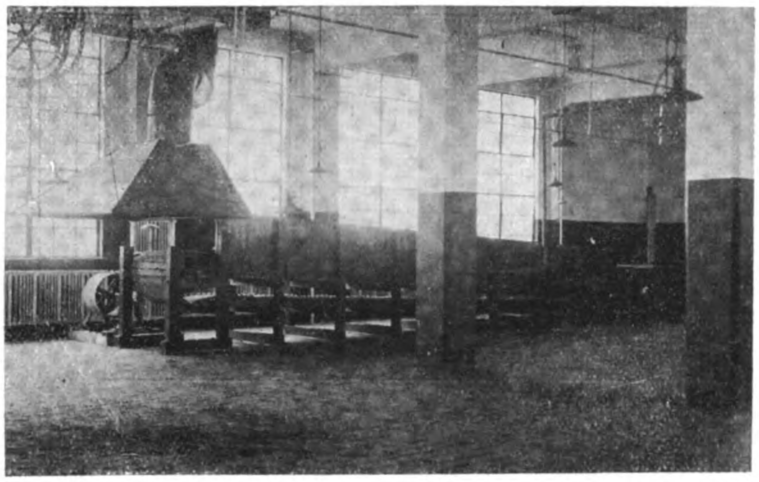
The order for the machinery for each of these vessels was placed with Vickers, and the two Diesel engines are now completing trials at the Barrow works.

A single engine is to be installed in each of these ships developing 600 to 650 b.h.p. at 150 to 160 r.p.m. It is a six-cylinder type, with cylinders $18\frac{1}{4}$-in. diameter and a stroke of 27-in., and embodies the main features employed in the larger Vickers mercantile engines installed in many tank ships. The chief characteristic in this design is, of course, the employment of solid injection instead of the more usual atomisation by means of highly compressed air. Only one pump, operating at about 4,000-lb. per sq. inch, is used. This is driven from a layshaft operated through spur gearing from the crankshaft. The fuel is supplied to a common

(Continued on page 24).



Dusting and Stalk-cutting Machines

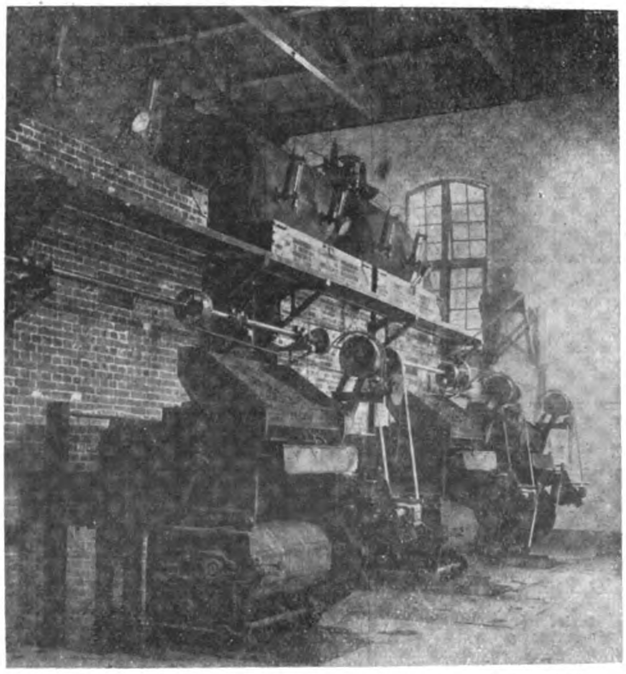


Damping Machine

The Tobacco Industry of Chosen

TOBACCO manufacture in Korea was started for the first time in 1903 by the Korean-Japanese Tobacco Company, and this led to other companies being established in various parts. At the time the monopoly was instituted, there were about thirty factories at work, those of the East Asia Tobacco Company and the Korean Tobacco Company being the largest. In 1913, after the British-American Trust quitted the field, the East Asia Tobacco Company bought up two of the smaller companies and thereafter supplied 80 per cent. of the whole demand of the country.

Since the application of the Japanese tobacco monopoly law to Chosen (Korea), the government has taken over a number of existing tobacco and allied companies. The factories of the Toa Tobacco Company, Ltd., the Tozai Shokai and the printing works of the Keijo Printing Company have been reorganized and improved although these organizations have not yet been brought up to a desired efficiency. In March, 1924, a new tobacco factory was completed at Taiku, costing Y.1,740,000. This factory is modern in every respect.



200 H.P. "Takuma" System Water Tube Boiler, in the Taikiu Tobacco Factory

The following factories are engaged in producing cigarettes and allied products :—

Head Office, printing only.

Jingido, Keijo Branch Office, cigarettes and cut tobacco.

Gishu-dori, cigarette with mouth-pieces.

Taihei-dori, rough cut-tobacco. Seidaimon

Zenshu Branch Office, cigarette with mouth-pieces.

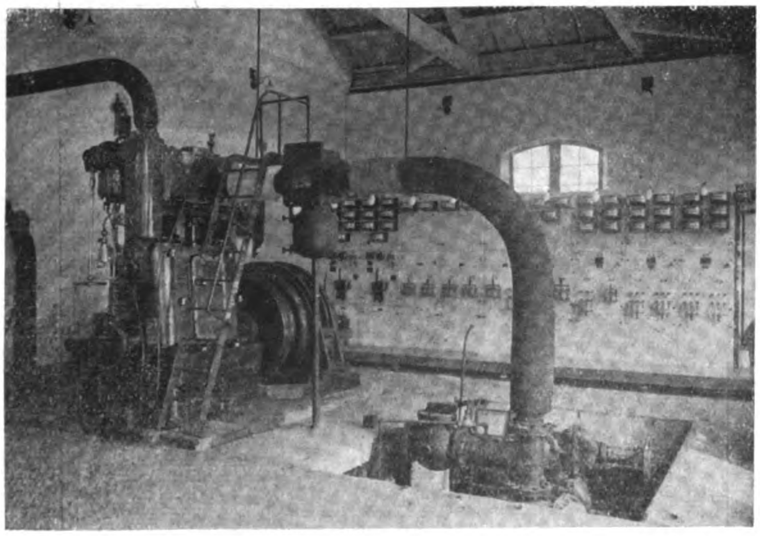
New factory, Taikiu Branch Office, cigarettes with and without mouth-pieces.

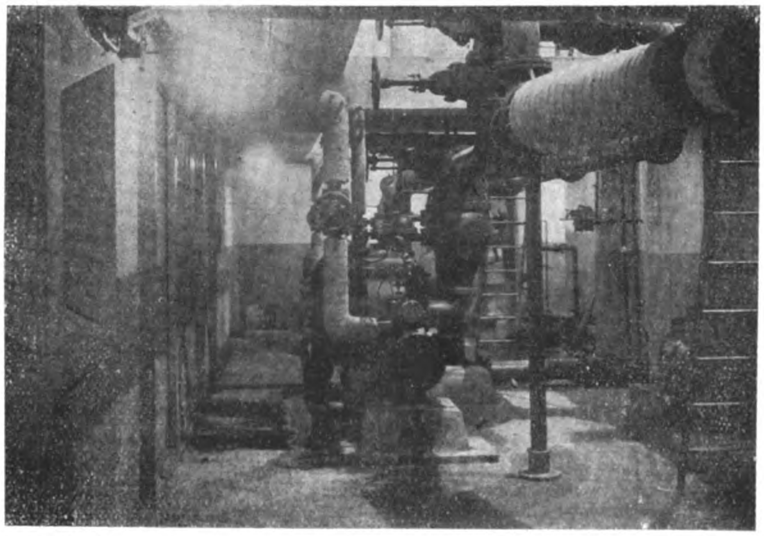
Branch factory, Shinonome-cho, rough cut-tobacco.

Heijo Branch Office, cigarette and rough cut-tobacco.

The brands manufactured are as follows :

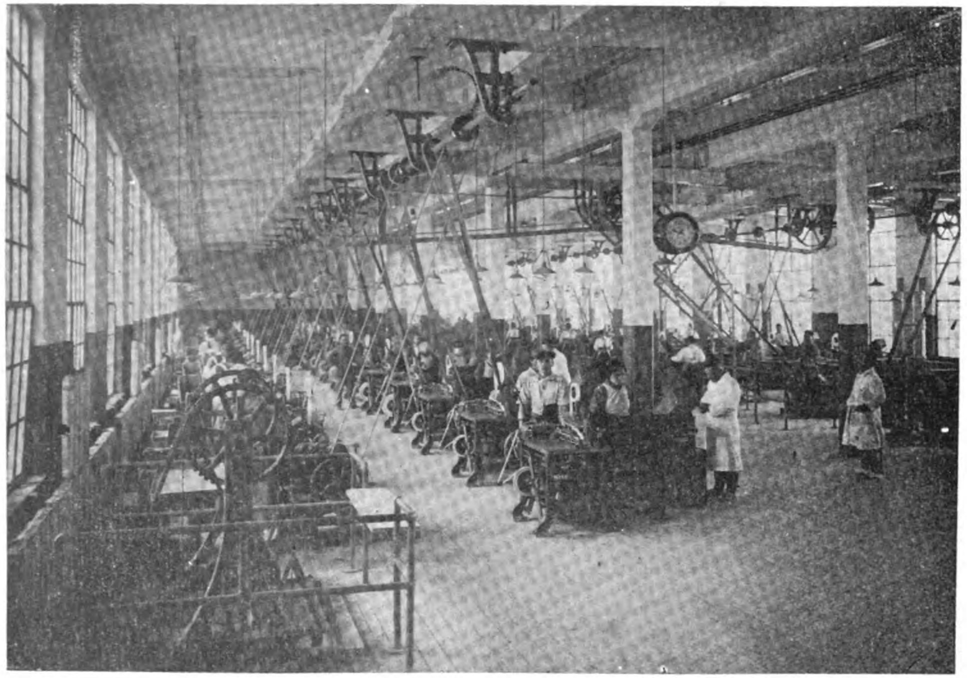
Cigarette with mouth-pieces: "Shikishima," "Asahi" and "Matsukaze."



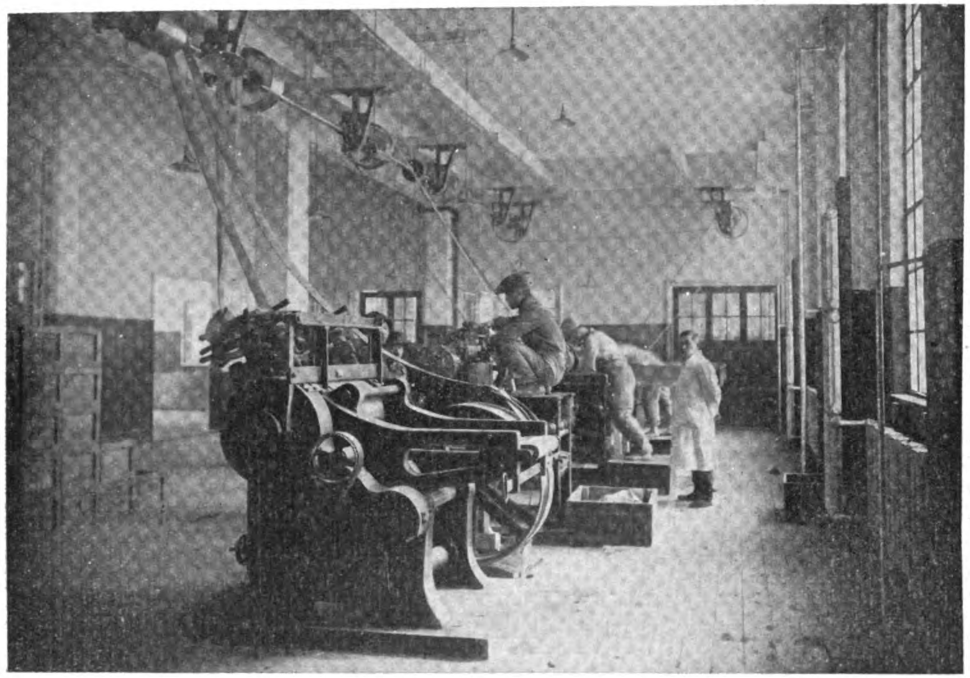


125 K.W. Generator and Condenser

MODERN MACHINERY IN TAIKIU TOBACCO FACTORY

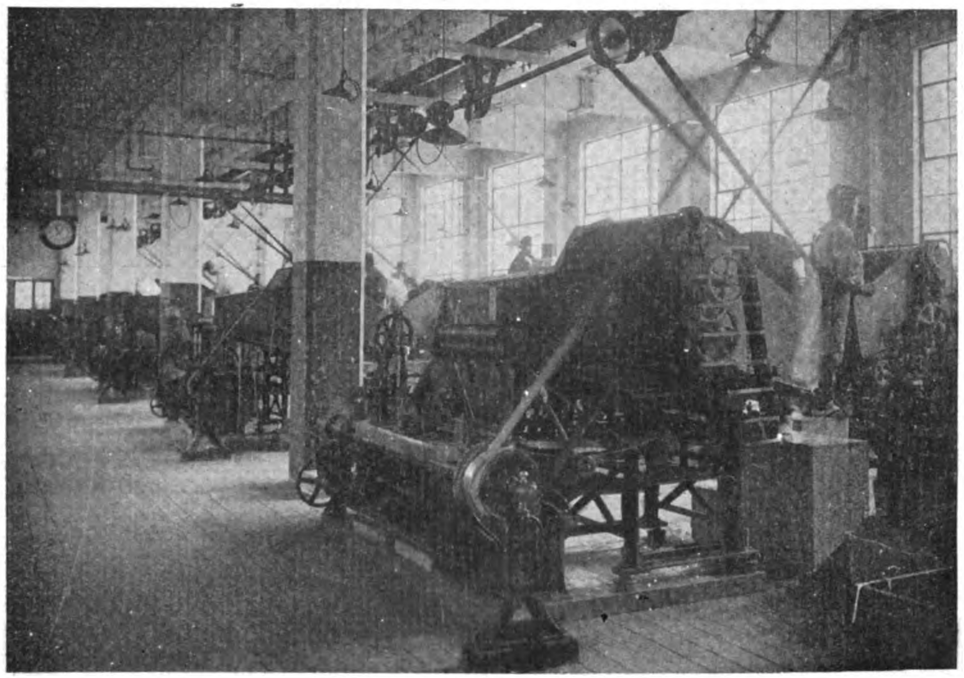


"Hirose" System Cigarette Machines



Cutting Machines

Sealing the Packages

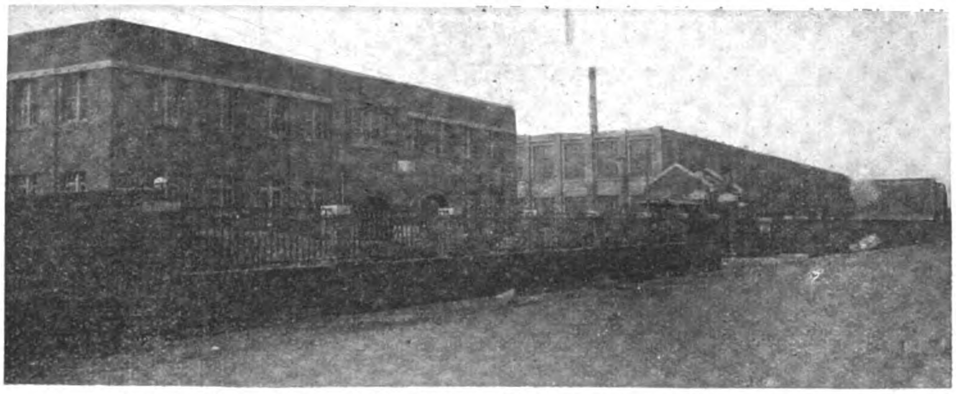


Curling Machines

Cigarettes without mouth-pieces : " G. G. C."" Kaida," " Pigeon," " Mako " and " Maple."
Cut-tobacco : "Satsuki " and " Ayame."
Rough cut-tobacco : " Choju-en " and "Kien."

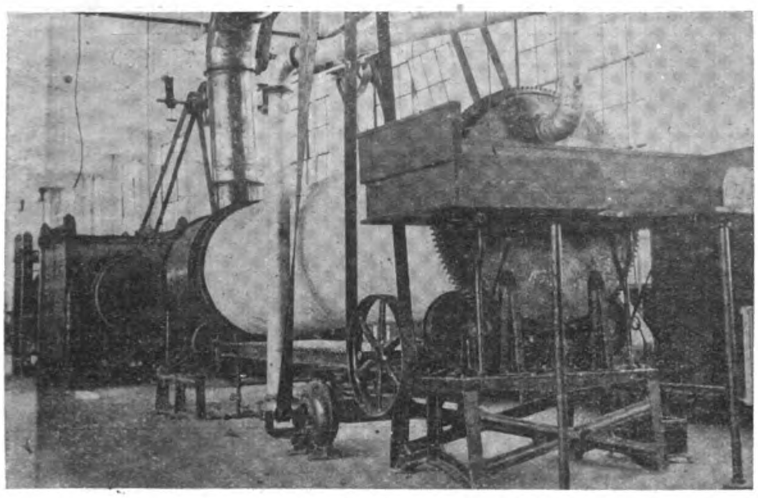
Rough cut tobacco was at one time manufactured outside the tobacco monopoly. The government found, however, that the non-monopolistic companies produced this commodity at a high price while the grade of goods was inferior. Since 1922, the monopoly has been producing this type of tobacco, which is exceedingly popular among the poorer classes of Koreans. At one time, cigarettes with mouth-pieces were more popular than any other forms. This type of cigarette is gradually losing in favor.

The following tables shows the consumption of various types of tobacco in Chosen :—



General View of the Taikiu Tobacco Factory operated by the Chosen Government Tobacco Monopoly

Year	*Cigarette with mouth-pieces*	*Cigarette without mouth-pieces*	*Cut-tobacco*	*Rough cut-tobacco.*
1921*	984,900,000	2,039,914,000	19,230 *kwan*‡	— *kwan*
1922 ..	1,645,540,000	2,370,414,000	23,226	93,918
1923 ..	1,069,960,000	2,894,639,000	30,708	676,463
1924†	1,170,000,000	3,650,562,000	25,200	975,000



Drying Machine

Tobacco leaf used in the production of cigarettes and rough-cut tobacco is Korean grown. Better brands of cigarettes with mouth-pieces, such as the Shikishima and Asahi brands, are made of Japan-grown leaf blended with the native products. For the best grades American tobacco leaf is used.

Tobacco cultivators' associations, co-operating with the Bank of Chosen, have been organized in various parts of the country with the purpose of improving the cultivation of tobacco and fostering the industry. The first of these associations was organized in 1913, since when twenty-five organizations, having a membership of 50,000 have come into existence. These associations co-operate with the tobacco monopoly.

The consumption of tobacco leaf is given in the following table :—

Year	Japan leaf	Foreign leaf	Chosen leaf	Totel
	kwan	*kwan*	*kwan*	*kwan*
1921	118,271	93,956	692,368	904,595
1922	184,281	196,595	873,256	1,254,132
1923	138,947	211,509	1,493,911	1,844,367

The production of tobacco products has increased steadily since the commencement of operations under the tobacco monopoly. The following tables give the total production and the value thereof :—

* Beginning July
† Estimated.
‡ Approximately 8¼-lb.

Cigarettes with Mouth-pieces

Brands.	1921 (9 months) Quant.	Amount.	1922 Quant.	Amount.	1923 Quant.	Amount.	1924 (estimated) Quant.	Amount.
Shikishama	91,000	682,500	220,960	1,657,200	228,740	1,715,550	180,000	1,350,000
Asahi	453,200	2,719,200	819,100	4,914,600	470,640	2,823,840	540,000	3,240,000
Matsukaze	338,800	1,694,000	605,480	3,027,400	370,580	1,667,610	460,000	2,070,000
Shiratsuyu	101,900	407,600	—	—	—	—	—	—
Total	984,900	5,503,300	1,645,140	9,599,200	1,069,960	6,207,000	1,180,000	6,660,000

Cigarettes without Mouth-pieces

Brands.	1921 (9 months) Quant.	Amount.	1922 Quant.	Amount.	1923 Quant.	Amount.	1924 (estimated) Quant.	Amount.
G. G. C.	—	—	180	7,200	150	6,360	360	14,400
Kaida	24,105	361,575	40,728	610,920	10,500	157,500	27,600	414,000
Pigeon	106,995	1,069,950	253,920	2,539,200	332,220	3,322,200	322,500	3,225,000
Peony	35,115	280,920	—	—	—	—	—	—
Melon	177,775	888,875	—	—	—	—	—	—
Mako	238,020	1,190,100	1,040,800	5,204,000	722,120	3,610,600	900,000	4,500,000
Pheonix	—	—	120,620	603,100	—	—	—	—
Maple	1,457,904	4,859,680	914,112	3,047,040	1,829,640	6,098,800	1,944,000	6,480,000
Total	2,039,914	8,651,100	2,370,360	12,011,460	2,894,639	13,195,460	3,194,460	14,633,400

Flavoring the Leaf

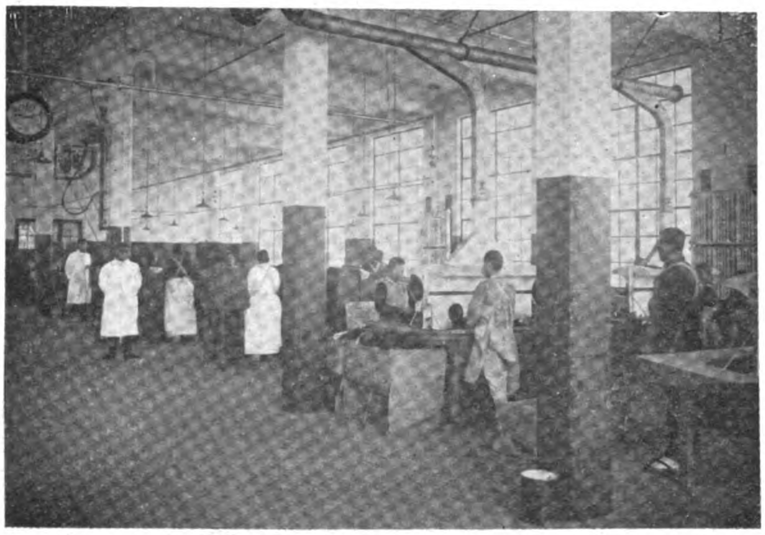
Fixing the Mouth-piece

CUT TOBACCO

	Kwan	Yen	Kwan	Yen	Kwan	Yen	Kwan	Yen
Satsuki	6,030	120,600	13,140	262,800	15,528	310,560	25,000	500,000
Ayame	9,036	144,576	10,086	161,376	15,180	242,880	15,000	240,000
Hagi	4,164	51,091	—	—	—	—	—	—
Total	19,230	316,267	23,226	424,176	30,708	553,440	40,000	740,000

ROUGH CUT TOBACCO

	1921 (9 months)		1922		1923		1924	
	Kwan	Yen	Kwan	Yen	Kwan	Yen	Kwan	Yen
Choju-en	—	—	—	—	250,242	1,668,280	400,000	2,666,666
Ki-en	—	—	86,340	345,360	423,965	1,695,860	400,000	1,600,000
Rough cut-tobacco (no brand)	—	—	7,578	37,890	2,256	11,280	—	—
Total	—	—	93,918	383,250	676,463	3,375,420	800,000	4,266,666
Gross total Amount ..	—	14,470,667		22,418,086		23,331,320		26,300,066



Trimming the Leaf

Packing Cigarettes

Electrification in Java

An interesting item of electrical news has just been made public in the announcement that the first trains on the electrified section of line between Meester Cornelis, a suburb of Batavia, and the port of Tandjong Priok will run on June 1 next. Following the opening of this section of line, electrification work on the Batavia-Buitenzorg line will be at once commenced.

New Book by Hongkong Engineer

As a matter of interest it may be mentioned that Messrs. Crosby Lockwood, have in preparation an illustrated treaties on " Practical Road Engineering," by Mr. Henry E. Goldsmith, executive engineer in charge of roads, Hongkong. The work, which has been written with the assistance of other experts in this branch of engineering, is based on the author's previous book, " Modern Road Construction and Maintenence," which has already gone through two editions.

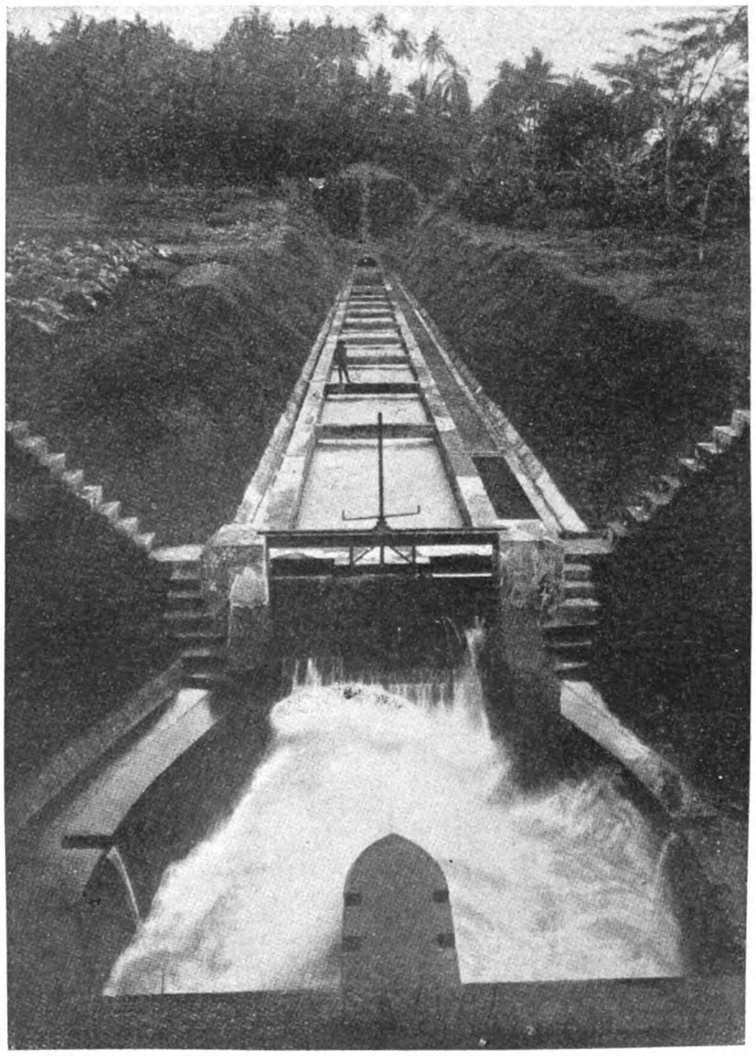
Irrigation and River Control in the N.E.I.

JAVA (with Madura) forms so far the most important island of the D. E. I. and it is therefore not surprising, that, what till the present day has been constructed in irrigation works, has chiefly been achieved in Java. Indeed up till now very few irrigation works have been constructed in the outer districts, though an increasing activity in irrigation matters has been noticeable there in late years.

The following general outline will for this reason almost exclusively refer to Java. The irrigation works thus far constructed in the outer districts were, as a matter of fact, built on the same principles as those in Java.

Rivers

The rivers in Java have nearly all a short course, which is due to the small width of the island. The largest, the Solo river, though running mostly lengthwise over the island, has only a river basin of 15.400 k.m.^{2} (5.950 square miles). The length of the Solo river amounts to 540 k.m. (340 miles), and of the Brantas, the second largest river of Java, which shows the peculiarity to run successively in all the four main directions of the compass, to 310 k.m. (190 miles) with a river basin of 11.000 k.m.^{2} (4.250 square miles). The peculiar characteristics of the rivers in Java are little discharge, sometimes they even entirely drying up in the east monsoon, floods in the west monsoon, caused by the immediately preceding heavy rains. However sometimes there are also large discharges in the first mentioned season.



Banjar-Tjajana Works in the Banjumas Residency. Main Canal Between First Tunnel and Syphon under the Meran River

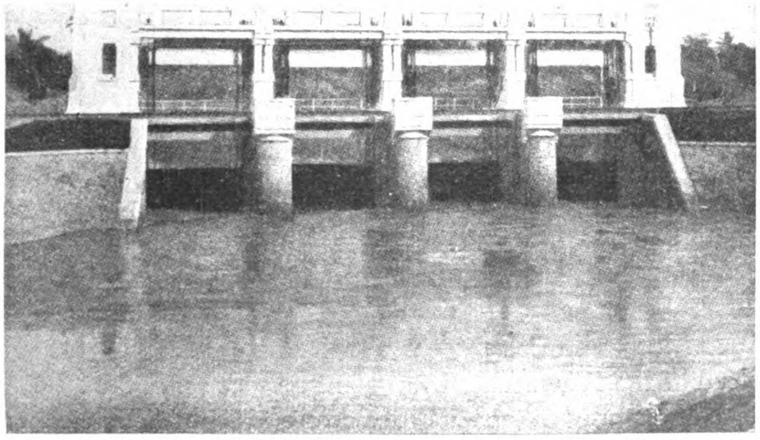
That also, apart from the sudden overflows, provided the position of the water basin is favorable, the water level can remain fairly high, is proved among others by the Bondojudo river, which receives its water from the south-east slopes of the Tengger mountains and of which the waterlevel in the east monsoon compares favorably whit the one in the west monsoon ($\frac{1}{2}$—$\frac{2}{3}$). Also other circumstances, viz.: the nature of the soil of the river basin, exercise sometimes a favorable influence on the waterlevel in the east monsoon.

The slopes of the Klut and its loose upper surface of young volcanic material is known as being highly water absorbing.

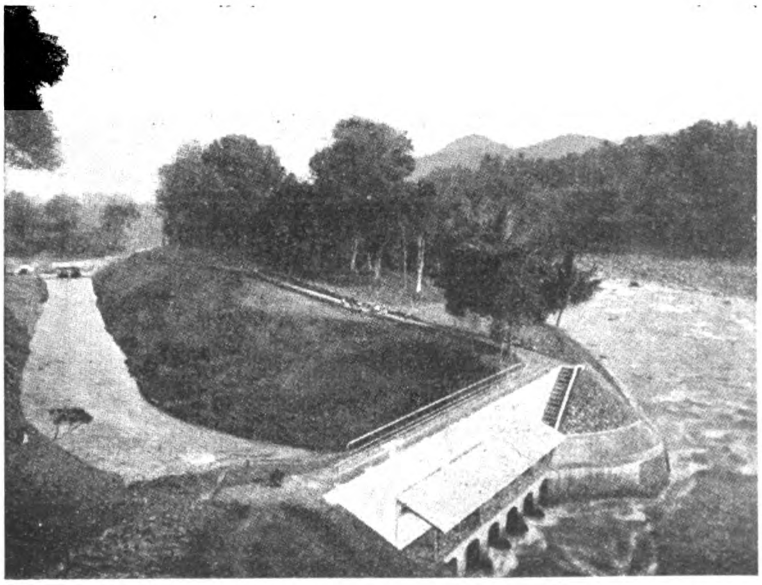
High in the sand streams of this active volcano, the water disappears in the soil to appear again at the foot in a zone of wells, the water level of which only begins to drop in November.

The Merapi and the Slamat are also known as being rich in wells, such as the northern slopes of the Tengger, on which a few springs extraordinarily rich in water, rise at only a few metres above sea level.

As a rule there is however

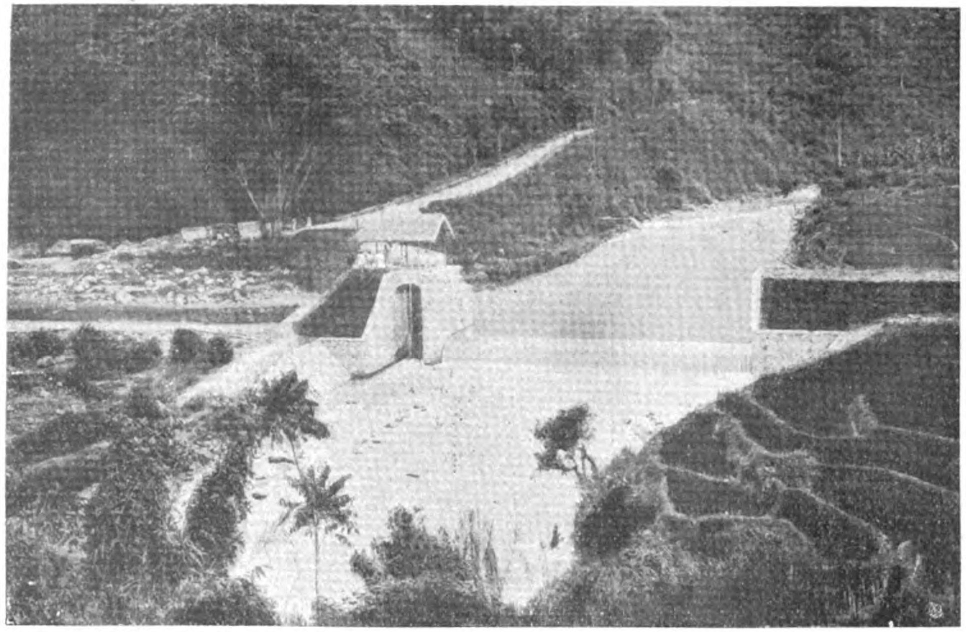


Flood Protective Sluices at Batavia

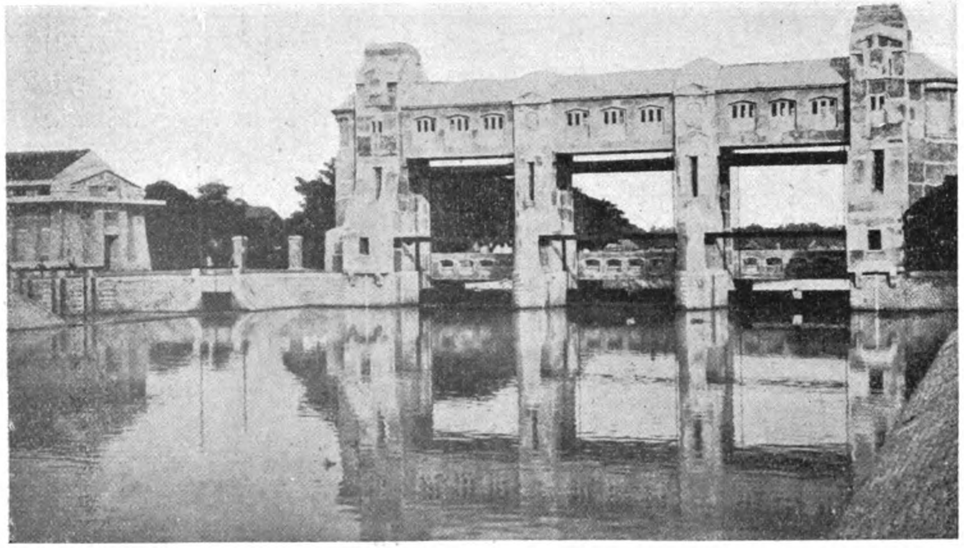


Head Sluice at Singomerto and Main Canal in the Banjumas Residency: Scouring Sluice in Background

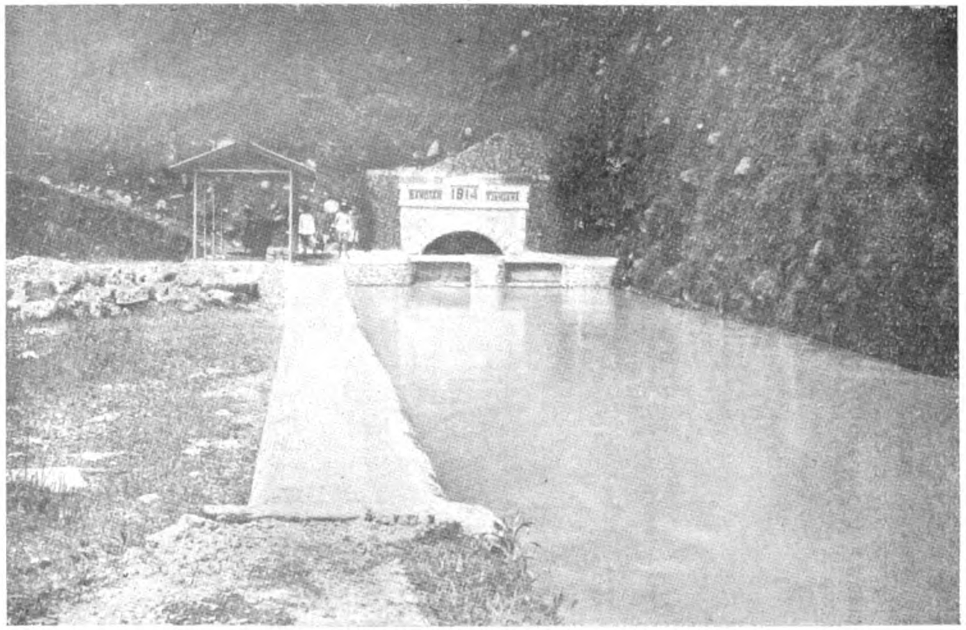
RIVER CONTROL AND IRRIGATION WORKS IN JAVA



Watergate on the Tjiwidej



Sluice Gates at Wonokromo



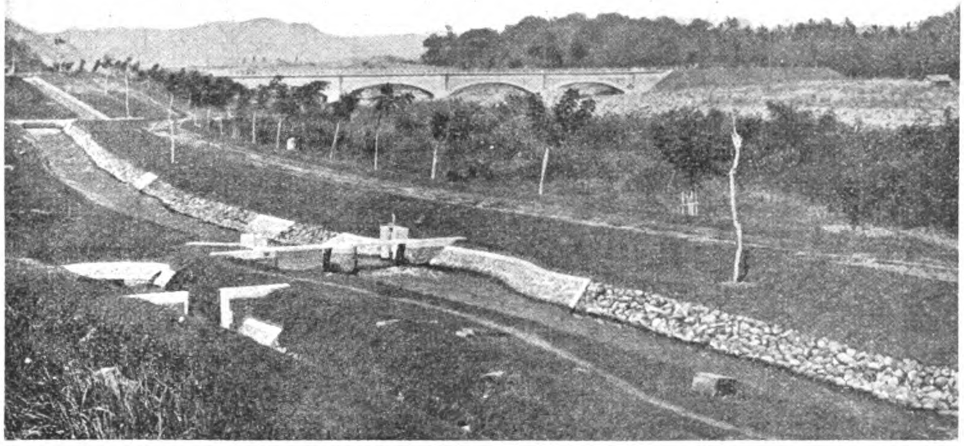
Tunnel at Bandjar

Aquaduct at Leuwikoeja

a great difference between the water levels of the east and west monsoons, even in the large rivers.

In view of the increase in newly cleared land being cultivated and the consequent deforestation, the rainfall becomes very irregular, which has been proved most clearly in Java.

Details regarding the river basins, maximum and minimum discharges of some of the principal rivers in Java, are compiled in the following table :—

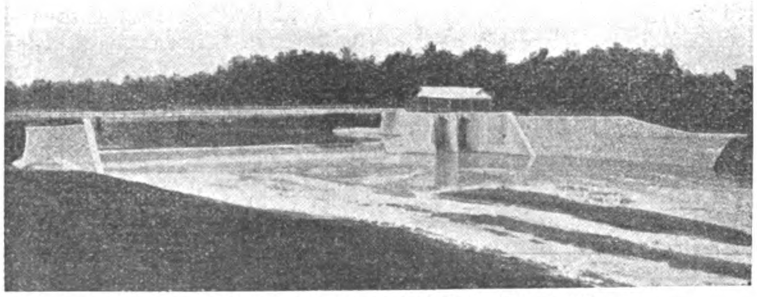


Aquaduct in the Goengleiding

Name of the River	Residency	Size of River Basin in Square Miles	Approximate Output Per Second by: Normal Highest Output Cub. ft.	Extraordinary Floods Cub. ft.	Normal Lowest Output Cub. ft.
Tjiudjung	Bantam	665	35.000	62.000	710
Tjitarum	Preanger and Batavia	1.500	40.000	—	990
Tjimanuk	Preanger and Cheribon	1.280	25.000	34.000	600
Pemali	Pekalongan	340	25.000	34.000	250
Tjomal	,,	290	20.000	65.000	600
Tuntang	Samarang	240	25.000	39.000	600
Serang	,,	320	18.000	70.000	600
Solo	Surakarta Rembang and Sourabaya	5.950	70.000	90.000	810
Brantas	Pasuruan Kediri and Sourabaya	4.250	40.000	60.000	2.610
Sampean	Besuki	462	18.000	95.000	390

The width of the rivers is in general not very large, rarely more than 200—400 feet; the depth is very alternately, on the lower course of the Solo river at low water, it amounts from a few d.M. to 10 M. and more. The difference between high and low tide in the Solo river amounts to 6 M. on a distance of 40 K. M. from the mouth.

In a country like Java, especially in the higher regions, with its mostly loose volcanic soil, its moist, warm climate and heavy rains, the water of course carries along a great deal of solid matter : mud, sand and stones.



Intake at Pesajangan, Pekalongan Residency

The highest percentage of mud is shown in the lower Solo river with a figure of 6 and for the Serang river $3\frac{10}{16}$ ounces per cubic feet, while for the Brantas, barring the abnormal condition after the Klut eruption—the last one took place on May 20, 1919—$1\frac{11}{16}$ ounce per cubic feet is given. In Holland they found in the Maas at Grave 2, in the Merwede at Gorinchem $1\frac{1}{8}$, while the mud figure for the Mississipi at New Orleans amounts to $2\frac{11}{16}$. The averages of the mud figures, however, differ considerably more than the limits. At any rate for the Solo river, one comes to an average of $2\frac{3}{4}$ ounces per cubic feet per year, for the Rhine $\frac{1}{16}$ ounce. Considering that the Solo mud has a specific gravity only 1.35 against the Rhine mud of 2, it appears that the Solowater is about 60 times more impregnated with mud than the Rhine water. Should it be possible to spread the mud, carried during a year over the whole river basin, it would, in a dry state, form a layer of a thickness of 1.5 m.M. The Solo river would therefore need 8 months to lower her basin about 1 m.M. According to Guppy, the Po requires 2.4 years for this, the Thames 32.2 year and the Rhine 6.3 years.

In the lower course of the Solo river the mud contains 6 per cent. sand, that one of the Brantas river 21 per cent.

The rivers of Java, owing to their richness in mud, consequently show a strong property to form higher strips along the banks on the lower course after inundations.

The larger rivers of Java's north coast all form deltas, which mostly protrude a long way into the sea and often increase rapidly. At the Tjimanuk delta an increase of 3 K.M. has been observed during the last forty years.

The continuous extension of the lower rivers, combined with their high level, caused more and more drawbacks, as the population grew and agriculture was extended, which led to dikes being constructed everywhere in the lowlands.

Nearly everywhere the native population itself, originally started to throw up dikes in a primitive way, exclusively to promote local interests ; everywhere, however, the dikes have been built too close to the river channels.

On Java's south coast with its deep sea and strong surf no deltas are found.

Agriculture

Before dealing with the irrigations, something should be mentioned about agriculture, as far as the irrigation system is connected with it.

The chief product of agriculture by the native is rice, the staple food of the population.

Principally there are two methods of cultivating rice in Java, viz., the rice culture on non-irrigated fields, practically only still carried on in scarcely populated mountain districts, and further the chief method : the rice culture on the irrigated rice fields, which are tracts, laid out in horizontal terraces, surrounded by low dikes to stop the water. This rice culture is partly dependent on rain, but wherever possible irrigation is applied. The rice fields which depend on rain, may turn out good crops, but this chance is changeable and moreover they miss most of the manuring action of the mud and the substances dissolved in it, which are carried away by the irrigation water.

Though the rainfall in Java compared with British India is favorable and calamitous droughts, which use to cause there the periodical famines, fortunately do not occur in Java, for the reasons mentioned above, irrigation must be considered as being of the greatest importance for the rice culture.

The rice fields are laid out as well in the plains as high in the mountains (up to 3-4.000 feet altitude, higher up rice culture is not possible), even gradients of 1 : 1 the Javanese manages to turn

into terraces for the rice culture. The size of the separate fields, surrounded by dikes varies from a few square metres to an even number of bahoes (1 bahoe is 1¾ acre=7.100 M²) in the plains.

The second largest culture on Java's irrigated land is the one of the sugar culture by European enterprises. Regular irrigation in the east monsoon, during which period the cane is planted, to be crushed in the following east monsoon, is a life condition for Java's sugar cane culture. Very little cane is planted by the European estates on non-irrigated land and where this is locally possible, one has to do with loose soil and high water level.

Where sufficient water is available, the native also grows rice again in the east monsoon, so that from some lands year in, year out, twice a year a rice crop is gathered. Where not sufficient water is available during the said season nothing is grown on the heavier soil, while on the lighter soil, so-called secondary crops as maize, cassava, peanuts, soya-beans, sweet potatoes and similar crops, and also, but less generally, tobacco, indigo and cotton is grown.

Native Irrigation Works

Though irrigation has been indigenous in Java since centuries and has also reached a certain degree of development, the native irrigation works suffer from many defects and the natives were not in a position to make use of the large rivers for irrigation purposes without foreign assistance.

The objections to the native irrigation works are chiefly the following: in the first place, the mostly primitive construction of the weir in the river, with, as a consequence, repeated breaches, whereby the river bed and banks at this spot were gradually entirely destroyed.

In the second place the open intakes, whereby when floods occur, the water enters in large quantities and damages the canals, even to such an extent, that the original canals of supply often turn into new river arms, while the real river beds gradually loose their discharging capacity.

In the third place the receiving in the main canal of the crossing discharge canals by damming the original watercourse, while as a rule none or only very insufficient spillways are constructed.

The latter two defects are the cause, that the irrigation canals are not only badly damaged, but also that sometimes heavy inundations occur in the plains.

The fourth objection is, that in the level districts, very often no distinction is made between supplies and discharges, so that in some districts, where the soil is mostly clayey, by obstruction in the water discharge and drainage, the crops may suffer, causing diseases, while on the other hand the irrigation is also disturbed each time by inundations, whereby the primitive weirs in the mixed canals are damaged or carried away entirely.

The consequence of the afore mentioned defects is, that in the long run nearly all big native irrigation works degrade more and more and continuously cause greater difficulties.

However a considerable part of Java's irrigations still exist, especially in the mountain districts, of such primitive works, but at present these have nearly all been placed under technical supervision, so that these defects can be rectified as soon as possible.

Oldest Technical Works; Development of the Irrigation System

Also before the creation of the public works department, which took place in 1854, the government has continuously more or less promoted the irrigation system. Ignorant of local conditions, mostly without proper details concerning the riverbasin, rainfall, outlet and not having sufficient experience of the power of the tropical floods, the Dutch civil engineers were at that time not always lucky with the results of their exertions.

Works, extant to this day, were also created in those years, of which the principal ones have been the works for the improvement of the hydraulic conditions in the delta of the Brantas river in the residency of Sourabaya (the so-called Sidoardjo delta) for a total surface of 48.000 bahoes.

This important work, however, did not form a complete irrigation system, as it only provided for the main water supply.

The first irrigation works, completely technically prepared, designed and carried out, were constructed thirty years later. They are the Demak waterworks in the residency of Samarang, having in view the prevention of further extensive crop failures, which in those districts had already repeatedly led to famine.

The Demak waterworks gave the push to and served as an example for further complete technically designed irrigation works in Java.

The execution of complete irrigation works has been continued without a break since 1885, though not always with great speed, because for a long time, many were of the opinion, which sometimes was also shared by the government, that such works would entail more costs than benefits. The circumstance, that in the D.E.I. up to now, nothing is charged for the use of the irrigation water and also in another way on account of the working of the tax system, the increased crops, after the execution of the irrigation works, are not clearly shown to the public in increased government revenue, has undoubtedly led to the spreading of this unfavorable opinion.

During late years the necessity of a good irrigation system has more and more gained ground, which is shown in the annual amounts spent on irrigation and drainage works, which, after a small decrease in the beginning of the great world war, show a considerable increase, to fall back again in the last few years, due to the necessity of a general cutting down of the government expenditure.

Below follows a table of the amounts spent during a few consecutive years for construction, upkeep and repairs of irrigation and drainage works.

Expenditure on Irrigation and Drainage Works.

Year	Construction glds.	Surveys glds.	Ordinary Upkeep glds.	Repairs glds.
1914	5,389,392	448.074	710,323	75,266
1915	4,347,775	329,006	1,079,880	106,787
1916	5,093,431	414,293	1,504,586	143,902
1917	6,294,136	440,383	1,352,326	145,019
1918	7,275,129	464,410	1,466,571	185,290
1919	7,696,172	460,873	1,658,456	348,387
1920	8,500,904	620,115	1,837,780	599,573
1921	8,805,506	647,173	1,792,130	498,663
1922	5,586,682	446,259	2.026,042	524,842

General Installation of an Irrigation District

The district, irrigated by a river, is subdivided into secondary squares, which as a rule are bordered by discharge canals, the size of which in connection with this, depends on field conditions. The secondary squares are again subdivided into tertiary squares, the so-called terminal squares. In these terminal squares, the size of which lately is fixed as much as possible at about 150 bahoes, the irrigation water is led on the land to be irrigated, direct from the so-called tertiary canals.

From the feeding river the water is led by means of a weir (which, however, is not always necessary) with an inlet sluice into the main canal. By means of distribution sluices, the water is brought into the secondary canals, which divide their water with the help of tapping sluices among the tertiary canals of the terminal canal.

The crossings of the irrigation canals with roads and water-roads takes place by means of culverts, aqueducts or bridges. Superfluous rain-water is removed by spillways from the main canals and led into discharge canals. Finally the irrigation canals are provided, wherever necessary, with gauges, in order to be able to divide the irrigation water among the different canals.

For the discharge of the used irrigation water and the rain water, an irrigation district is furthermore provided with the necessary discharge canals.

Required Quantities of Water, Capacity of the Canals

The capacity of the canals is regulated according to the crod requiring most water, the rice; this culture requires, that the fields are inundated and kept in such a condition for quite some time.

The quantity of water required for this, largely depends upon the conditions of soil; in the first place on the porosity of the soil, further on the gradient of the land and the height of the ground water, which again depends upon the local rainfall.

The comparatively small quantity of water, which the plant absorbs during its growth and the quantity, which is lost by evaporation, which is about 0.32 liters per bahoe and per second during the west monsoon, the season when the rice is chiefly grown, may be considered as practically stable for the whole of Java.

It is entirely different, however, from the quantity, which penetrates into the soil and disappears in this way. This variable quantity is the cause, that the quantities of water required in the different irrigation districts, very often differ to a great extent.

Still as a rule a water supply of 1-1.25-lbs. (liters per bahoe per second) for the period of the full irrigation can be considered as sufficient in the plains. As an example of the course of the water requirements for the rice culture, we will deal here with those in the Pemali irrigation district (residency Pekalongan).

At the commencement of the culture, water is first required for the working of the nursery beds, which take about 1/8 to 1/10 of the total area to be planted. A period of a fortnight is required for the laying out of nursery beds of average size, during which time for each bahoe of nursery bed during 24 hours 35-lbs. of water is required for the soaking of the dried up ground ; once the soaking has taken place, not much more water is required.

This quantity tallies with a supply to the main canal 1/8 by 35/14=0.3-lbs.

The time, during which the seedlings remain on the nursery beds, before being transplanted, is about 45 days, which time is used to work the rice fields. For this, also for the transplantation, a supply of 1-lb. is necessary during a month and a half, after which during three months 0.7-lbs. is required. Afterwards the plant needs a couple of weeks to ripen, during which time, however, no water is required.

By combining the various main canals of an irrigation system into groups, which do not start the rice culture at the same time, but at various intervals, one can succeed in connecting the required quantities of water as much as possible to the regimen of the feeding rivers, while it is also possible to restrict the capacity of the main canals.

The Pemali district is divided into five of such groups, which each time start the culture with a space of half a month, with the exception of the last two groups, which, if possible, and this is generally the case, are worked at the same time.

Discharge Canals, Re-use of Used Water

The improvement of the irrigation by the construction of technical works is nearly always, at any rate always in the plains, followed by the improvement of the local drainage, while also in the lowlands one very often has to make an alteration in the course of the larger rivers and to dig, outside their delta, a shorter new mouth to the sea, so as to be protected from floods and inundations by the rising of the high water.

Also with the construction of entirely new irrigation works in still undeveloped districts, often considerable works were found to be necessary for the drainage of the water. This is especially the case when bringing into cultivation the swampy jungle districts in which it is not a rarety, that the riverbeds mostly run blind.

The construction of water protecting dikes along the big waterways in Java's lowlands, cannot, as a rule, be eliminated.

When improving irrigation works, this as a rule, must be provided for, a provision, which may cause a considerable expenditure, owing to the mostly dense population of the river banks. This circumstance often makes it cheaper simply to alter the mouth of the river.

In the construction of the older irrigation systems, the view was taken, that the irrigation water, which reaches the discharge canals, should not be used any more for irrigation purposes. Though this objection was not always based on the fear, that the used water should be injurious to agriculture, one was still of the opinion, that the so much more salutary fresh water with the foodstuff floating and dissolved in it, should be used exclusively on all soil of an irrigation district, even if the quantity of water, available for each bahoe, would be greatly reduced by it. Also it was feared that the necessary leveling up of the discharge canals, when re-using the water, would have an unfavorable influence on the general drainage conditions and would eventually lead to diseases in the crop.

Later on this principle had more or less reluctantly to be dropped. The population itself gave the example in this instance, by secretly damming the discharge canals in the rainy season, which naturally, threatened to call into existence again the same objections, which one tried to avoid by introducing the improvement works. Also the quantity of water, accumulating in the discharge canals, sometimes proved to be much more than one had imagined. At present one hesitates no longer, wherever necessary or advisable, to use once more the water from the discharge canals into which movable weirs are constructed for this purpose.

Below follows a table of the total area of the irrigated districts in Java and Madura at the end of 1919:

	Number of H. A.	per cent.
1. Irrigation districts, for which permanent works have been put in use	803.346	21
2. Ditto, for which permanent works are under construction.	239,417	6
3. Ditto, for which permanent works are being studied or planned	544,218	14
4. Irrigated land and land dependent on rain, for which no plans exist	233,000	59

Irrigation from Reservoirs, by Means of Pumps, etc.

Very little has come so far of the construction of large reservoirs in Java. In connection with the rainfall in the west monsoon, favorable for the rice, though irrigation is of the highest importance for this crop, the costs of construction of large reservoirs, generally speaking, would be too high, to be paying for the rice culture at any rate in comparison to the revenue with the present native system of production;

This is still less the case with regard to the so-called secondary crops (maize, cassava, etc.) It is different with regard to the European sugar-cane culture, in the interest of which repeatedly plans have been brought forward for the erection of large reservoirs.

The condition of the soil is on the whole not very favorable for the construction of large reservoirs. The slopes of the volcanoes are generally too porous for large reservoir dams, for which they offer indeed little opportunity, while in the tertiary hill districts the marl and chalk formations very often do not offer a safe base to reservoir dams, while one also has to reckon with the manifold earthquakes in some of the districts, so that very little has come so far, of the various plans for the erection of large reservoirs.

The largest reservoir built, up to now is the Wadoek Pridjetan in the Solo valley with a capacity of 9 million cubic metre, constructed in the valley of the small river of the same name, which in previous years, caused a lot of trouble, owing to the sometimes heavy floods and the inundations caused by it.

There are several smaller reservoirs in Java, constructed by the natives, especially in districts, where the rainfall is poor, such as in the Solo valley ; they are mostly formed by damming small valleys. Also a few crater lakes are used on a small scale as reservoirs, as for instance the lake of Ngebel in the residency of Madium, on the west slopes of the Wilis, and the small Telaga (lake) Pasiz on the east slopes of the Lawu in the same residency.

Irrigation by means of pumps has not been found paying so far for native plantations, but is very much applied for the sugar-cane fields of the European sugar estates. As a rule, the water which collects in the discharge canals is profitably used again by pumping it to the sugar-cane fields by simple easily removable centrifugal pump installations.

On a large scale, water is pumped from the rivers by stationary pumping stations (of which are many with a capacity of 1 M^1 per second) to supplement the output of the irrigation canals and sometimes also to feed small irrigation canals which have been especially constructed for the irrigation of complexes of sugar-cane estates, which otherwise would not receive any irrigation water. The pumping of artesian or ground water for irrigation purposes, such as on the Hawaiian Islands is carried out on such a large scale, is only done by a few sugar estates and even then only on a limited scale.

Flood Protective Works

A factor, which is of the greatest interest for all cultures is the care for a regular discharge and protection against the water, so that, besides irrigation and discharge works, also embankments have been constructed or are under construction. The most important flood protective works constructed for this purpose, are those to prevent floods from the Solo and the Brantas river, also those to safeguard the capitals Batavia and Sourabaya from floods.

Finally a few words should be said about the struggle against the unfavorable effects of the material, discharged by the active volcanoes. The rivers rising from the slopes of these volcanoes,

sometimes change into veritable sand or mud-rivers, which, in leaving the original bed, destroy everything that is in their way.

As regards the Klut it is a highly unfavorable circumstance, that a lake is always formed in the crater, the water of which is thrown out with an eruption, immediately forming mudstreams, causing death and destruction. The great loss in life and the enormous damage caused by the last eruption in 1919 by this volcano has led to an effort, which is now being carried out by the service of the mining department, to cut a tunnel through the volcano slope, which will make it possible to drain the crater. Should this effort succeed, for which there is every chance, most certainly a very beneficial victory will have been gained on nature.

Besides the Klut, especially the Smeru (residency Pasuruan) and the Merapi (residency Surakarta), the excrements of which cause a lot of damage, are a danger and nuisance and necessitate continuous watching and interference. The fighting of the so-called sand trouble of many of the rivers, rising from the slopes of these mountains, belongs to the heaviest and unfortunately most thankless task of the hydraulic engineers in the D. E. I.

Below follows a survey of the expenditure on construction, upkeep and repairs of dams during a few successive years:

EXPENDITURE ON FLOOD PROTECTIVE WORKS.

Year	Construction	Ordinary Upkeep	Repairs
	glds.	glds.	glds.
1914 ...	901,214	123,885	41,100
1915 ...	790,202	142,131	1,131
1916 ...	826,516	153,061	120,148
1917 ...	1,018,365	172,710	224,646
1918 ...	2,069,224	198,558	465,878
1919 ...	1,336,957	275,415	252,860
1920 ...	1,484,554	271,630	442,347
1921 ...	1,915,609	241,989	169,749
1922 ...	1,364,621	221,041	28,214

Organization of the Irrigation Service

Irrigation, drainage and flood protective works were, so far, almost exclusively constructed by the government under the management of the department of public works, as its technical section for irrigation, drainage and flood protective works is more especially in charge of these works.

The technical irrigation service resorting under this department are, as far as Java and Madura are concerned, to be distinguished in:

I. Service of construction (special services) and
II. Service of exploitation (irrigation sections).

I. Services of Construction

These are, in the first place in charge of the making of surveys, measuring of water quantities and other observations, the designing and estimates of plans and the execution of works of the above described nature.

The leader is a chief-engineer or engineer, who is directly subordinate to the chief of the department and who has a staff of personnel (engineers, architects, surveyors, native superintendents and foremen).

Even after new works have been partly finished, the exploitation of these is, for the time being, put in charge of the construction service, which afterwards gradually, partly or entirely passes into the exploitation service.

II. Services of Exploitation

For the exploitation of the irrigation works, irrigation sections have been created in Java, which comprise in general the stream and irrigation district of one or more large rivers and derive their names from these rivers,

Probably in due time, Java will be divided altogether in such sections.

A chief-engineer or engineer is in charge of an irrigation section, who in technical matters is directly subordinate to the chief of the department, but from an administrative point to the relative resident(s). He is assisted in the management of the irrigation works by the heads of the section, in which the irrigation sections have been subdivided, and by engineers, architects, surveyors, native superintendents, foremen, etc.

Besides the management and the exploitation of all irrigation works and waterways within their district, the chiefs of the irrigation sections are also charged with the surveying, designing and construction of waterworks within their territory, as far as no special construction service has been appointed for it, while sometimes they are also in charge of the construction of roads, and in exceptional cases also have the supervision of small harbors.

Agricultural advisors, who are stationed in most of the residences take care of the agronomical interests of the irrigation system about which they give advice to the residents or also direct to the irrigation engineer.

The water supply is based on strict regulations, while heavy penalties are imposed for any offence against these regulations.

At the beginning of 1923 the personnel of the irrigation service in Java and Madura consisted of: 100 chief engineers and engineers, 9 architects and 176 surveyors.

Does Agricultural Improvement Pay?

By T. F. Tung

THE college of agriculture of the national south-eastern university of Nanking has been devoting its energy to the improvement of cotton, rice and wheat for five years and up to the present the results are reported satisfactory. There are three cotton experimental stations of the college at Kiangpoo in Kiangsu, Wuchang in Hupeh and Chenchow in Honan disseminating improved cotton seeds to 323 neighboring farmers, which were planted in 1,771 *mow* of land. As shown from the reports of these farmers, the minimum yield of seed cotton per *mow* from the improved seeds was seventy catties and the maximum yield, about 150 catties. On the average, the yield per *mow* which the farmers got with the improved seeds was at least twenty catties more than that of other cotton farmers near the stations not using the university seeds. The improved rice seeds were also disseminated last spring to farmers near Dah Shen Kwan experimental station. According to their reports the increase in yield per *mow* was more than one *ton* or one-tenth of a *dan*. Mr. C. C. Nieh, formerly chairman of the chamber of commerce of Shanghai and now a member of the board of trustees of this university, in his recent letter to Dean P. W. Tsou asking for improved seeds of cotton and rice, expressed sincerely his idea about the good work of rice improvement which this college is doing. His letter contained the following statement:—

" The result as obtained from the planting of improved rice seeds supplied by this college in 1923 was remarkable. The yield was about ten per cent. more than that of the ordinary farmer. We expect to have two or three *dan* more of the newly improved seeds tested in several places, and wonder if you will supply us with so much."

The expert workers on cotton improvement are Profs. T. S. Kuo, E. L. Sun, S. C. Wang, T. Y. Yeh and C. C. Hsu, and the one on rice improvement is Prof. C. C. Yuan. Through five years' intensified research work they have accomplished much in their enterprises, and if the work is extended to a large extent Chinese agriculture will be greatly benefited. It is estimated that in Kiangsu province the area devoted to cotton planting is more than 12,000,000 *mow*. If there is an increase in yield of twenty catties of seed cotton in every *mow* the total increase of product from the land will be about 2,400,000 piculs. As each picul sells about fifteen dollars the total increase in income of the Kiangsu farmers from the increase of yield will be $36,000,000 a year. Then again the area of land in Kiangsu under rice is about 28,000,000 *mow*. If an increase in yield of one-tenth *dan* of rice is produced from each *mow* and if each *dan* sells five dollars, then the total increase of income from the total increase of crop (which is about 2,800,000 *dan*) will be $14,000,000 a year. This assumption is made on the basis of two of many crops that grow in China and is limited to this province only. If the improvement work reaches every agricultural section of the country, what a large revenue our Chinese farmers will receive from their work! Is it unjust to assert that the agricultural improvement is the most important and fundamental way to solve the life problems of the Chinese people?

Southern Pacific Locomotive Equipped with Worthington No. 3 Boiler Feed Pump and Feed Water Heater 45,000 lbs. per hour (90 gallons per minute) Capacity

Worthington Locomotive Feed Water Heater

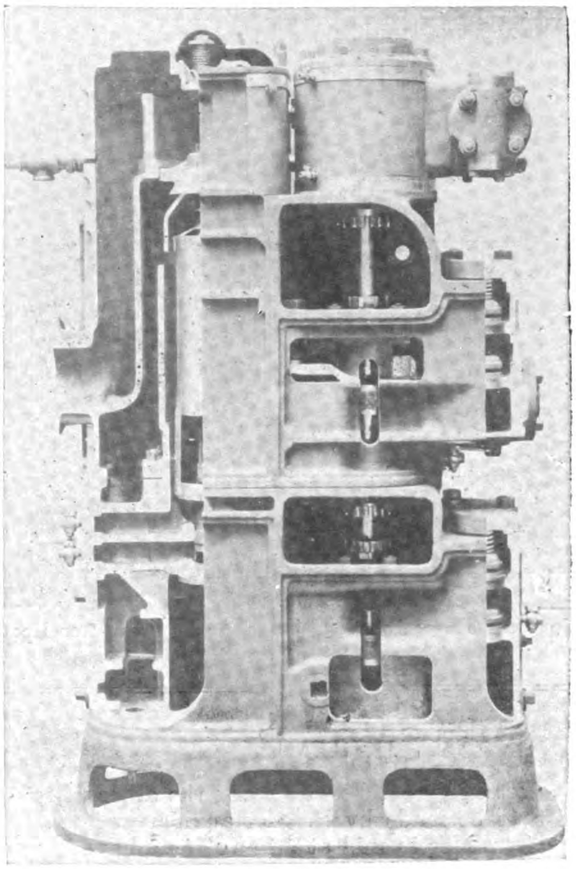
THAT the new Worthington combined feed water heater and feed pump for locomotives has proven everything that the manufacturers claim for it is evidenced by the remarkable increase that has taken place in the use of the Worthington apparatus during the comparatively short time that has elapsed since it was first placed on the market. At the present time this Worthington heater is being used by over thirty railroads in North America and on thirty-three railroads in countries outside of the United States. Two of the largest railroad systems in the United States have adopted these Worthington heaters as a standard and have several hundred of them in use. In each of these cases the heaters were subjected to the severest trials and tests under actual working conditions and with special reference to different kinds and grades of fuel, and with feed water as found in the different parts of the country. Observations were also made as to the influence of the different seasons of the year upon the results obtainable. The difficulties overcome in this latter respect alone will be better understood when it is stated that in the northern part of the United States extremely cold weather with great quantities of ice and snow are encountered during the winter season, while in the summer, practically tropical conditions prevail in the southern portions of the country. There are localities in Canada where these Worthington heaters encounter variations in temperatures from 100 degs. F above zero to 53 degs. F below zero, and their operation is perfect under these extreme climatic conditions. During a period of about four years the Worthington heater has been required to meet every possible combination of these exacting conditions, and its eventual adoption as a part of the standard equipment for locomotives by such a large number of progressive railway systems in the United States and abroad is an achievement that, as far as we are aware, has not before been equalled in the case of any similar class of apparatus.

During recent years the price of fuel has risen so rapidly that the engineering world has found it necessary to make a special study of the development of heat-saving devices, and the application of the Worthington heater to locomotive service is one of the outstanding results of these efforts toward heat conservation. In comparing the desirability for the development and use of apparatus of this kind as between the stationary power plant and the locomotive, which may be described as a portable power plant, it is clear that the necessity for same is by far the greatest in the latter case. A locomotive is compelled to carry both the fuel and the water through which its power is to be produced. Therefore, any saving that can be effected in the use of these materials is equivalent to reducing the quantities of same that have to be stored and carried. Furthermore, this saving also has the effect of increasing the power that can be obtained from a given quantity of fuel and water and to that extent increases the power output of any given size of engine.

It will be noted also that not only is it possible to carry a lesser quantity of water, but that a large percentage of the exhaust steam, which in the ordinary type of locomotive is entirely lost by being exhausted into the atmosphere, is recovered by condensing the same in the heater. The heat in the exhaust steam is also saved, and with the condensed steam in the form of hot water is returned directly to the boiler. Careful tests have also proven that an important saving results from the fact that the condensation of the exhaust steam in the heater reduces the back pressure of the exhaust upon the main pistons of the engine.

The heater portion of this Worthington combination is what is known as the "open type," and does not require the use of tubes like those used in the closed heaters and which have always been found to be source of trouble. In the Worthington open heater the exhaust steam and the water mingle in the steam chamber and the water is heated by direct contact with the same, producing the highest possible degree of efficiency.

The pump is of the direct acting type with a special form of steam valve gear which is undoubtedly the most economical and reliable form in its class that has ever been devised. There is one pump cylinder for handling the cold intake water and one pump cylinder for pumping the heated water directly to the boiler. Only one steam cylinder is used to operate both of these pump cylinders.



Sectionalized Size No. 2—Type B. Worthington Locomotive Feed Water Heater and Pump, Front View

In the adaptation of this Worthington combination for use on the locomotive, the best principles of modern practice were adopted, with the idea of producing a unit that would be a model of simplicity, and that would be easy and inexpensive to supply to operate and to maintain. The simplicity of this Worthington unit is a guarantee of absolute minimum cost of maintenance, and the surprising results that are being obtained in this respect are indicated in the tabulations given below.

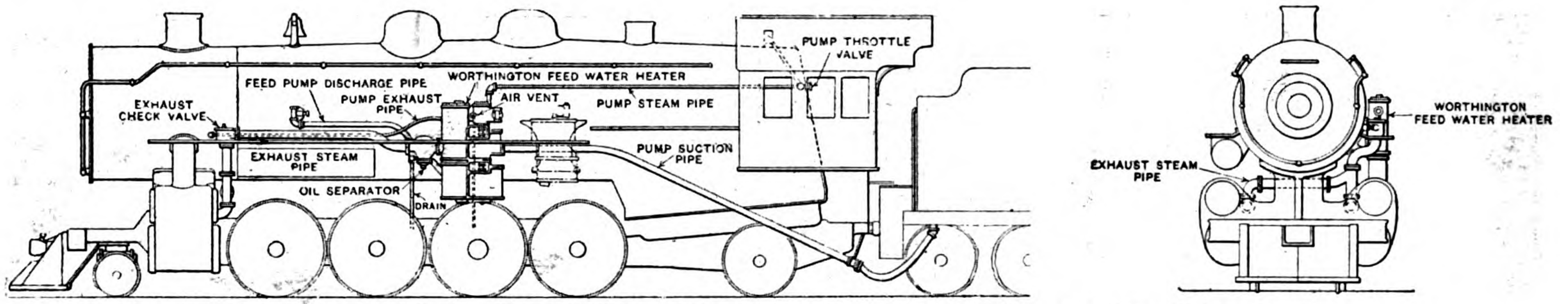


Diagram Showing Application and Piping of Worthington Locomotive Feed Pump and Feed Water Heater

A minimum of piping and fittings is required, and the apparatus is not influenced by the accumulation of scale, etc., from poor water either in its operation or in its heating effect. The heater proper and the entire water supply to it comprise a low-pressure system. Inspection when required is a most simple matter, as the heater is not a part of the locomotive itself and every portion of same is most conveniently accessible. We mention some of the good points of the heater that are most appreciated by locomotive engineers. Where a Worthington heater is used, it is not necessary to fill the boiler while the engine is standing still, in order to be ready to start up. Neither is it necessary to fill the boiler on the down grade in order to be ready for the next up grade. These things are possible because of the small steam consumption of the Worthington steam pump that is used with this heater, as compared with the consumption of the ordinary injector. Furthermore, the air vent on this heater is so arranged that temperatures above the atmospheric pressure are obtained. In fact, with a back pressure in the locomotive cylinders of eight or ten pounds, the temperature of the feed water delivered to the boiler will be within ten or twelve degrees of the temperature of the exhaust steam. The question is sometimes raised regarding the possibility of ~~oil getting into~~ the boiler feed water through the heater. Absolutely no trouble of this kind has ever been experienced with a Worthington open type of heater.

A cut is illustrated herewith showing a cross section of the Worthington combined heater and feed pump, and from which a clear idea may be obtained of the general arrangement and construction of same. An illustration is also shown of a locomotive with one of these heaters mounted and in use. A line cut shows the disposition of the connections of this heater in place. Another cut shows the external appearance of the combined heater and pump. In actual service and comparing the actual results obtained with the same locomotive when using an ejector and when using the Worthington feed water heater, it has been found that the coal saving per I. H. P. with the locomotive operating at or near maximum capacity is from 12 to 15 per cent. Another method of comparison is that adopted by the American railway association committee, based on the rise of temperature of the feed water. On this basis, it is found that the rise in temperature for heavy trains ranges from 130 degs. F to 185 degs. F with an average of 150 degs. F. For light trains, the rise in temperature ranges from 92 degs. F to 175 degs. F with an average of 144 degs.

Type of Locomotive	4-6-2	2-8-0	2-8-2
Average steam pressure in lbs. per square inch	201.6	203.5	173
Percentage of fuel saved over operation with injector ..	12.6%	14.1%	15%
Percentage of increase of water evaporated per pound of fuel over operation with injector	13.7%	20%	16.55%

The principal results obtained by the use of these Worthington feed water heaters on locomotives are the following :—

1.—Longer life to boiler tubes because of absence of scale and mineral deposits.

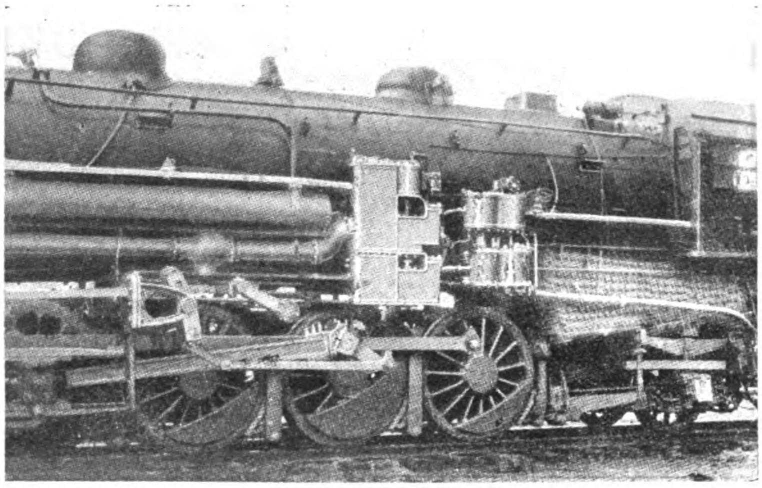
2.—A reduction in the amount of fuel required to produce a given amount of power.

3.—Less water is needed for the same work.

4.—The reduction in back pressure on steam pistons renders the locomotives easier to handle and more powerful.

5.—It has been found that the saving in fire box maintenance alone, without considering any other economical feature, is so great as to make the investment in a Worthington heater fully justified.

That these are real and practical gains over locomotive feed with injectors is unhesitatingly attested to by all locomotive engineers who have operated or have observed the operation of the Worthington open feed water heater and pump for locomotives.



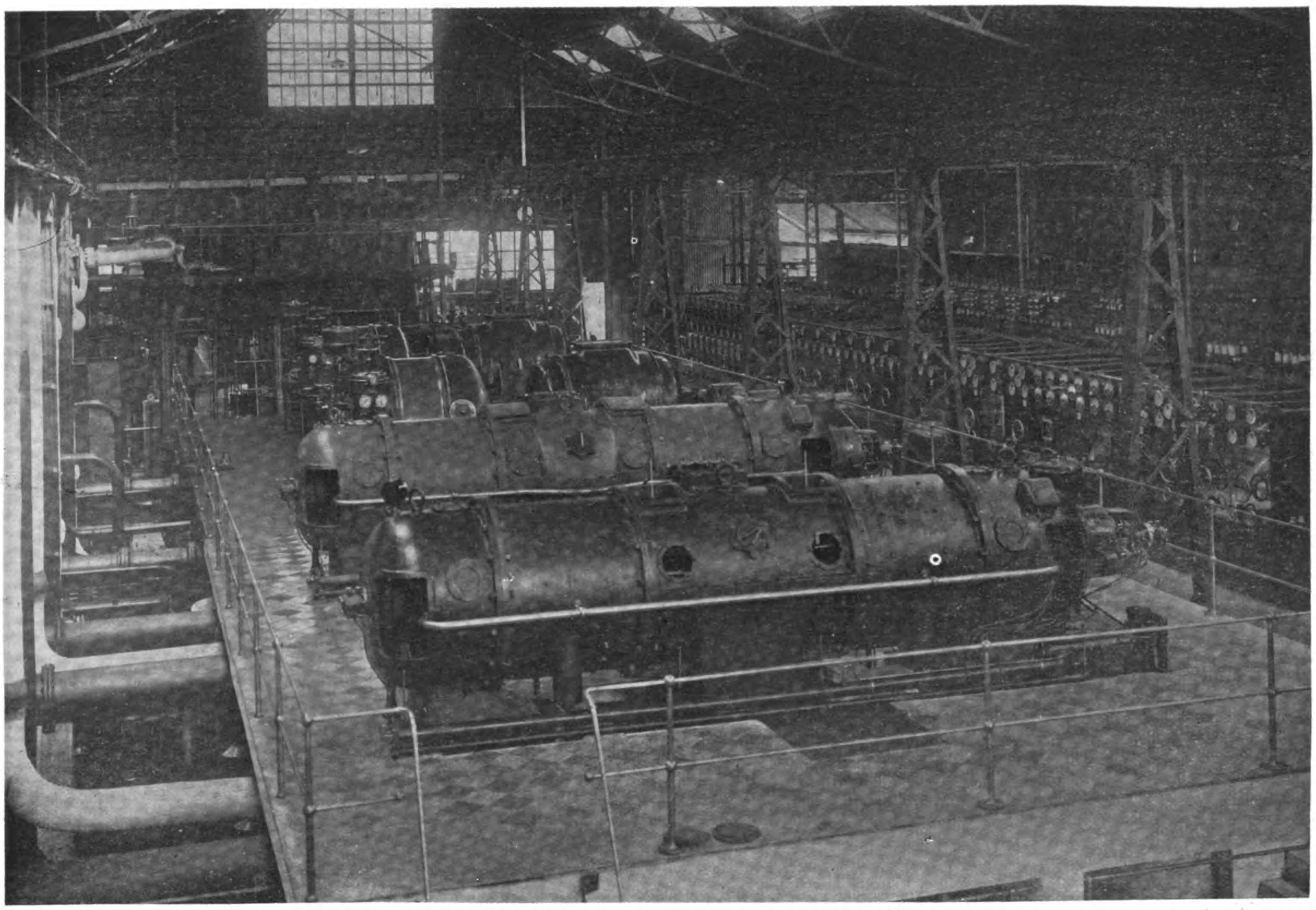
Worthington Locomotive Feed Pump and Feed Water Heater in Mikado Type Locomotive

Sugar Rolls

ANOTHER instance of the application of electricity to rolls in the raw sugar industry is an installation to be made by P. Costas, Bercetche & Mosoteguy in their San Martin mill at Tabacal, Argentina. This is the first application of its kind in that country. The plant is already well electrified, but mill expansion caused the owners to extend the use of electricity to driving the rolls, a practice not yet universally adopted in the sugar industry.

An extension to the present mill is to be erected and complete electrical equipment has been ordered from the General Electric Company of America, through the Argentine General Electric Company, agents of the International General Electric Company. Two 1,250-kilowatt, variable speed turbine generators have been specified, one of which will supply power to the motors driving the rolls ; the other will be used as a spare, both for the roll drive and for auxiliary power. Seven 300-horsepower, variable speed induction motors have been ordered. Six of these will be used regularly for driving the rolls while the seventh will be a spare. Other electrical equipment will include switchboard and control apparatus, together with a number of auxiliary motors.

Another unusual feature of the installation is the adoption of a motor-driven governor adjuster. This will permit remote control of the frequency of the turbine from the roll room by adjusting the governor by means of push-button stations. The whole grinding operation is thus under the control of the operator in the roll room. A frequency meter on the same panel with the push-button station will enable the operator to ascertain at any time the speed at which the rolls are running.



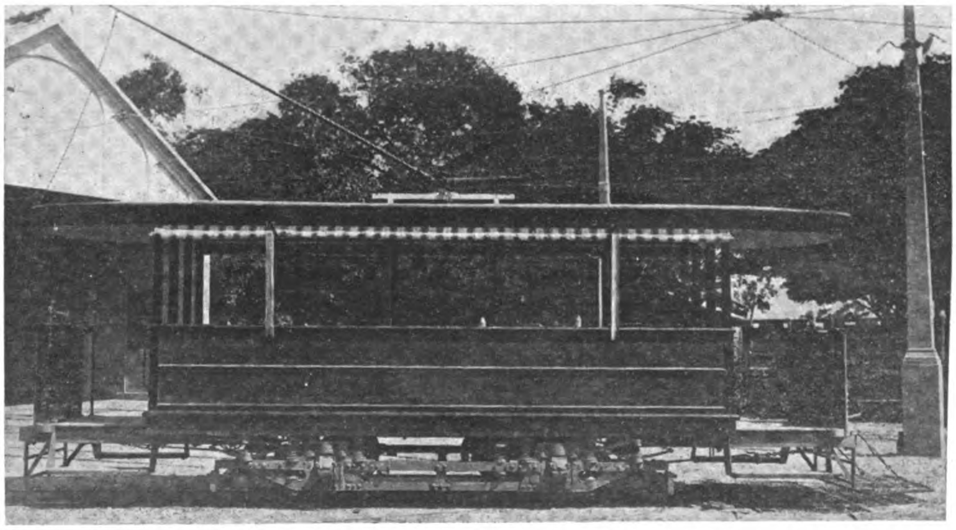
Generating Room of the Siam Electricity Company's Powerhouse at Bangkok, Siam. In foreground are two Lungstrom (STAL) turbo-generating sets each 2,800 k.w. with two A.E.G. turbo-generating sets of 1,200 k.w. each in rear. In the background is reciprocating steam set of 750 k.w.

Bangkok's Tramways and Lighting

The Siam Electricity Company, Ltd.

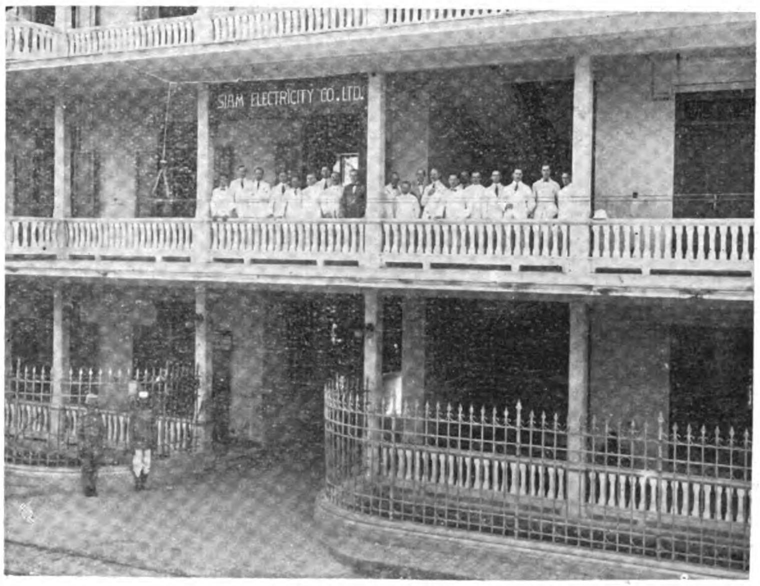
ONE of the most promising power developments in the Far East is found in Bangkok, the capital of Siam, where the Siam Electricity Company, Ltd., holds a virtual monopoly for furnishing light and power to the city and its suburbs. The history of this development goes back to May 1887, when a concession was granted by the Siamese government to Messrs. John Loftus and A. du Plesis de Richelieu to operate a horse-drawn tramway from Bangkolem (the southern-most point of the town) to the royal palace. The concession was transferred to an English company (the Bangkok Tramways Company, Ltd.) which worked it for some years with but poor results. This company went into liquidation, and on May 23, 1892 transferred the concession to a Danish company.

This company electrified the line (which work was completed in May 1894, at a time when most cities in Europe were without electric tramways) and operated it for some years until in November 1900 the concern was taken over by the Electricity Co., Ltd.



Type of Car operated in Bangkok by the Siam Tramway Company

Independently of these developments Messrs. L. de Richelieu and Aage Westenholz obtained in July 1900 another concession to construct and operate a tramway (the Samsen Tramway) which connected the northern part of Bangkok with the centre of the town and this concession was also transferred to the Siam Electricity



Offices and Storehouse of the Siam Electricity Company at Bangkok

Co., Ltd., and traffic was commenced on this line in September 1901.

Electric lighting was first started in Bangkok by a Siamese nobleman in 1890 and was taken over by the government in 1893. It was transferred to an American company, the Bangkok Electric Light Syndicate, in 1897 and this company obtained a contract for lighting of public roads and government premises which contract after certain alterations was taken over by The Siam Electricity Co., Ltd., upon its formation.

The Siam Electricity Co., Ltd.—This company was formed and incorporated in Copenhagen on December 27, 1898 for the purpose of acquiring the concessions, contracts and rights of the former companies and started its existence with a registered capital of £33,400 and with Mr. Westenholz as its manager.

In the course of 1900 and 1901 the fusion was completed whereby all the electric tramway and light undertakings in Bangkok were combined under the S. E. C.

One of the first undertakings of the new company was the removal of the machinery of the two old tramway stations to the electric light station situated in the temple premises of Vat Lieb which latter station the company had acquired by virtue of its concession and where the company's activities are still carried on.

In the course of time the prosperity of the company grew and in 1907 it acquired a controlling interest in the Siamese Tramway Co., Ltd., a company started under royal charter in 1904 by Siamese princes and noblemen to operate another system of tramways in Bangkok.

The Siamese Tramway Co.'s power station was demolished and its management taken over by the S. E. C. and while the two companies each maintain their independent character, the shareholders and board of directors are to a great extent the same and the management is common for both companies, while the current is supplied from the power station of the S. E. C.

The company's offices growing too small a new three storey ferro-concrete office building was erected and the company was honoured by having these premies formally opened by his majesty the king of Siam on September 1, 1916.

The Siam Electricity Co., Ltd., is incorporated under Danish law with a capital of £700,000 fully paid. Its chairman since 1902, is the founder, Mr. A. Westenholz, with Comdr. W. L. Grut as vice-chairman and managing director.

While at the beginning of its existence the company received its main profit from the tramways the position is now reversed. Apart from the light supply and the tramways the company's profit to an increasing extent is accruing from electric installation, sales of stores, contracts, workshop, garage, etc.

The power plant is equipped with two A.E.G.—Curtis turbo-alternating sets of 1,200 k.w. each and two Stal (Lungstrom) turbo-sets of 2,000 and 2,800 k.w. capacity. Two of these sets operate as single phase, 100 cycles with 2,000 volts transformed to 100 for lighting and the other two sets are three-phase, 50 cycles delivering 3,500 volts and 110 for service. In conjunction with the lighting plant, there is a separate installation for supplying the tramways with 550 volts direct current consisting of one 750 k.w. reciprocating steam generator set, one 700 k.w. and one 800 k.w. motor-generator. Steam is generated in ten Babcock and Wilcox boilers of 2,852 sq. ft. of heating surface each at 160-lbs. pressure superheated to 300 degrees.

The tramways operated and owned by the Siam Electricity Company are twenty kilometres in length, of metre gauge. There are 51 motor units, of which two are freight cars, and 20 trailers. The car miles for the year 1921 was 1,893,106.

One of the features of the boiler plant is the use of paddy or rice husks as fuel, of which there is always a plentiful and cheap supply from the numerous river-side rice mills in Bangkok. This fuel is delivered in barges alongside the power house and fed into storage bins by a system of conveyors driven by electricity on the principle of an Archimedian screw revolving in a steel casing. The method of feeding the boilers from the husk bunkers is by an arrangement of mechanically controlled shutters which regulates the feed according to the requirements.

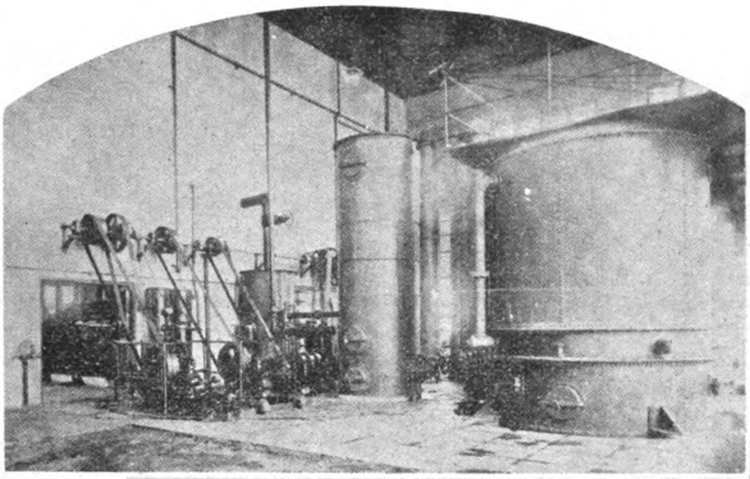
As noted above the Siam Electricity Company also controls the Siamese Tramway Company, Ltd., established in 1904 with a capital of Ticals 725,000 (about £75,000). This company operates ten miles of single track line, with 33 motor units and purchases its power from the plant of its affiliated company. The number of car-miles run for both companies in 1922 was over three million. In addition the company has a large and well equipped repair and machine shop with iron and brass foundry attached ; a garage with agencies for manufactures of several well-known cars and accessories ; and an import and sales departments, with stores and showrooms which mainly works in the electrical and allied fields.

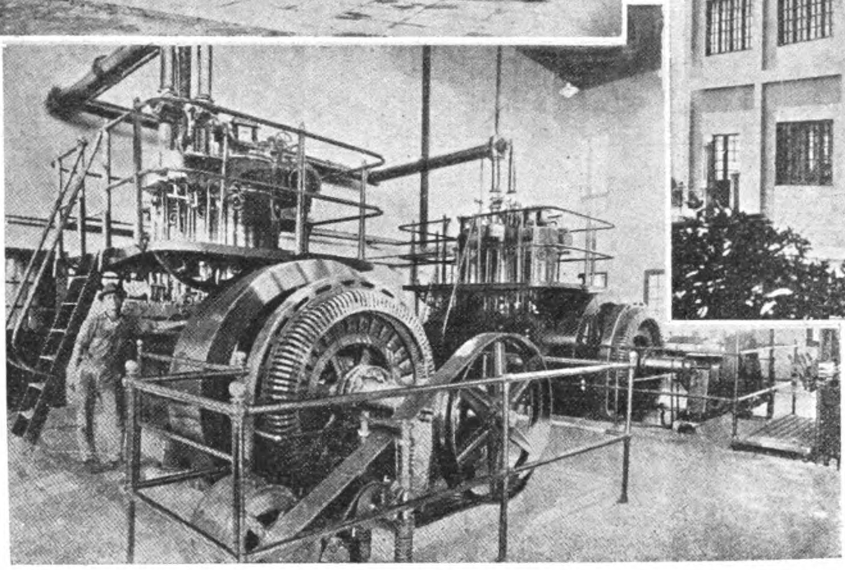
The total number of employees comprises 20 Europeans and about 1,100 Asiatics, the majority being Siamese.

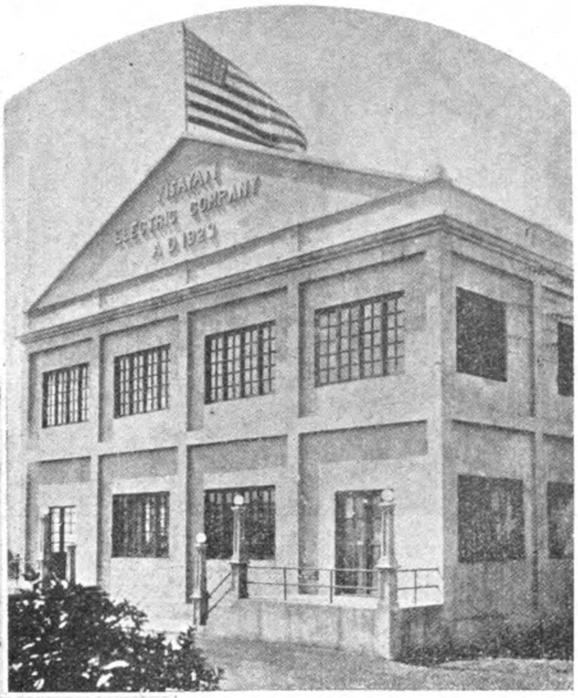
Important New Zealand Contract

In connection with the extensions which are now taking place at the Lake Coleridge hydro electric power-station of the New Zealand government, it is interesting to note that Messrs. Bruce Peebles & Co., Ltd., Edinburgh, have been successful in securing the contract for the supply of the two 7,500 k.w. alternators, each complete with direct coupled exciter.

The alternators will be designed to operate at .85 power factor and to generate a three-phase 50-cycle current at a pressure of 6,600/7,000 volts when driven at a normal speed of 500 R.P.M. They will be of the totally enclosed forced ventilated type, the cooling air being provided by an induction motor-driven fan which is also to be supplied by the firm. There will be two main bearings of the forced lubricated type, the oil pump being driven by belt from the main shaft. The alternators will be designed to withstand a runaway speed of 90 per cent. above normal. The contract includes for the supply of oil tanks and strainers, oil coolers with water tanks and all apparatus necessary for the successful operation of the plant.







Top—Two Akerlund gas producers which use Philippine coal. Bottom—Two Rathbun producer-gas engines, direct connected to electric generators. Right—Front of the up-to-date building of the Visayan Electric Company, Cebu, P. I.

Gas Producer Power Plant in the Philippines

A LITTLE over a year ago a 500-h.p. gas producer plant started active operations at Cebu in the Philippine Islands, and the performance of this installation has been so satisfactory in the meanwhile that we feel justified in referring to it, says *The Compressed Air Magazine*. The plant in question is the property of the Visayan Electric Company; and the initial problem involved was to obtain prime movers which could be operated most economically with the fuel obtainable from local sources—in other words, equipment that could utilize to advantage Philippine coal. In passing, let it be pointed out that the native coal is not of a high grade.

On the face of it, it was plain that the coal would not prove efficient if burned under a boiler; but its chemical composition gave ample warrant for the belief that it could give satisfactory and far better results if used in conjunction with gas producers for the driving of gas engines. Having settled this point, the engineers were then called upon to choose producers and gas engines which would get the most out of the available fuel. After a survey of the market, they decided to purchase two No. 30, Type "B," Akerlund gas producers and two 250-h.p. Rathbun gas engines—each of the latter to be direct connected to a 175-kilowatt generator. The electric current generated is for town lighting and for service in various small industries.

Akerlund gas producers are designed to work upon the down-draft principle and, therefore, function differently from up-draft gas producers which employ mechanical scrubbers to clean the gas before it is delivered to the gas engines. The type "B" gas producer is the outcome of wide experience, relatively simple in its get-up, and is capable of generating from low-grade coals a maximum of clean gas of uniform quality such as is required for the best work in a gas engine. The Rathbun gas engine is, likewise, the outcome of much experience and engineering skill; and the combination adopted for the Cebu central station has rendered excellent service.

The plant began to deliver current to the company's lines in September of 1923, and has been running well ever since. Philippine coal, mined from near by, has been found to be the cheapest domestic fuel and considerably more desirable as a gas producer than either Japanese or Australian coals—both of which have been tested.

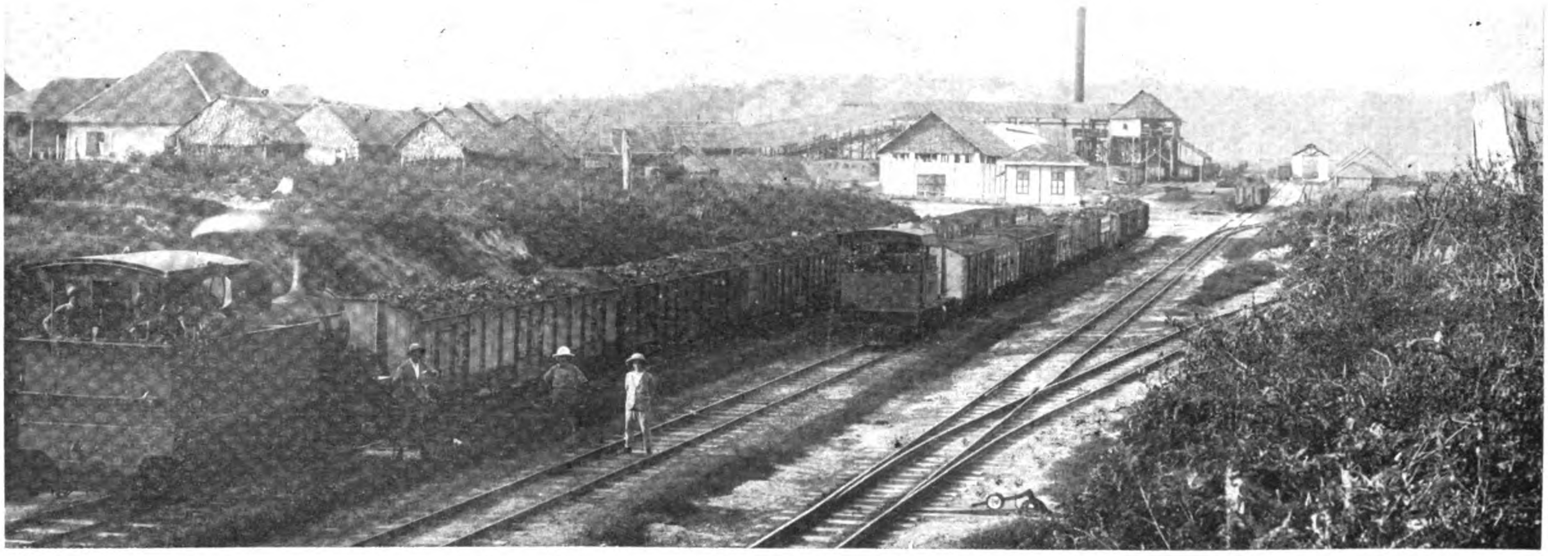
What has been done by the engineers of the Visayan Electric Company is striking evidence of how modern power plants can be adapted to utilize effectively and efficiently local fuels which, at first blush, are far from promising sources of motive energy.

A New League of Nations

Ten countries are contributing to the modernization of the Java state railways, which is equipping with modern cars and trailers for suburban passenger service a section that includes the cities of Batavia and Meester Cornelis. The United States, India, Holland, France, Belgium, Cuba, Switzerland, Canada, Germany and England are furnishing material for the work.

The United States is contributing the major part of the electrical equipment, the rubberoid for the roofs, the devices for coupling in emergency to the existing steam trains, the vestibule buffers, the pneumatic door opening mechanisms, and the car seats.

The General Electric Company of America is electrically equipping ten of the cars. India is furnishing the teak wood for the roofs. France is contributing the wood for the floors. The all-steel bodies are being built in Holland. The window glass, wheels and axles are from Belgium, and the mahogany for interior trim from Cuba. Switzerland is supplying the wiring devices, and Canada the asbestos linings. The truck springs are from Germany, and the air brakes from England.



Private Railway Siding of the Malayan Collieries, Ltd., at Batu Arang, F.M.S.

Malayan Collieries Ltd.

Notes on Batu Arang Colliery

Paper Read Before the Engineering Association of Malaya

By James Barr, B.E., M.I.M.M. (Aust.), M. Am. I.M.M.E.

THE property, consisting of 8,660 acres held under mining lease, is situated in the Mukim of Rawang, district of Ulu Selangor, and the mine itself is distant three-quarters of a mile from the Kuang-Batang Berjuntai government railway, to which it is connected by a private siding, the traffic over which is carried out by the company's locomotives.

It is not certain that coal exists under the whole of the leases, but known reserves amount to approximately thirty million tons. Three seams probably exist, but only two are being worked.

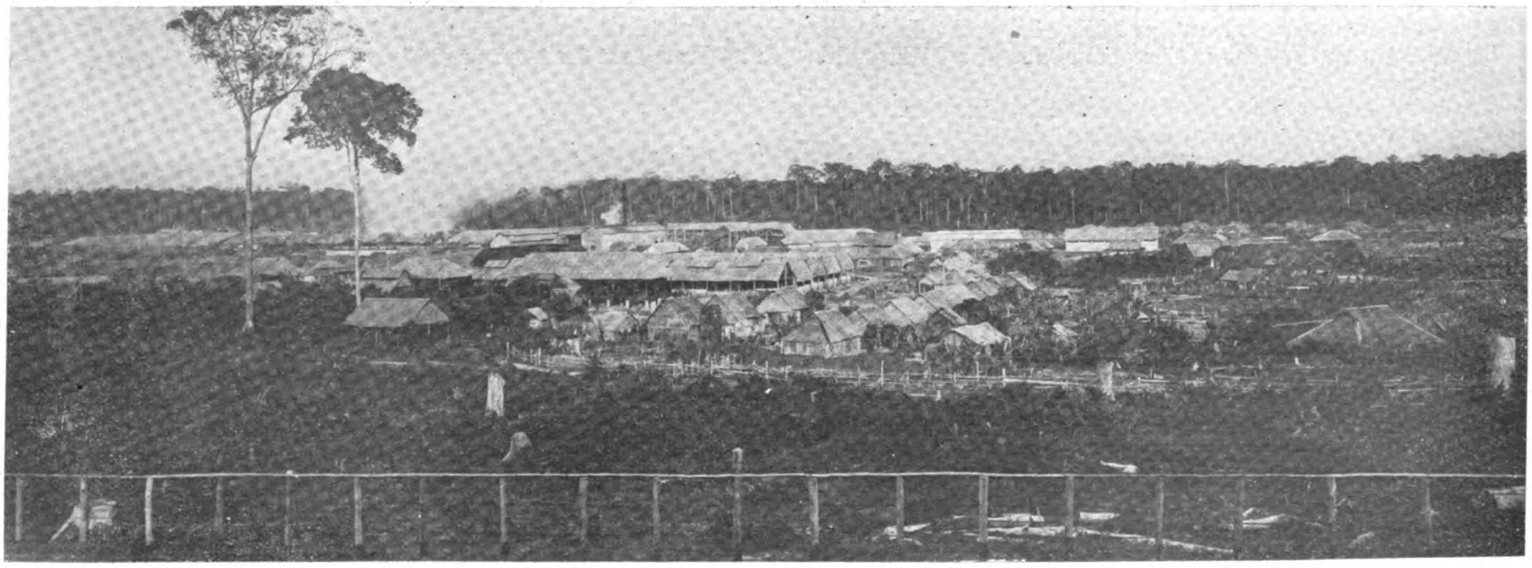
All coal despatched is weighed by the F.M.S. railways on their weighbridge, situated near the colliery screens. The average output at the present time is 24,000 tons per month. This can be trebled, should the demand for coal ever warrant the increase. The output comes in about equal proportions from the underground workings and the open casts.

The coal might be called an advanced lignite. It is pitch black in color, hard when freshly mined, and breaks with a conchoidal fracture. The specific gravity varies from 1.2 to 1.3, and the calorific value of the screened coal is 11,000 B.T.U. The output is marketed in three sizes: screened, unscreened, and smalls.

The coal comes from the mine in tubs, holding 12 cwts., and these pass through a head Wrightson rotary tippler, and discharge on to a bar screen 16-ft. long by 6-ft. wide, with bars spaced 1¼ inches apart. The screened product falls directly into railway wagons, and the smalls into a hopper, from which they are easily transferred to the wagons below.

Working Plant

The working plant falls naturally under the two headings of surface, and underground. As machine mining is not necessary, and therefore not practised, the underground plant is limited in character, and consists of pumping machinery, and haulage machinery only.



The Malayan Collieries and the Village of Batu Arang, F.M.S. Nine Years Ago this was Virgen Jungle

The surface equipment is rather more elaborate, and includes the following :—

Boiler House.—Containing four Babcock and Wilcox horizontal type water tube boilers, two of 2,531 sq. feet heating surface, and two of 2,010 sq. feet. Each fitted with mechanical chain grate stoking plant, and working at a pressure of 160-lbs. per sq. inch. An induced draught fan was originally installed, but it was found unnecessary, and was dismantled.

Two main boiler feed pumps of the turbine type, electrically driven, and two steam-driven Worthington pumps kept as standby. Feed water tank of brick, capacity 30,000 gallons. Steel chimney stack, on a brick foundation. It is 9-ft. 3-in. diameter, by 130-ft. high.

Power House.—Power house of brick, containing three 300 k.w. sets, by Mather & Platt, 500 volts, direct current, compound wound dynamos, with commutating poles. These are direct driven by Browett and Lindley high-speed compound engines. The switchboard is by Erskine Heap & Co. Lighting is provided for by a 16 k.w. motor generator, 500 to 100 volts.

All motors are compound wound, with commutating poles, and are fitted with Brock-Hirst special type of mining starters, with overload and no volt releases.

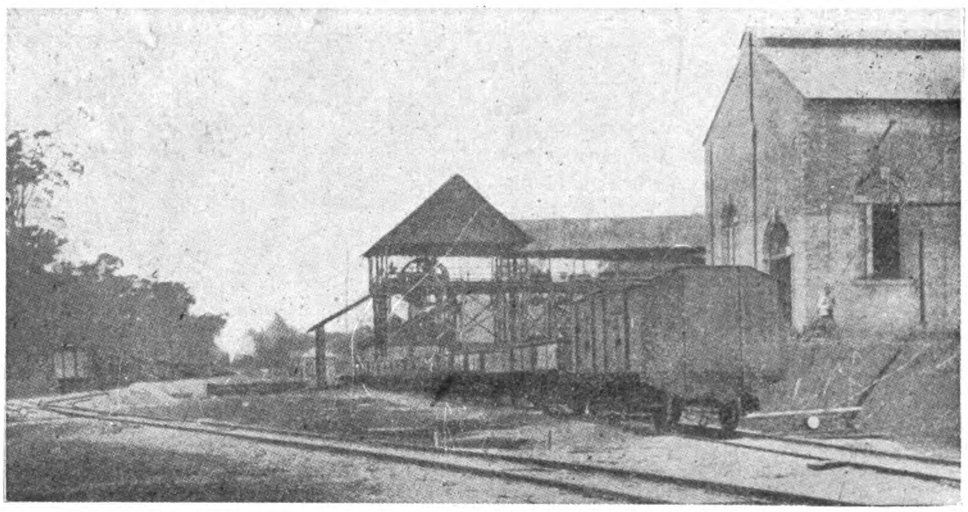
All cables carrying main current to the mines, workshops, etc., are special tropical, twin core, paper insulated lead covered, and are laid below ground in bitumen in stoneware troughing. The cables in the mine itself are of similar type, but are armored with steel wire, and suspended from timbers.

Workshops.—Of brick, with galvanized iron roofing. They are equipped with the following :—

One 14-in. centre, lathe.
One 10 inch centre, lathe.
One punching and shearing machine.
One planing machine.
One radial drilling machine.
One screwing machine.
Grinders.
Blacksmithing outfits.
Ventilating-fans.

—The main fan is a "Sirocco," 98 inches diameter, capable of passing 200,000 cubic feet of air per minute against a 4-inch water gauge. It is rope driven by a 200 b.h.p. motor. The smaller fan, which is kept as a standby, is of the "Turbon" type, 36 inches in diameter, capable of delivering 20,000 feet of air per minute, and is direct driven by a 25 h.p. motor.

Hydraulic Stowage Pumps.—As adjuncts to the underground stowage plant there are on the surface two centrifugal pumps, 8 inch delivery, 1,100 gallons per minute ; direct driven by Mather and Platt motors.



Malayan Collieries at Batu Avang, F.M.S.

Railway Sidings.—Apart from the siding connecting with the government railway, there are in use 3½ miles of colliery sidings, and this length will soon be considerably extended.

Brickmaking Plant.—Plastic type, capable of turning out 1,000 bricks per hour.

Stores Buildings.—These are of brick, and are 105-ft. by 60-ft., and 105-ft. by 30-ft., respectively.

Open Casts.—The open casts are equipped with portable boilers, small haulage winches, and side tipping trucks. This is anything but an ideal arrangement, but it has to be remembered that opencasting was started at a time when people were fortunate in being able to get any kind of plant, good, bad, or indifferent. The existing equipment has always been looked upon as a stop gap. It has served its purpose, and will shortly be replaced by something more efficient.

Bungalows.—Eleven bungalows, of comfortable design, accommodate the staff ; and a small club house and tennis court are also provided.

Underground

Approximate sections of the two seams being worked are as follows :—

Top Seam.

Roof	Shale.
Coal	17-ft. 0-in.
Clay parting	9-in.
Coal	7-ft. 0-in.
Carbonaceous shale	6-ft. 0-in.
Coal	7-ft. 0-in.
Clay parting	2-in.
Coal	9-ft. 0-in.

Bottom Seam.

Roof	Shale.
Coal	25-ft. 0-in.

Both outcrop at the surface, and dip at an angle of 14 deg. They have been attacked by inclined galleries, variously known as slopes, tunnels, inclined shafts, etc. Rails are laid in these slopes, and the coal is hauled through them in tubs by means of haulage winches, geared 3 to 1, with cylinders 12 inches in diameter, by 18 inches stroke.

Mining Methods.—Until two years ago the system of working employed was that of ordinary bord and pillar.

In the bord and pillar system of mining the area to be worked is divided into small districts, or blocks, by main entries or levels, and cross entries, or headings. The coal in each block is mined by turning off from the headings at stated intervals a number of bords, or rooms. The blocks of coal left between the bords, or rooms, are known as pillars. In ordinary practice these pillars are recovered, usually soon after the bords have been driven in a certain distance, but in special circumstances only after the bords have reached the boundary of the property. The thickness of the pillars to be left in the first working is determined by several factors, such as the nature of the roof, the thickness of the overhead cover, the thickness and nature of the coal seam. Generally speaking, the greater the cover, and the thicker the seam, the greater must be the width of the pillar. At Batu Arang, the seam being very thick, extra large pillars had to be left ; but when the time came for their removal a most disconcerting factor obtruded itself. This was the liability of the coal to spontaneous combustion. It is obvious that when pillars are extracted, the roof being left unsupported must fall, and at this colliery nearly every fall of roof was accompanied by an outbreak of fire. The situation was rather a difficult one. Either the pillars had to be left intact, and 70 per cent. of the coal left behind, or they were to be taken out at the risk of serious fires, which in turn meant either partial dislocation or entire stoppage of output.

Both positions were untenable, and a way out had to be found. This was discovered in hydraulic stowage, which, in other words, means the replacement of coal extracted by sand sluiced into the depleted workings.

The natural concomitant of hydraulic stowage is the longwall system of working and to-day our method is longwall and hydraulic

stowage. For the time being attention is concentrated on winning the coal left in the pillars of the old workings, and practically the whole of it is being recovered. In the longwall system as usually practised all the coal is extracted, and the roof allowed to fall or cave over a partially or wholly packed goaf, haulage roads being maintained through the caved area by means of packs built along their sides. In general, longwall is not usually applicable to thick seams, but here, through having command of large quantities of sand, we can apply longwall to a thick seam, for we are able to thoroughly fill the goaf, or empty spaces ; and so control the roof settlement that the danger of fires is very considerably lessened, if not altogether eliminated. Hydraulic stowage has certainly enabled us to obtain a high percentage of extraction, and thereby prevented wastage of a national asset, but it is an expensive process, as will be evident when it is remembered that the sand has to be mined, transported from a distance, sluiced underground, and the excess water pumped to the surface.

The following brief description of the round of operations will help to convey some idea of how the system works :—

The sand is mined by an ordinary gravel pumping plant at Kundang, and transported by rail to the colliery. Arrived there, the wagons are run over the top of, and are emptied direct into, sand bunkers. These sand bunkers are rectangular, brick lined excavations, divided into two parts by a curved retaining wall. One part is the sand bunker proper, and the other the receiving and mixing chamber. The bunker has a sloping bottom, about 1 in 4, down which the sand is flushed through narrow vertical openings in the retaining walls into the receiving and mixing chamber. This chamber is built over a shaft, down which is carried the pipe which conveys the mixed sand and water into the underground workings. In the mixing chamber water is added, to give the sand the required consistency. Depending upon the distance the mixture has to be carried the consistency varies from one of sand to six of water, up to one of sand to ten of water. Normally 1,000 yards of sand can be conveyed from the bunkers and stowed in the workings in eight hours. The stowage pipes are 5 inches in diameter, and the wear and tear on them is surprisingly small. The bends naturally suffer most in this respect, and they are of special design. All pipes are turned periodically, to distribute the wear.

The place to be filled with sand is barricaded off by means of props between the roof and floor. Stretched round these props from top to bottom are strips of cheap Hessian cloth. This cloth has sufficient strength to keep back the sand, but its loosely woven structure allows the water to escape quite freely. The escaping water is made to travel as long a distance as possible before arriving at the pump sump. Interposed in its course are several silt, or settling pits, so arranged that one-half can remain in service while the other half is being cleaned out. Arrived at the main sump the now comparatively clean water is pumped to the surface by means of two eight inch, direct driven, centrifugal pumps, by Mather and Platt ; each capable of delivering 1,100 gallons per minute, against a head of 500 feet.

Handling the Product.—The coal, after being broken down, is filled into tubs which are brought along the face. The filled tubs are pushed out to haulage ways, or " jig planes " and jigged down to the level. These jig planes are simply self-acting inclines, operated by a pulley fixed to a prop. at the head of the jig, the descending full tub raising the empty one.

Arrived at the level, the loaded tubs are drawn by storage battery locomotive to the main " Flat," or assembling sidings, whence they are raised to the surface in rakes of eleven at a time, up the slope, or engine plane, already mentioned.

New Motor Ships for the O.S.K.

(Continued from page 24.)

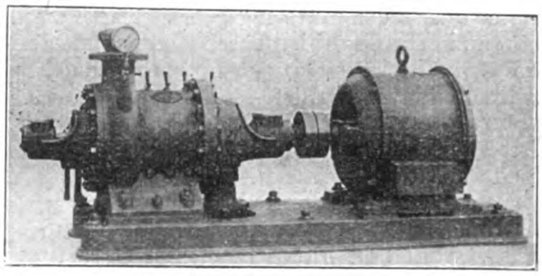
These auxiliary engines are of the airless-injection Diesel type recently developed by Sulzers, operating on the two-cycle principle and being very simple in design owing to the complete absence of mechanically operated valves. Ample provision is to be made in the engine-room for a supply of manœuvring air, and there will be two auxiliary manœuvring compressors, each driven by a 140-h.p. electric motor. The machinery for two of the ships will be built by Sulzers in Switzerland, but that for the third vessel will be constructed at the Mitsubishi Dockyard under licence. When completed these ships will be placed on the Japanese-South American run.

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE
No. 4 AVE. EDWARD VII

蘇爾壽工程事務所
上海愛多亞路四號

SULZER HIGHLIFT CENTRIFUGAL PUMP



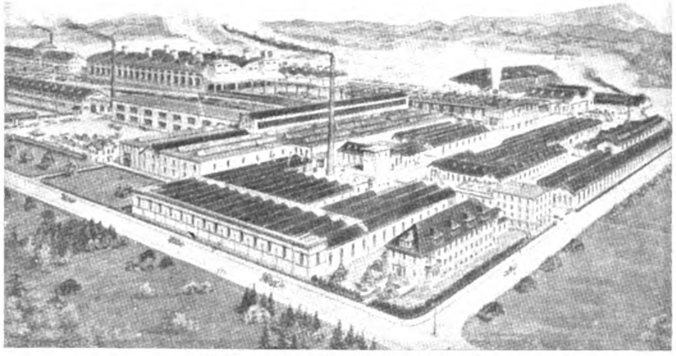
Uniflow Steam Engines, Upright Water-tube Boilers, HIGH AND LOWLIFT CENTRIFUGAL PUMPS, Fans and Ventilators for all purposes, Fire Engines, Stationary and Marine Diesel Engines, Airless Injection Diesel Engines, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

本公司常備目錄供給各界 垂詢工程事務亦竭誠酬答

WINTERTHUR. SWITZERLAND.

BUHLER BROTHERS
Engineering Works and Foundries
UZWIL (SWITZERLAND)

Established 1860 Employees abt. 2,000



Our Works at Uzwil, Switzerland

SPECIALITIES:

Portland Cement Works
Brick and Tile Making Plants
Chocolate and Cocoa-Factories
Breweries and Malteries
Powder and Celluloid-Presses
Crushing and Breaking Machinery
Silico-Calcareous Brick Works
Paste-Goods Factories
Briquetting Plants
Rice-Mills
Roller Mills for Soap and Paint Manufacture
"Duplex" Newspaper Printing Presses
Conveying Plants of every kind

Saw-Mill and Woodworking Machinery

For particulars apply to the
Far Eastern Office: BUHLER BROTHERS
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

MAR 23 1925

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

上海仁記路第五號

遠東時報

THE VOICE OF NEW JAPAN

DR. SCHURMAN'S SPEECH ON EXTRATERRITORIALITY

SAUCE FOR THE GANDER

THOSE UNEQUAL TREATIES

JAPAN'S PLAN FOR THE RECONSTRUCTION OF CHINA

RUSSO-JAPANESE TREATY

BARON OKURA

THE PIONEER OF SINO-JAPANESE CO-OPERATION

PENCHIHU

SALT INDUSTRY IN KOREA

A MODERN GLASS FACTORY IN CHINA

JAPANESE CEMENT PLANT

PENANG MUNICIPAL POWER STATION

BRITISH ENGINEERING TRADE IN INDIA

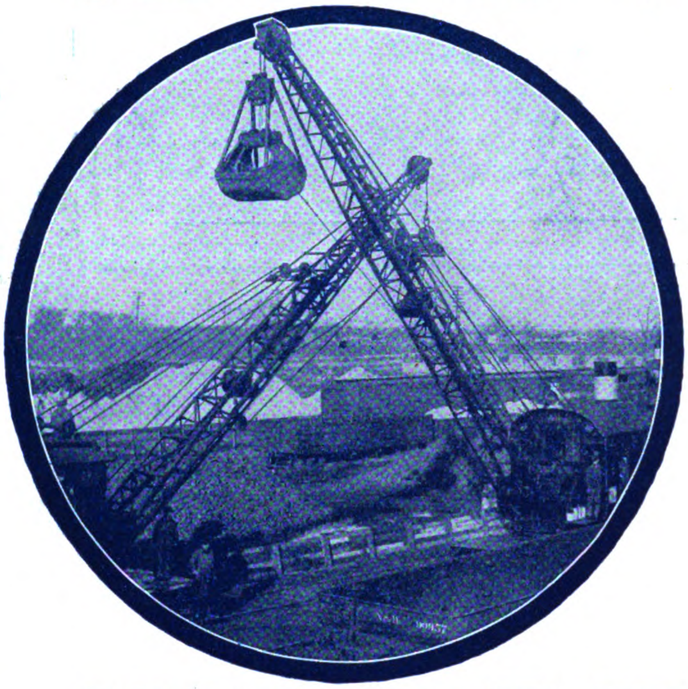
HIGH POWER RADIO STATION IN JAVA

Vol. XXI February, 1925 No. 2

SHANGHAI, PEKING, TOKYO AND MANILA

A. L. TAYLER

BROWNING



Combine Long Life and Economy

Even after from 15 to 23 years of hard service, scores of Brownings are still on the job doing a full day's work—and doing it efficiently and economically.

Browning Locomotive Cranes on all kinds of material handling work effect the maximum in operating economies and do so over the longest period of time.

Let a Browning engineer show you how a Browning will speed your work at a profit.

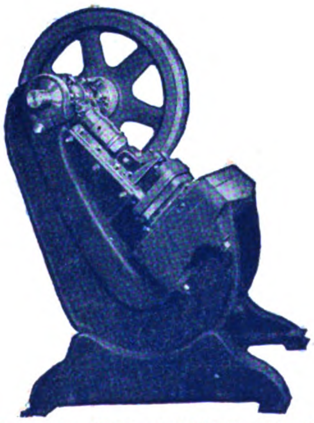
The Browning Company

16226 Waterloo Road
CLEVELAND, OHIO, U.S.A.
Cable Address: "Browning"

LOCOMOTIVE CRANES AND BUCKETS

ONE OF THE MANY TYPES OF TIN CONTAINERS

MADE ON BLISS MACHINERY.



Bliss No. 21 Special Oil Can Head Press.
For blanking and forming tops and bottoms of rectangular oil cans.

For the manufacture of rectangular olive oil or cottonseed oil cans such as illustrated above, we build complete lines of machines.

The machine shown is one of a number required for making approximately 2,500 cans per day of the type illustrated.

Building machinery of this kind has been our specialty for over 68 years. Our machines embody the most modern and best devices developed by experience in actual use.

In order to quote intelligently on the equipment best adapted to your work be sure to send us samples or sketches showing dimensions and state the approximate daily production you wish to obtain.

BLISS FOR MACHINERY

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N. Y., U. S. A.**

American Factories: BROOKLYN, N.Y. HASTINGS, MICH. CLEVELAND, OHIO. SALEM, OHIO.

FOREIGN SALES OFFICES AND FACTORIES:

ENGLAND, Pocock St., Blackfriars Rd., S. E., London ITALY, 345 Via Nizza, Turin FRANCE, 54 Blvd. Victor-Hugo St. Ouen, Paris

FOREIGN REPRESENTATIVES:

India—Duff Engineering Co., Ltd., D. S. Clive Building, Calcutta

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum

VOL. XXI FEBRUARY, 1925 NO. 2

CONTENTS:

	PAGE
THE VOICE OF NEW JAPAN	49
"SAUCE FOR THE GANDER"	50
THOSE UNEQUAL TREATIES	52
JAPAN'S PLAN FOR THE RECONSTRUCTION OF CHINA	53
DR. SCHURMAN'S SPEECH ON EXTRATERRITORIALITY	54
THE RUSSO-JAPANESE AGREEMENT	56
A PIONEER OF SINO-JAPANESE CO-OPERATION	*59
PENCHIHU	*60
POWER DEVELOPMENT OF THE KEIHIN ELECTRIC POWER COMPANY	*65
THE PENANG MUNICIPAL POWER STATION	*69
MALAYA'S HYDRO-ELECTRIC SCHEME	72
HIGH POWER RADIO STATION IN JAVA	*73
ADVANCE IN FLOUR MILLING IN CHINA	*74
A MODERN GLASS FACTORY IN CHINA	*76
THE CHEMICAL TRADE OF THE FAR EAST	78
BRITISH PUMPING ENGINES FOR PEKING SYNDICATE MINES	*80
THE SALT INDUSTRY OF KOREA	*81
A MODERN JAPANESE CEMENT PLANT	*82
PAPER MAKING IN CHINA	*90
THE SUGAR INDUSTRY OF QUEENSLAND	*93
DISTRIBUTION OF PETROLEUM IN BURMA	*95
BRITISH ENGINEERING TRADE IN INDIA	*97

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allen & Co., Ltd., Edgar 11
American La France Fire Engine Co., Inc. 35
American Locomotive Sales Corp. 25
American Tool Works Co. 1
Associated British Locomotive Manufacturers for China 49
Attwater & Sons 48
Avery, Ltd., W. & T. 11

Babcock & Wilcox, Ltd. 36
Baldwin Locomotive Works 65
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 5
Bethlehem Steel Export Corp. 31
Bliss Co., E. W. .... Cover
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Browning Co., The .... Cover
Bucyrus Company 7
Buhler Brothers ....(Text) 98
Butterfield & Swire 44

Canada Carbide Co., Ltd. 70
Cargo Fleet Iron Co., Ltd. 4
Chambers Scott & Co., Ltd. 14
Chartered Bank of India, Australia & China 48
Columbia Ribbon & Carbon Mfg. Co. 70

Daido Electric Power Co., Ltd. 28
Dai-Ichi Ginko 62
Dai Nippon Brewery Co. 34
Diamond State Fibre Co. 71
Dixon Crucible Co., Joseph 70
Dodge Brothers 3

Drewry Car Co., Ltd. 15

Electricity Department, S. M. C. 4
Escher Wyss & Cie 16
Evans & Sons (Wolverhampton), Ld., Joseph 2

Fairbanks Co. 35
Fairbanks Morse & Co. 17
Fuji Gassed Spinning Co. 10

Gas & Fuel Plants, Ltd. 14
General Fireproofing Co. 41
Gleniffer Motors, Ltd. 15
Goodbrand & Co., Ltd. 6
Goodell-Pratt Co. 63
Green Island Cement Co., Ltd., The .. 20
Greene, Tweed & Co. 71
Greenfield Tap & Die Corp. 21

Heinemann, A. G., Gebr. 19
Hongkong Rope Manufacturing Co. . 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co., Ld. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. 58
International Banking Corporation .. 55
International General Electric Co., Inc. 51

Japan Sugar Co., Ltd. 6
Jardine Engineering Corporation, Ltd., The 12
Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. 10
Kawasaki Dockyard Co., Ltd. 33
Kelvin Bottomley & Baird, Ltd. 27
Kitchen & Wade 62
Kokusai Kisen Kaisha 45

Link-Belt Co. 63
London Directory Co., Ltd. 61
Louisiana Planter & Sugar Manufacturer, The 62

Manning, Maxwell & Moore, Inc. 14
Mather and Platt, Ltd. 2
McConway and Torley Co. 72
Mills & Manning, Inc. 52
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd. 38
Mitsubishi Marine & Fire Ins. Co., Ld. 38
Mitsubishi Shoji Kaisha 18
Mitsubishi Warehouse Co. 38
Mitsubishi Zosen Kaisha, Ltd. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. 18
Mitsui Bussan Kaisha 26
Motor Rail & Tram Car Co. 5
Mustard & Co. 72

Nippon Menkwa Kabushiki Kaisha .. 50
Nippon Yusen Kaisha 46, 47
Nipponophone Co., Ltd. 34
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. 24
One Hundredth Bank, Ltd., The 59
Osaka Shosen Kaisha 42

Redpath Brown & Co., Ltd. 15

Reyrolle & Co., Ltd., A. 27
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 5

Sale & Frazar, Ltd. 8
Shanghai Dock & Eng. Co., Ltd. 32
Shanghai Municipal Council 4
Siemens China Co. 36
Simons & Co., Ltd. Wm 13
Smidth & Co., F. L. .... Under Index
Smith Major & Stevens, Ltd. 16
Smooth On Mfg. Co. 71
South Manchuria Railway Co. 64, 68, 69
Standard Oil Co. of N. Y. 29
Standard Underground Cable Co... 14
Sturtevant Co., B. F. 63
Sulzer Bros. ....(Text) 98
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd. 60
Superheater Co., The 27

Thornycroft & Co., Ltd., John I. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 7

United States Steel Products Company ....23, 37, Back Cover

Walworth International Co. 72
Westinghouse Electric International Co. 74
Williams & Co., J. H. 7

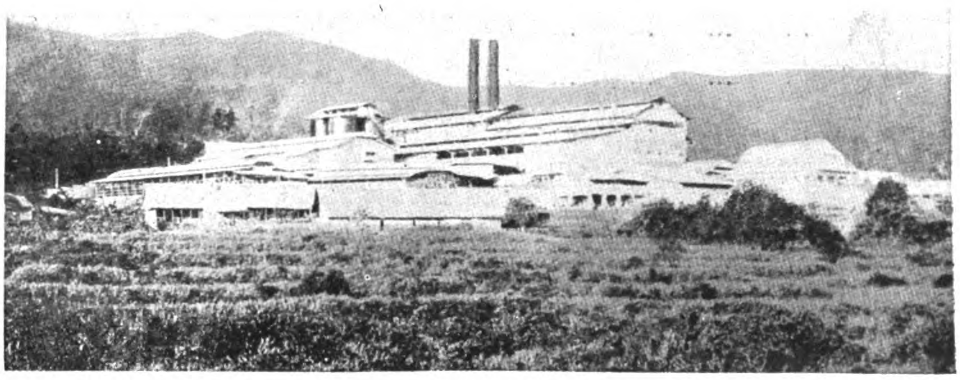
Yarnall-Waring Co. 17
Yarrow & Co., Ltd. 21
Yokohama Dock Co. Ltd. 34
Yokohama Specie Bank, Ltd. ....Cover

F. L. SMIDTH & Co.

PEKING—CHINA

Telegraphic Address: **"FOLASMIDTH," PEKING**

LONDON
SYDNEY
PARIS
RIO de JANEIRO
TURIN



NEW YORK
COPENHAGEN
33 VESTERGADE
BIELSKO
JAPAN

The Nederlandsch-Indische Portland Cement Works at Indaroeng, West Coast of Sumatra, equipped with F. L. Smidth & Company's Cement Machinery

MACHINERY FOR CEMENT WORKS

LIME WORKS, BRICK WORKS, NODULISING PLANTS FOR IRON ORE AND VARIOUS MINING INDUSTRIES

More than 300 Rotary kilns, with a total yearly output of 60,000,000 Barrels, have been supplied and 5,000 grinding plants equipped with our Machinery

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, FEBRUARY, 1925 No. 2

The Voice of New Japan

A Message Pregnant With Meaning

Baron Shidehara Proclaims a New Doctrine of Asiatic Independence

With Patience and Sympathy, Forbearance and Hope, Japan Stands by the Chinese People in their Struggles for Self-Government and Guarantees that their Administrative Independence will be Respected

TRUE friendship between nations is the outgrowth of an intelligent and sympathetic understanding of each other's problems, maintained and strengthened by broad-minded statesmanship and open diplomacy. The continuity of such relations is assured by reciprocal trade and economic co-operation. This truism has been accepted by the rulers of Japan as the corner-stone of their relations with China. The future of these two peoples is bound up in each other. If China breaks under the strain of her present troubles it is only a question of time when Japan's political independence will be placed in jeopardy. Looking far ahead into the future with that same prescience which a century ago influenced an American president to proclaim a fundamental policy for the perpetuation of American independence and democratic ideals of government in the western hemisphere, the statesmen of Japan have laid down a program which will assure to the people of Nippon their right to exist in that quarter of the globe to which they are confined by the operation of the exclusion laws of other lands.

Like the Monroe doctrine, this basic policy of Japan carries no menace to the peace or security of her Asiatic neighbors or to the commercial rights of other nations. It is direct, honest, sincere and commendable. No power or combination of powers can stop the gradual evolution of a doctrine based on friendship. No power or combination of powers can impede the eventual coming together of China and Japan in bonds of enduring understanding as the Chinese people become convinced of Japan's sincerity. The fundamental policy of Japan received its initial impulse from her business men, her financiers and industrialists who rebelled against the program of the militarists and impressed upon their rulers the necessity of a radical and immediate change in Japan's attitude towards China. In five years, the new program has worked marvels. China and Japan have compounded many of their troublesome differences and are now well along the road to a full understanding. For the first time in twenty years it may be said that public opinion in China is not unfriendly to Japan. A new era is opening for both nations, one that will bring security, increased prosperity and enduring peace to Eastern Asia.

Distracted by the chaos and civil wars in this country, Chinese and foreigners alike have ignored the rapid *rapprochement* between China and Japan. The full expression of this new trend in Far Eastern politics can be read between the lines of the speech of Japan's foreign minister at the opening of the present session of the diet. It is pregnant with meaning. In it will be found a declaration of faith, hope and sympathy with the Chinese people in their present troubles and a guarantee that there shall be no further impairment of their sovereign rights by the establishment of international control over any of their administrative organs. This announcement of Japan's new policy towards China is identical in spirit and tone and is based upon the same lofty principles which impelled President Wilson to withdraw official support to the American group in 1913. Coupled with a firm determination to defend at all costs her hard won economic position in Manchuria and Mongolia, is seen a resolute intention to stand with China against any combination or influences inimical to the position she rightfully enjoys and is entitled to amongst the nations.

Baron Shidehara's presentation of Japan's new outlook on world affairs and his declaration of her aims and aspirations will stand as one of the most important political utterances of the year, a message to other nations whose full weight will be understood at once by those in charge of their foreign relations.

" Admittedly," he says, " the nations of the world have not, so far, fully recovered from the paroxysm of the late war. Their financial and economic conditions still remain abnormal. Nor has complete stability yet been restored in international relations. The realization of the highest ideals of humanity would seem still far off. It, however, admits of no doubt that the age of international antagonism is passing, and that in its place an era of international co-operation is dawning. This new order of thought is styled, in some quarters, as Internationalism, and denounced on the grounds that it is incompatible with nationalism and repugnant to national interests. If nationalism, so-called, implied the selfishness of a nation—if it assumed that all other nations should minister to the convenience of that particular nation—it is obvious that such a doctrine is irreconcilable with the present drift of world affairs. If by ' national interests ' were meant those of an immediate and transient nature or any special advantages enjoyed by a small section of the nation, it is equally obvious that they can find little support in the awakening consciousness of mankind. But the earth is not made to suit the will of a single power. No nation, however, powerful in strength, however rich in resources, can have its own way in the council of nations. History shows that all attempts made by any power, in reliance upon its strength and resources, to force its will upon the rest of the world are doomed to grievous failure. The true and lasting interests of a nation can be secured only when they are in keeping with the rightful positions of other nations on a fair and equitable basis. UPON THIS FAITH WE STAND AND PROPOSE TO REGULATE OUR RELATIONS WITH ALL FOREIGN COUNTRIES.

" As to our policy towards China, I ventured to lay before you its general outlines in the last session of the diet. I made it clear that we were resolved to respect the position which China justly enjoys, and at the same time to safeguard the position which is rightfully assured to us. I also declared that we had no intention whatever of interfering in any domestic affairs of China.

" In September of last year hostilities unfortunately broke out between Kiangsu and Chekiang, leading to a still more serious warfare between Mukden and Chihli. For a time, grave disturbances prevailed in China. In the presence of this situation, we have consistently conformed ourselves to the policy already enunciated.

" In the first place, we have constantly kept in view the safeguarding of our rightful position, and, in particular, of our rights

and interests in Manchuria and Mongolia. In order to provide against any possibility of these rights and interests being ignored and unprotected as a result of the recent fighting around Shanhaikwan, we addressed an identic communication to the two warring parties on the thirteenth of last October, frankly calling their attention to our position in regard to the situation.

"It need hardly say that our concern is not confined to the condition of affairs in Manchuria and Mongolia alone. We are interested in the whole of China to an extent and in a degree absolutely essential to our national existence. But more particularly keen are our national sentiments over Manchuria and Mongolia, because of historic reasons in addition to those general considerations. I refer to the fact that Japan, in self-defence and in the interest of peace in the Far East, staked the country's fortunes on two great wars in the Manchurian plains. By such supreme efforts, we are now enabled actively to engage in peaceful undertakings in that region. I desire to repeat here once more what has been so often declared by the Japanese government, that we have no aggressive or territorial designs of any kind in in that or any other part of China.

"Secondly, we have followed with the strictest exactitude the principle of non-interference in China's internal politics. We have absolutely refrained from supplying any party in China with arms, munitions or loans that might be utilized for the purpose of continuing hostilities. Knowing that the Chinese people were sick of war, we believed that the refusal of assistance to any particular party in China was, in effect, assistance rendered to the whole nation of China. Another point to which we attached particular importance was our belief in international good faith. The Japanese government already subscribed some years ago to the resolution of the powers prohibiting supply of arms and ammunition to China. We further declared on more than one occasion our policy of non-interference in the domestic troubles of that country. We have now translated these commitments faithfully into fact.

"What has been the result of this attitude? I am happy to believe that the sense of justice and fairness with which we have met the situation is now widely appreciated not only by the Chinese people, but by all the powers of the world, with a consequent marked improvement in our relations with China and increased mutual confidence between us and the other powers.

"With the assumption of the office of provisional executive by Marshal Tuan Chi-jui, we have, on consultation with the powers, recognized his government as the 'de facto' government of China. We are not directly interested in the question, who will assume the reins of government in China, or what constitutional system may be adopted in that country. With a long historical background and amidst the surroundings peculiar to the country, the Chinese people must be left free to order their own national life in their own way. All that we consider important is that China should be provided with a sufficiently strong government to fulfil her international obligations in good faith and to maintain peace and order within her borders.

"Believing that the provisional government of China are seriously striving to attain these objects, we pray with deep sympathy for their success, and we are further prepared to render to China, in common with the other powers, such friendly assistance as may lie in our power. It should, however, be clearly understood that such sympathy and assistance are extended, not so much to any particular person or any particular party in China, as to the whole nation of China whose greater good we have always at heart.

"It is undoubtedly a tremendous undertaking to establish peace and unity in China. Although that work has not so far made such progress as might be desired, it must not be concluded that the Chinese people are not fully endowed with the gift of character needed for self-government. Such inference seems to us entirely unwarranted. In no case can we accept any plan based on these mistaken premises to place Chinese railways and other administrative organs under international control. We are satisfied that no such project is under contemplation by any foreign government.

"The reports that China may possibly become a communist state, or that she contemplates repudiation of all international commitments which she may deem prejudicial to herself, do not seem to us to be worthy of credence. We shall watch, with hope and tolerance, the efforts of the Chinese people to carry out political reforms so much needed for the country. While fully asserting our legitimate rights and interests in China, we shall give due and sympathetic consideration to the special conditions under which she is laboring, and we shall direct our best attention to the promotion of mutual understanding and co-operation—spiritual, cultural and economic—between the two nations."

There is no mistaking the import of the message conveyed in the above words. It tells the world that the Japan of ten years ago, the Japan of the militarists, the Japan of the twenty-one demands, discarded the mask as soon as its wearing was no longer compulsory. The downfall of imperial Russia terminated for Japan a twenty year nightmare in which at all times she was forced to maintain herself at a high pitch of military efficiency and to be prepared at any moment for the war of revenge that Count Witte frankly confesses was scheduled for 1912. Relieved of this menace and assured of peace in the Pacific by the terms of the four-power treaty, the real Japan reveals herself to the world.

Clear and to the point rings the message that new Japan sends to her fellow-Asiatics across the Yellow Sea. Japan challenges the imputation of inferiority conveyed in the oft-repeated statement that the Chinese people are not equal to the task of self-government and declares her intention to stand by them while they are passing through their hour of trial. With hope and tolerance, with deep sympathy and forbearance, Japan is watching their efforts to establish peace, unity and a stable government. And while they are ordering their national life in their own way, Japan gives them the assurance that no plan that may impair their administrative independence will be accepted or tolerated.

Baron Shidehara's address to the diet is a new declaration of Asiatic independence, one that will take its place in history by the side of the Hay doctrine, a further guarantee made necessary by present conditions, that China's territorial integrity and sovereignty will be respected, no matter what happens. New Japan has spoken.

G. B. R.

"Sauce for the Gander"

International Control of China's Railways

BARON Shidehara's perfect command of English enables him to express in the most restrained and correct diplomatic language, Japan's determination to oppose any plan having for its object international control over the Chinese railway system. Coming at this juncture when *The Times* and other organs of British opinion are strongly urging the application of this remedy to save the railways from complete ruin and guarantee to foreign bondholders the payment of defaulted interest and principal on outstanding loans, the pronouncement of Japan's foreign minister indicates how far the two nations have drifted away from each other on Asiatic policies since the alliance was dropped.

One of the main reasons urged by British sympathizers with China for dissolving the partnership with Japan was the allegation that under cover of its provisions Japan was protected in pushing forward aggressive designs upon China's sovereignty. In fact, the Chinese were encouraged by this reasoning to go still further and assert that *all* of their political woes and misfortunes were traceable to the terms of the alliance. It is well to recall this hysterical outburst when, three years after the disappearance of this

" root cause " of China's evils, Japan's foreign minister declares that no further impairment of China's administrative independence will be tolerated, with pointed reference to the plan for internationalization of her railways. This should provide food for serious thought to those important British interests which now find it necessary to devise some plan to save their investments in China from utter ruin.

The mistakes of the Anglo-American group in China have provided Japan with the opportunity to reinstate herself in the good-will of the Chinese and to stand as their champion, opposing any attempt to force through a program which extends foreign supervision over their principal revenue bureaus by bringing their railways under international control, which by reason of her investments, would hand their administration over to British experts. The mere fact that such a plan is even deemed worthy of discussion would indicate that the full significance of the new trend of Asiatic affairs has not yet been grasped. At a time when China is bent upon regaining her administrative independence through cancellation of unequal treaties, abolition of extraterritoriality and treaty port concessions and other infringements of sovereignty, in which she is openly supported by Russia, it is hopeless to expect that she will view with favor another plan which fastens foreign control for an indefinite period over her most important revenue-producing department.

Western exclusion laws have thrown Japan back upon Asia, giving birth to a fixed national program based on the most intimate relations with China. Co-operating loyally with the other powers in carrying out the provisions of the Washington treaties, Japan places her own vital interests above those of her partners and announces that henceforth she will assent to no plan, program or policy which jeopardizes her legitimate aspirations in China. In this stand she is fortified by her recognition of Russia and although for the present the treaty may convey no menace to other interests in Eastern Asia, it must be accepted as an effective check to an attempt on the part of any other combination to impose their policies upon China. The Anglo-American group four years ago counted Japan out of the race. She has come back in an unassailable position.

This is the answer of Japan to the long-drawn-out propaganda directed against her interests in China, a propaganda which did its utmost to discredit her in the eyes of the world, brought upon her trade a disastrous boycott, invalidated her loans to the Peking government, deprived her of a vital strategical railway right in Inner Mongolia and forced her to surrender Tsingtao together with the Shantung railway and mines. This campaign even went so far as to challenge her position in Manchuria, encouraging the Chinese to denounce the 1915 treaties which assures to Japan for 99 years her lease-hold of the Liaotung peninsula, the key to her economic and strategic security. Had this campaign succeeded in its entirety, Japan's huge investments in China would have been completely wiped out.

The advocates of exclusive Anglo-American co-operation in China have lost sight of the fundamental truth that a preferred position in a foreign country is invariably created through a preponderance of capital investments in the industries of that country. Including the South Manchuria railway, its subsidiaries and other industrial plants in China, the present investment values of these Japanese properties approximates Yen 5,000,000,000, a sum fifteen times greater than the cost of all Chinese railways built through foreign loans.

The bulk of the funds advanced for the construction of China's railways is nominally British but analysis of the loan flotations will reveal that including their equity of £13,520,000 in the Chinese Eastern railways, the French have invested a total of £28,595,000 in the railways of China. The British equity, including a £12,000,000 loan to the South Manchuria railway, stood at £26,620,000 in 1919, but the following year the responsibility for repaying the South Manchuria loan was taken over by the Japanese government, reducing the British equity in Chinese railways to £14,620,000. If the proportion of nominal British bonds subscribed in the Paris market at the time of the issuance of the loans be deduced from this, the British equity would be decreased probably 40 per cent. and the French equity increased proportionately. These figures are important in any discussion leading up to the imposition of foreign control over Chinese railways at this time. When spheres of interest and political preferment are eliminated from such discussions the wishes of the nation having the preponderating capital investment in the country must be given due and sympathetic consideration by other creditors.

On the part of the Japanese there is no hostility to any straightforward business plan that will protect foreign investments in Chinese railways, but there is a well-grounded fear that in return for China's consent to the reorganization of her railways under foreign management the Anglo-American group will encourage and assist the Chinese to regain control over the South Manchuria railway. They do not forget that British and American influence exerted a tremendous pressure to compel them to surrender their rights to the Taonan-Jehol railway and control over the Shantung line and with the new Soviet deal which restores to China joint administrative control over the Chinese Eastern railway, there remains only the Yunnan and South Manchuria lines under exclusive foreign ownership. The Japanese also vividly recall the official report of an American trade commissioner on China's railways in which they were accused of attempting to monopolize all her transportation lines and how Senator Brandagee demanded from the state department that the report be submitted to the senate during the fight in 1919 over the Paris peace treaty, in order to further inflame American public opinon against Japan.

Much water has flowed under the bridges since the signing of the consortium agreement and the Washington treaties. In the interests of peace and good-will, Japan sacrificed every advantage she had gained in China as the result of twenty years of watchful diplomacy and gladly accepted the doctrines which eliminated spheres of interest and guaranteed China's complete administrative independence. In doing so, she suffered heavy financial losses, but she has not whimpered or demanded the repayment of these loans at a time when the funds would tide over a great financial stringency.

Accepting that the British equity in China's railways is now in the neighborhood of £17,000,000 by including defaulted paymentt of interest and principal for the past five or six years, and thas in order to protect this investment, foreign supervision is now deemed essential; would those who advocate this plan be willing to extend the same concession to Japan and see her take over the supervision of some Chinese revenue bureau as a guarantee for the repayment of her loans ? Would they accept in the same spirit the imposition of Japanese direction over the Kiukiang-Nanchang railway, in default for many years on its obligations to Japanese investors ?

Let us remember that the Japanese took over the Shantung railway from Germany and in six years spent nearly as much as its original cost in improving it. Let us recall that Japan spent many millions in extending the port and city of Tsingtao, converting the fashionable watering place and naval station into an important manufacturing centre, creating work for the people and prosperity for the hinterland. Let us also not forget that Japan was willing to have the old German leasehold of Kiaochow and the port of Tsingtao converted into an international settlement, that she stood ready to internationalize the Shantung railway and mines by handing over their administration to the consortium. Let us remember that Anglo-American official and public opinion would accept no compromise short of full restoration of China's sovereignty over these properties and that Japan smilingly accepted the verdict which destroyed her investments, and got out. Let us recall the pleasing picture of a prosperous Tsingtao and Shantung when the port, railway and mines were administered by Japan and then look at their present condition . . . . and weep. The advocates of international control of China's railways three years ago rejected Japan's plan to safeguard her investments in Shantung. Would they be willing at this time to restore Japanese administrative control over the Shantung railway in exchange for Japan's consent to the internationalization of China's other railways ? Japan's surrender of her position and rights in Shantung are incorporated into a solemn treaty, which cannot be broken. When they find their own interests menaced with complete ruin, have the advocates of the present plan the courage to now propose that the Shantung railway be included in the lines to be brought under international control ?

Japan has sunk nearly Yen 50,000,000 in loans to the Han Yeh Ping Coal and Iron Company and there is little likelihood that the Chinese with their present system of management will ever repay the obligation. Instead of insisting upon taking over control of this premier Chinese industrial enterprise as a guarantee for the repayment of these loans, Japan is now sinking a further

Yen 9,000,000 in order to keep the steel works and mines alive. If conditions on the loan built railways of China are now so deplorable that foreign administration is imperative in order to save them from utter ruin, would those who favor this plan concede Japan's right to control China's iron and steel industry ? In exchange for Japan's acquiescence in the international administration of China's railways would the advocates of this plan be willing to reciprocate and agree to Japanese direction over the Han Yah Ping coal, iron and steel enterprises and to purchase from this Sino-Japanese company the materials required for the reconstruction and equipment of China's railways during the period of foreign control ? This would seem to be a very equitable arrangement if the proposition be considered from a strict business viewpoint. Japan now owns outright about 40 per cent. of all the spindlage of China's cotton mills. In addition she has made many loans to Chinese-owned mills in order to save them from going under. Would the advocates of international railway control view with sympathy the foreclosure by Japanese capitalists on the mortgages covering these Chinese cotton mills and other important industries and mines ?

In any plan for bringing China's railways under foreign administrative control, what is the inducement held out to American interests to assent to such an arrangement ? Would the United States government sacrifice its traditional policy in China in return for a few subordinate jobs in the direction of China's railways ? Outside of the quarter participation in the Hukwang loan amounting to $7,500,000, and a few extra millions owing to American firms for materials supplied to Chinese railways, what motive could be urged in order to obtain America's consent to a plan which places their administration under experts from another country?

What will such an arrangement benefit Japan? What guarantee can the interested parties give to Japan that once an international commission is directing the state railways of China that a campaign will not be initiated for bringing the South Manchuria line under its control ? It goes without saying that once China's railways are brought under the administration of an international commission dominated by Anglo-Americans that its thirst for power would grow as it became more strongly entrenched in authority. It does not require any undue political prescience to look ahead to the day when in order to consolidate its control over all railways in China such a commission would inspire an agitation to deprive Japan of the exclusive direction over the South Manchuria line by challenging the validity of the 1915 treaties. It worked in Shantung. The day may also arrive when Japan may be caught in a position where it would work in Manchuria.

The most successful and most efficiently operated railway in Eastern Asia is under Japanese direction. Its organization includes experts in every branch of railway operation. It employs a body of high-class technical experts for the creation and development of mining and industrial enterprises. They have accomplished wonders in Manchuria and if permitted could duplicate their work in other parts of China. If the proposed plan arises from an honest desire to protect the foreign bondholders, expedite the extension of her transportation system and develop her industries, what objection could there be to the South Manchuria railway authorities, acting as the trustee for these interests ? Remembering that the Japanese hold a mortgage on the Shantung and the Kiangsi railways in China proper and on the Kirin-Changchun and Ssupingkai-Taonan lines in Manchuria, that their banks have advanced large sums to the ministry of communications, would the advocates of the plan be willing to accept Japanese leadership in carrying it out ?

Anglo-American opposition to Japan's activities in China forced the creation of the new consortium, it brought about the Washington conference and the treaty that guarantees to China her administrative independence. Japan paid the price. She accepted the new line-up in world affairs and has lived loyally up to her committments. Conditions have since changed. Anglo-American business interests and investments in China are now being destroyed in the same manner that Japan's investments were formerly imperilled. America and Great Britain fixed the rules of the game at Washington. They posed as the saviors of China receiving due praise and gratitude from the Chinese people for establishing their status amongst the nations. Baron Shidehara diplomatically declares that the pledges made at Washington must be fulfilled. Japan assumes the rôle of China's champion and says in so many words, " What is sauce for the goose is sauce for the gander."

Those Unequal Treaties

Japan Rejects the Idea that China will Repudiate Her Treaties: A Guarantee that Her New Understanding with Russia Does not Clash with Her Washington Committments

DIPLOMATIC speechmaking as a means of giving publicity to a nation's foreign policy is rapidly superceding more formal announcements through regularly constituted official channels. The clear, concise and commendable outline of Japan's program in China announced in Baron Shidehara's speech before the diet followed Minister Schurman's equally forceful presentation of American government's attitude on the abolition of extra-territoriality, acknowledging the right of China to cancel the so-called unequal treaties just as soon as China has established a unified government capable of discharging its obligations.

The message of Minister Schurman provides the opportunity for Mr. Karakhan, the Soviet ambassador to Peking, to take up the discussion where Baron Shidehara and Dr. Schurman left off. In a speech delivered before the Peking National University on January 21, he takes direct issue with the American program of evolution and asks :

" But what does this term really imply ? To repudiate unequal treaties by an evolutionary method means to put one's self at the mercy of those who forced such treaties upon China, it spells waiting, asking, entreating and after all, leaving the cancellation of the treaties, in the hands of those who do not wish to cancel them " . . . America's promise to cancel unequal treaties after the establishment of a strong Chinese government is nothing else than a polite way of refusing to give them up. You may write this down in exactly this sense."

Like all Soviet leaders, Mr. Karakhan has the word " revolution " on the brain spoiling an otherwise enlightening contribution to Far Eastern politics by declaring that the annulment of the unequal treaties can come only through this method.

What would be the consequences to China if the so-called unequal treaties are cancelled without previous arrangement with the other powers ? What nation would dispatch its armed forces to China to uphold and maintain their treaty rights ? Would it be possible to stir up American opinion and congress to the point where they would agree to send an expeditionary force to China for the purpose of defending our extraterritorial rights ? Will Japan modify her new policy towards China by joining in such a movement ? Would Great Britain standing alone, or with France, enter into an adventure of such magnitude without the co-operation of America and Japan ? On the other hand we see Russia standing behind China urging her to take the leap, citing the ease with which Afghanistan established her independence and the victory of Turkey over European imperialism.

" Their example will," he hopes, " lead to the national emancipation of the Chinese people, which knows that far from being the product only of the last years, our policy was formulated in an absolutely precise manner as early as 1919. We feel certain," he adds, " that our policy is uniting with ever stronger bonds the people of the U.S.S.R. and China, mutually strengthening our international position. And I think that not the least role in the struggle which you will carry on with stubbornness and self-devotion until you

achieve ultimate victory, will be played in the presence at the frontier of many thousand miles of a reliable and revolutionary brother, a people following your struggle with millions of admiring eyes."

This is a very straightforward admission of Soviet aims in China, leaving no room for doubt as to what is actually transpiring at Peking.

In the past five years China, unconsciuously perhaps, has traveled more than half way along the Soviet road of repudiation of debts and cancellation of treaties. It is true that China has not formally repudiated her debts, but she is not paying them or manifesting any inclination to do so. There seems to be little difference in practice between chronic default and actual repudiation, only in the former there is always a hope that the debt will some day be paid. In like manner, China has not openly denounced any of her treaties, but she has unblushingly ignored their existence and violated them as it suited her whim. Here, also, there seems to be little difference in principle between actual cancellation and deliberate evasion. For all practical purposes China has followed in the foot-steps of Russia and the only inconvenience she has suffered has been the slight extra work entailed upon the Waichiaopu secretaries in filing away in some obscure pigeon hole the voluminous protests of the diplomatic corps at Peking. Is it any wonder that foreigners in China are now forced to sit on the side lines and witness the Soviet prodding the Chinese to make effective what they have been carrying out in practice for the past five years ?

The picture is disquieting. If China takes the plunge, who is responsible ? Does not the responsibility go squarely up to those who initiated, encouraged, organized and directed the anti-Japanese campaign of 1919, 20 and 21 ? Japan was the only check against the spread of Bolshevism in Eastern Asia ; the Anglo-Japanese alliance the one guarantee that Russia would be kept in her place. The pressure of world opinion compelled Japan to withdraw her army from Siberia, surrender vital strategic concessions designed to protect China and herself against the " menace from the direction of Urga," cancel a military alliance with China entered into for the express purpose of checking the advance of the red armies and brought about the abandonment of her alliance with Great Britain. As step by step Japan surrendered her positions, the Soviet advanced until they regained full possession of all rights enjoyed by imperial Russia in 1914. Japan had carefully built up a wall that would have enabled her to effectively keep the Soviet out of China. Anglo-American diplomacy interested primarily in safeguarding China's interests, demolished the wall and left her defenseless. Japan's attempt to stem the tide of Bolshevism in Eastern Asia cost over a billion yen or more than half the profits accrueing to the nation as a result of the great war. An industrial and commercial depression that nicked another big slice out of these war profits was followed by a calamity that in two days destroyed property to the value of Yen 15,000,000,000. Stripped of her power of defense and lacking the funds to maintain her strategic position, Japan found herself unable to further carry the load of checking the advance of Russia in Asia. Faced with this complete breakdown of her program, Japan accepted the inevitable, made the best of a bad bargain and re-established relations with Russia.

Does this mean, as some British and American editors seem to fear, an understanding for mutual co-operation in China against other foreign interests, the formation of a Russo-Chinese-Japanese or Pan-Asiatic bloc ? Mr. Karakhan openly urges the Chinese to denounce the unequal treaties at once, but Baron Shidehara in his speech to the diet declares that the prospect of China becoming a communist state or of repudiating her international committments is not worthy of credence. This official utterance following immediately on the heels of the new Russo-Japanese treaty leaves no room for doubt where Japan stands on this question, an assurance to other foreign interests in China that she will seek no special advantage by co-operating with the Soviet in its plan to destroy their rights. This assurance is amplified and strengthened by a statement given out by Baron Hayashi in London. He says :

"The alleged activities of Soviet agencies attempting to establish a Soviet government in China will fail completely. The Soviet theory of government is absolutely incompatible with all Chinese philosophy and social traditions.

"The Chinese are not a revolutionary people, and yet their most fundamental traditions would have to be overturned before they could accept Soviet and communistic theories of government. So there is no real danger of China being Sovietized.

"There is danger, however, of 'young China'—the student class—becoming inflamed by Soviet propaganda and attempting to destroy the present system, foreign treaties and extraterritorial rights."

These two statements clarifies the atmosphere in regard to Japan's relations with Russia. They align Japan on the side of the other powers favoring the restoration of China's full sovereignty through evolution. The statements also imply that Japan now holds the deciding vote in any program for stabilizing China. Should she, as some people fear, decide to throw in her lot with Russia, the program of the other powers must fail. The success of Anglo-American diplomacy in China would therefore depend on the full and loyal co-operation of Japan, handing over to her the leadership in the solution of China's problems. That Japan is preparing to qualify for this leadership may be sensed from the full statement given out by Baron Hayashi.

Japan's Plan for the Reconstruction of China

Baron Hayashi Says, at the Proper Moment Japan will Take the Lead in Calling a Conference to Devise Plans for Reforming China's Finances, Tariff and Railways in which Her Sovereignty will be Fully Safeguarded

IF Japan rejects the British plan for international control over China's railways as the only way to save them from utter ruin and we eliminate the so-called " Dawes plan " originated by Americans what have we left ? How will Japan maintain her leadership in China without a definite program that will appeal to the other powers and at the same time give effect to her new policies towards China ? For a fuller exposition of Japan's policy we must turn once more to the diplomat for enlightenment, and here again we find it fully outlined in an interview given to the United Press by Baron Hayashi, Japan's ambassador at London :

"Japan's policy in China," he said, "is based upon complete and open understanding and co-operation with the great powers. Japan is determined to avoid any intervention in China's affairs, except in the form of friendly assistance offered jointly by Japan, the United States and other great powers.

"In other words, Japan plans no action in China, no interference in Chinese affairs, no act of assistance or move-

ment to tranquillize China, except by concerted action of the great powers.

"I think there must eventually be an offer of assistance to China by the powers," he continued. "This would have to come after a Chinese conference, in which the powers would participate, and no action could be taken unless it were agreeable to China.

"We cannot force assistance upon China. She must be willing to accept it. The present does not seem propitious to attempt such a conference or offer such assistance. When the moment is opportune, and it is known China will accept, Japan will willingly take the initiative if desired—but first the powers and China must have reached a well defined understanding.

"In other words, the conference must not fail. Whenever it is called we must be pretty sure in advance it will succeed.

"Military intervention in China by any or all the powers would be a colossal blunder, in the opinion of Baron Hayashi. It may be necessary, he said, to give local protection to foreign lives and property in an exigency, but anything approaching a military expedition would inflame China and might cause a repetition of the Boxer uprising.

"The form of foreign assistance to China should be financial and advisory," explained the Ambassador. "Foreign advisers, under Chinese direction, would undertake tariff, financial, railroad and like problems."

Baron Hayashi's statement constitutes a very definite promise that Japan is willing to exert all her powerful influence on the Chinese government to consent to the convocation of a new international conference for the purpose of laying down a reconstruction program that will cover tariff, financial, railway and other reforms just as soon as there is a stable government at Peking to deal with. He warns the other powers that the plan must be based on the full recognition of China's sovereignty and that all experts and advisers called in to assist in this reconstruction program must be subordinated to Chinese direction. In other words, international control through commissions or heads of bureaus will not be tolerated.

Baron Hayashi's statement also seems to imply that Japan will take the initiative and do its utmost for the proper protection of other foreign interests in China providing the Chinese be permitted to establish a government at Peking that it can deal with, that is to say, one that is not avowedly anti-Japanese. Here again is seen Japan's answer to the long-drawn-out campaign against her interests. After five heartbreaking years of misery, misrule and ruin following a futile attempt to bolster up an anti-Japanese government at Peking, the political wheel has turned and restored to power the "traitors" who were kicked out because of their friendship for Japan.

Although it may not be said that the present government at Peking is pro-Japanese, it certainly is not anti-Japanese and there is every reason to believe that if Tuan Chi-jui is successful in restoring the central power over the provinces and *tuchuns* that he will accept Japan's offer of mediation and consent to calling the proposed conference. This effectively disposes of all other tentative plans for convoking tariff, railway and financial conferences on the initiative of the nationals of other countries. It will be difficult to dislodge Japan from the leadership she has now assumed and as long as she lives up to her new policy towards China, her position is impregnable.

Dr. Schurman's Speech on Extraterritoriality

A Straight-Forward Statement of American Policy Indicating a Continuance of a Policy of Friendship Toward the Chinese People

ADDRESSING the Anglo-American association in Peking, Dr. Jacob Gould Schurman dealt with the entire question of extraterritoriality with a breadth of vision, an understanding of the aspirations of the Chinese people and an appreciation of the position and interests of the United States in China, unusual in an American minister in Peking. For many of the present difficulties of Americans in China have arisen from a dogmatic policy developed in the American legation when Dr. Reinsch was minister, a policy which on the one hand held out to China hopes which could not be fullfilled and on the other hand instigated the Chinese to distrust and dislike foreign nations, other than the United States. In this differentiation as between one and another foreigner in China lay the germ of distrust and eventual dislike for all foreigners in China, a germ nurtured and cultivated by the younger element of the Chinese who have found in Russia and Turkey emulatory examples.

Dr. Schurman in discussing extraterritoriality attacks the root of Sino-foreign relations. It is not worriment over tariff reforms which causes friction between Chinese and foreigners, but the sense of loss of sovereignty, the presence of foreign controlled, foreign managed, foreign administered areas within China. There is much to say for the foreign point of view that the concessions and settlements are the results of the enterprise and initiative of hardworking, energetic foreigners who for more than half a century have been laboring to turn swamps and bare hills into modern cities, the like of which were never dreamed of in the interior of China. On the other hand, it is fatuous to ingore changes in political tendencies among peoples. We are living in an era of intensive nationalism. Among all the peoples of the universe this insistence upon nationalism, upon the right of those who are of one kind to work out their own salvation in their own way, unhampered by the co-operation or even the advice of those nations which have been more successful in the historical struggle for power, is constantly becoming more and more accentuated. No matter how unfavorable internal conditions in China may be, the Chinese apparently prefer what they have, to what they might get through foreign co-operation. This fact, Dr. Schurman senses keenly when he says:

"The great majority of foreign business men in the treaty ports have no idea how sensitive Chinese have become on this subject. Only a small number of them whose business ramifies throughout the vast interior of China are brought by experience into actual contact with the growing sentiment of nationality among the Chinese people. This is why foreigners in the treaty ports are so conservative whenever any revision of the treaties is proposed which involves a fuller recognition of Chinese sovereignty. On the other hand, missionaries, who live in the interior, certainly American missionaries, in spite of many miscarriages of justice which take place under their very eyes, generally sympathize with the aspiration of the Chinese people, which seems to them a perfectly natural one, for the recovery of full judicial sovereignty within their own territories. But, as I have said, the conservative tradition of the treaty ports is averse to modifying the present system of extraterritoriality and indeed deprecates all discussion of it. It is an extreme position and with the lapse of time will in my opinion become more and more untenable."

The inability of the average foreign business man in China to understand political conditions in China, to read beyond the bare headlines of the newpapers published in treaty ports, is evident from the resolutions passed at the annual meeting of the associated American chambers of commerce in China which met fully a week after Dr. Schurman's address was published in the newspapers and which had ample opportunity to consider the necessity of the American merchant in China not acting in opposition to the expressed sentiments of the American government as pronounced by the officially accredited American representative to this country. According to the newspaper accounts of the resolutions passed at this annual meeting, was one recommending to the American government that no action be taken toward the appointment of delegates to the special tariff conference or the commission to investigate the status of extraterritoriality until conditions in China have become stabilized and a government has been established which is able to exercise constitutional authority throughout the land.

The shortsightedness of the resolution lies not in the reactionary character of the merchants' objection to all and any changes of status, as though any political or social relationships could be of a permanent character, but in the fact that they oppose even the appointment of a commission to investigate into the possibility, the desirability, the advantages or disadvantages of change. Surely such resolutions can only lead Chinese to believe that the American merchants fear that should impartial Americans, fresh to the situation, study it, they would immediately conclude that extraterritoriality should forthwith be abolished.

Actions such as these influence Chinese to adopt tactics which give the appearance of revolutionary activity. Dr. Schurman perhaps over-emphasized the importance of Mr. Karakhan or his government in their influence upon the younger generation of China. The revolutionary movement in China commenced many years before Russia knew the Soviet, many years perhaps before Mr. Karakhan was born. The T'aiping rebellion and its effects upon the Manchu court introduced a revolution in governmental ideas and methods in China, the effects of which are just beginning to appear in the popular movements of contemporary China. Mr. Karakhan's policy of repudiation of treaties and agreements was in the background of Chinese diplomacy before Mr. Karakhan came to the country and in effect, has been practiced in many respects, particularly as regards taxation and the non-payments of debts. The difference between the Chinese and the Russian is a difference in training and temperament. The Russian repudiates his treaties in a loud-mouthed, blatant manner, after the fashion of a street orator haranguing a crowd. The Chinese politically does nothing and says less, but the effect is exactly the same. The treaties are in many respects unenforcable and there is no one to gainsay China at this moment. When Lu Yung-hsiang, the bepraised *tupan* of Kiangsu, instituted the tobacco tax in Chekiang province, which he then governed, and when the central government admitted its impotence in preventing him from breaking the treaties between China and the foreign powers, China did very much what Mr. Karakhan advised when he suggested that treaties be repudiated.

Of course, the Chinese in the Waichiaopu having had a longer experience in diplomacy than those who now govern Russia, a wiser course will in the end be taken. Dr. Schurman suggests that that be :

> I hasten, therefore, to point out a more excellent way. It is not reactionary like the first but progressive. It is not revolutionary like the second but evolutionary. It tends to promote not distrust and hatred but confidence and good will and friendship. It involves not single-handed and arbitary action on the part either of China or of the treaty powers but the co-operation of both and the conciliation of each and only such a medium of compromise as wise and practical negotiators dealing with great and conflicting interests are always ready to make."

The evolutionary, progressive method has many advantages to China, as it has for the foreign powers. The internal political situation of China is such that it would undoubtedly give the Chinese government much less work to do, if, whatever steps are taken to abolish extraterritoriality, do not have a direct bearing upon that situation. No foreign power is willingly going to give up her rights in China unless the Chinese government devises some method to take over such rights in a manner which will conform to the basis laid down by Dr. Schurman :

> "The first is that foreigners in China must continue to be assured of justice as measured by western standards. The second is that with every step in the abandonment of extraterritorial jurisdiction, with the surrender of each successive element of it, a just, practical and effective substitute must be found to take the place and discharge the functions of each factor eliminated. If extraterritoriality is to be abolished there must be developed a Chinese judicial system and practice which will assure to the foreigner clean and even-handed justice."

To accomplish this task China must have time and the intelligent co-operation of the powers, a co-operation which is not forced, not co-operation which is in effect an impediment, not co-operation which leads to hatreds, but a co-operation based on a principle that both sides want success to crown the efforts, that both sides fully believe that the work undertaken is in the best interests of all parties concerned. Dr. Schurman seems to favor a plan which he discussed at some length in his address :

> ' Now there seems to be a simple way of preventing this miscarriage of justice and clearing up this judicial confusion while conserving the rights of all parties concerned. The remedy was suggested in 1919 by Mr. Woodhead, the Editor of the *Peking and Tientsin Times*. It is that so long as there are foreign courts in China they shall at least all administer the same law—the law of the new Chinese codes. It would of course be necessary that these codes should have been examined and, with or without amendment, adopted by the treaty powers. This might be one of the duties of the commission provided for by the Washington conference to investigate the subject of extraterritoriality."

This plan has been discussed by jurists and others interested in the reorganization of China's courts and her judicial procedure, not only from the standpoint of finding a legalistic system which will approximate the jurisprudence of the west, so that foreigners might with some safety live under the codes of China, but also with a view to providing the Chinese people with a more equitable system of law. Dr. Tung Kang, at one time minister of justice and at another chief justice of the supreme court of China, after a visit to European and American courts, suggested that one of the supreme weaknesses of the modernized jurisprudence of China lies in the fact that the new codes have been taken largely from continental European codes via Japan rather than from the Anglo-Saxon legal system, which he believes comes closer to the ancient Chinese traditional ideas of equity. But it makes little difference what codes are adopted, since the benefits of law to the litigant lie not so much in interpretation as in the procedure of the court and the general construction of the law. In Anglo-Saxon countries, the construction of the law, follows age long precedents originating in English common law and developing through a line of decisions by learned judges. This adherence to precedent, to the written word, has made the courts of England the model of the modern world.

The creation of such a body of precedents, the lifting of the court out of the muck of politics, the creation of a popular respect for its decisions and a confidence in its wisdom, is not a work of a day. The decisions of Chinese magistrates, the diaries of taotais and Shaohsing lawyers, the aphorisms of scholars and sages, present such a body of precedents, but these have not been formulated into anything approximating the body of English law, although they apply for a larger number of human beings. Nor have they been adapted to modern legal procedure nor to current affairs. There has been no Bracton, Coke or Blackstone in China, although the belief of many foreigners that there have been no great legal minds in China is altogether without foundation.

The emphasis on courts in this article and in all discussions of the problem of abolition of extraterritoriality arises from the fact that as life and affairs are organized under the present economic and social system, security and continuity depends upon the law and its administration through court decisions. Paternalism and the individualistic wisdom of the chosen few satisfied medieval conditions, but corporate enterprises and the intricacies of property-ownership require that men shall have some idea of the legal stutus of a proposition before the event, that is, before the law is broken and the property endangered by the possibility of an adverse decision. There has to be a sense of security that in fol-

lowing the spirit and the letter of the law, there will be no jeopardy to property due to whimsicalities on the part of an individual jurist. The courts, ancient or modernized, now existing in China, offer no such security.

In the mixed court of Shanghai, China has the opportunity of creating an experimental court and a training school for jurists as well as an institution for the building up of a body of precedents such as has been developed in Anglo-Saxon countries. It is in this court that China and the foreigners in China have their most intimate point of contact, where daily questions of law and equity arise as between Chinese and foreigners, involving huge properties and the keenest questions of life and liberty, and where there has to be an adjustment between the law of China and the laws of every country having foreigners in China, and the customs and traditions of China and the customs and traditions of every country having foreigners in China. It is in the mixed court of Shanghai where East meets West and where the two must adjust their different viewpoint.

This court, as at present administered, is unsatisfactory both to Chinese and foreigners. The Chinese magistrates are not officials of the Chinese government nor are they trained jurists. They do not command the respect of either the old-style lawyers of China nor of the modern Chinese lawyers trained in European and American universities. The foreign assessors are usually young consular officers, often without any legal training, surely with no outstanding legal experience, whose decisions are too often rendered along the lines of national policy and consular suggestions, than on the broad basis of fundamental law. Such a court can nowhere command popular respect nor can its decisions have any weight among jurists in other courts. As a matter of fact, the supreme court of China has decided that the decisions of the mixed court of Shanghai, have no weight in the eyes of that court and that its decisions are not binding outside its immediate jurisdiction.

But were China and the foreign powers enjoying extraterritoriality to unite on a plan to appoint to this court as judges the best legal minds in China and as advisory judges or assessors the best legal minds available in countries having rights in that court, or better still, were China given the opportunity to select from the various countries the foreign advisory judges, this court would command the respect and its decisions would obtain the recognition of other courts throughout China. It would then become the leader in jurisprudence, the legal training school whence would come magistrates for the whole country. It is impossible for this article to discuss such a plan in detail, nor does its author, who is not a lawyer, feel competent to lay down the law for lawyers to follow, but the suggestion is made because the next time the question of the rendition of the mixed court arises between China and the treaty powers, it might be dealt with not as an individual problem nor on the narrow lines that nothing may change in China, but on the broader lines that changes there must be, that extraterritoriality must eventually be abolished and that a good place to begin the experiment is in this court.

The Russo-Japanese Agreement

A New Epoch in the Far Eastern Affairs Opens in Which Japan, China and Russia Are Associated for the Peace of the Pacific

The Saghalien Oil Concession Strengthens Japan's Navy

THE Russo-Japanese agreement signed at Peking by Mr. Karakhan, the Russian ambassador, and Mr. Yoshizawa, the Japanese minister, marks a new period in Far Eastern diplomacy. It will be remembered that when the Soviet régime began to make its policies felt in the Far East, it was Japan which undertook to establish a barrier against its advance into China. The associated powers immediately joined Japan in the Siberian campaign with a view toward preventing the permanent occupation of that country by a Japanese army, although Japan had expressed no intention of taking such a step. It was a time of suspicion in the United States and Great Britain of everything Japanese. It was a time when the anti-Japanese movement in China was at its height, when the British and American legations in Peking were exercising themselves over the political possibilities of the Nishihara loans, when every American journalist and many missionaries appointed themselves agents of the American secret service to ferret out incriminating information against a nation with which the United States was at peace and with which the United States was actually engaged in a joint military enterprise.

Nothing good could possibly come out of an enterprise which was conceived hysterically and conducted fulsomely. The ostensible reason, assistance rendered to a Czech army to free itself from bondage, having fulfilled itself, the armies of the western powers withdrew and it was expected that the Japanese army would also immediately withdraw, leaving the field to various disturbing " White " Russian factors operating in Siberia, Mongolia and, if the truth must be told, Manchuria. Japan, however, remained for some time, principally because Siberia not only is in close propinquity with Japanese territory (Korea), but because Japan has a special interest in the peace and order of Manchuria. During the fighting between the foreign troops and the Russians, an event occurred at Nicholaievsk which wounded every finer sentiment of the Japanese people. Japanese were massacred and the Japanese dead were mutilated.

Among eastern peoples, the dead command a special position. The system of ancester worship which is the keynote of Eastern Asian religions, requires that the body of the dead shall in no way be multilated, that every effort shall be made to provide a suitable burial, and that reverence be shown the corpse. In many respects this is true in most western countries, but in the East, such matters find an accentuation unknown elsewhere. Because of the Nicholaievsk occurrence, Japan seized and militarily occupied the Russian portion of the island of Saghalien. The occupation of this island and Japanese activities in the vicinity of Vladivostok engendered bad blood between Russia and Japan until finally the Japanese expeditionary force to Siberia was recalled.

Russian diplomatic policy in the Far East was first premised upon a union with China against Japan and perhaps the Anglo-Saxon countries. Mr. Yourin was sent to China to effect a peace agreement with the two countries. In public statements and through the Russian press organization founded in China, Soviet Russia offered China such startlingly good terms that it was surprising that China did not immediately accept. But the terms frightened the western powers even more than they did Japan. Whereas at the beginning of Mr. Yourin's visit to China, he met with a certain support from the hidden, perhaps self-appointed, Anglo-American agencies, he soon found himself attacked on all sides because it was felt by all foreigners in China, that his terms were designed to instigate China to an attack on the western powers. The automatic surrender of extraterritoriality, of concessions, of vested rights, was part of the propaganda period of the Russian Revolution. Mr. Yourin's efforts were directed toward affecting the western powers and Japan rather than the Chinese people, who turned a cold shoulder to him and to his offer.

Mr. Yourin's failure to accomplish anything in China resulted in his recall and Mr. Joffe was sent to China. Mr. Joffe was a man of outstanding diplomatic calibre. He had participated in the conferences which led to the signing of the Brest-Litovsk treaties and had assisted in the creation of the Soviet policy of finding recognition

among the powers which had refused to recognize Soviet Russia. He was not in the Far East long before he determined that the hub of the situation was Japan and that unless Japan and Soviet Russia came to an understanding, the diplomatic efforts of Soviet Russia would be nullified. Because, he must have learned what every one with an understanding of Far Eastern affairs knows, that Japan and China are so closely bound together in Manchuria that China would think twice before sacrificing Japan's friendship and co-operation for the uncertainty of friendship and co-operation with Russia, at a time when Japan and Russia were not on speaking terms. Mr. Joffe thereupon set out to win the good-will of Japan and succeeded in building up a group in Japan friendly to Russia and headed by Viscount Goto. This group invited Mr. Joffe to visit Japan and it appeared for a while that an agreement would be consumated. Mr. Joffe was suffering from neuritis and spent much of his time in bed. It was difficult for him to accomplish very much under such circumstances, although to him must go the credit for having begun a work which has finally succeeded.

Mr. Karakhan and Mr. Yoshizawa commenced their discussions soon after the Russian ambassador's arrival in China. These discussions were simultaneous with Mr. Karakhan's conferences with Dr. C. T. Wang regarding a preliminary agreement between China and Russia and each must have influenced the other. Mr. Karakhan was present at both conferences and Dr. Wang was a particularly suitable person for China's purposes because of his breadth of view and his friendship for both Japan and Russia. It will be recalled that Dr. Wang's conferences ended in failure because of a palace intrigue in Peking, certain politicians seeking to withhold from him the credit of a great accomplishment. Subsequently, Dr. Wellington Koo signed a preliminary agreement with Mr. Karakhan practically identical with that which Dr. Wang had arranged.

Altogether seventy-seven formal sessions were held by the Japanese-Russian delegates, in addition to which a large number of informal meetings took place. These meetings for a time being simultaneous with the Sino-Russian conferences undoubtedly, we repeat, resulted in a situation wherein one influenced the other. It was at the time suggested that a Tripartite Conference take place at which China, Japan and Russia might settle their outstanding differences together, thus forming a North Pacific understanding. But this suggestion was not taken seriously, probably because of the international position of China and the fact that the western powers would have viewed such a situation with the usual alarm.

The treaty which was finally signed on January 21, is important because it ends a situation in the Far East which always included the possibility of war between Japan and Russia, which war would have been fought on Chinese soil, Manchuria. Thus, is China, Japan and Russia freed from a spectre. That the earthquake had something to do with the consumation of the agreement cannot be denied. Japan once was ready to keep Sovit Russia out of Asia. Japan was once prepared to save the western powers from the effects of Soviet propaganda in China. Japan invested a huge fortune in such an enterprise in Siberia, and for this investment Japan naturally expected a reward. But the western powers utilized the full strength of their diplomacy to prevent Japan from accomplishing her purpose. To-day they are faced with the fact that whereas the United States and Great Britain have not come to an understanding with Russia, whereas the governing classes of both countries are in a white funk over the Russian question, Japan has come to a satisfactory arrangement with Russia and is already preparing to trade with that country.

Meanwhile, Russia is declaring herself ready to become the ally and protector of China against the western powers and is encouraging China to free herself from the unequal treaties between herself and the western powers by revolutionary means, while Japan has declared a Monroe Doctrine as regards her relations with China, as is recorded elsewhere in this issue. Thus has the Anglo-American policy in the Far East failed and it has failed largely because of the suspicion of Japan, unwillingness to co-operate with Japan, unwillingness to understand Japan. Japan, China and Russia are being thrown together, not only because of their geographic and political relationships, but because Anglo-Saxon diplomacy has indicated to them that their national aims are co-terminus.

The basic agreement between Russia and Japan in the second article states :

> The Soviet government recognizes as complete as complete and effective the Portsmouth treaty signed September 5, 1905, but reserves the right of either revising or nullifying, as occasion may require, all other agreements, concluded between the high contracting powers prior to November 7, 1917. The maintenance or revision of such agreements shall be discussed whenever occasion requires in future negotiations.

In Note 3, annexed to the treaty, Soviet Russia makes a reservation in which it provides that it is not responsible, politically, for the conclusion of the Portsmouth treaty. The date, November 7, 1917, sets the period after which Soviet Russia assumes responsibility for Russian affairs.

The full intent of the reservation or the explanation of its import has not been made public. It is, however, necessary to call attention to two treaties between Russia and Japan which were signed after the Portsmouth agreement and prior to November 7, 1917. The first was a political convention dated July 30, 1907, and contains the following provisions :—

> Art. I.*—Each of the high contracting parties engages to respect the actual territorial integrity of the other, and all the rights accruing to one and the other party from the treaties, conventions and contracts in force between them and China, copies of which have been exchanged between the contracting parties (in so far as these rights are not incompatible with the principle of equal opportunity), from the treaty signed at Portsmouth on September 5 (August 23), 1905, as well as from the special conventions concluded between Japan and Russia.
>
> Art. II.—The two high contracting parties recognize the independence and the territorial integrity of the empire of China and the principle of equal opportunity in whatever concerns the commerce and industry of all nations in that empire, and engage to sustain and defend the maintenance of the status quo and respect for this principle by all the Pacific means within their reach.

The second is an agreement with regard to Manchuria dated July 4, 1910† and containing the following provisions :—

> The imperial government of Russia and the imperial government of Japan sincerely attached to the principles established by the convention concluded between them July 17-30, 1907, and desiring to develop the results of that convention with a view to the consolidation of peace in the Far East, have agreed to complete the said arrangement by the following agreements :—
>
> Art. I.—For the purpose of facilitating the communications and developing the commerce of the nations, the two high contracting parties engage mutually to lend each other their friendly co-operation with a view to the improvement of their respective lines of railroad in Manchuria, and to the perfecting of the connecting service of the said railways, and to refrain all competition unfavorable to the attainment of this result.
>
> Art. II.—Each of the high contracting parties engages to maintain and to respect the *status quo* in Manchuria as it results from all the treaties, conventions or other arrangements hitherto concluded, either between Russia and Japan or between these two powers and China. Copies of the aforesaid arrangements have been exchanged between Russia and Japan.
>
> Art. III.—In case any event of such a nature as to menace the above-mentioned *status quo* should be brought about, the two high contracting parties will in each instance enter into communication with each other, for the purpose of agreeing upon the measures that they may judge it necessary to take for the maintenance of the said *status quo.*

From the signing of the Portsmouth treaty until the great war, Russia and Japan were coming closer and closer together. It is not to be assumed altogether that this understanding was a relationship engendered by the curious diplomatic situation arising from the triple entente and the Anglo-Japanese alliance. The Russo-Japanese entente was independent of these and was based upon the ideal that the northern Pacific peoples must work out a program for co-operation in the Pacific independent of North Atlantic diplomacy.

After the great war commenced these two powers entered into an alliance the terms of which are as firm as any alliance that

* Macmurray 1907/11.

† Macmurray 1910/1.

ever was made. In the treaty signed on July 3, 1916, the two powers agreed :

Russia will not be a party to any arrangement or political combination directed against Japan.

Japan will not be a party to any arrangement or political combination directed against Russia.

The treaty further provided that in the event of any such combination threatening either of the parties, both would confer with regard to measures to be taken mutually to protect each other's interests. In addition to these treaties, reports exist of two so-called secret treaties, the terms of which may or may not be correct. One was published in the *New York Evening Post* on March 2, 1918 and is taken from the files of the Russian foreign office when the Soviet government published its secret archives. This document refers to secret agreements in 1907, 1910 and 1912 and supplements them by a complete defensive and offensive alliance. The second is published in Dr. E. T. Williams' book, " China, Yesterday and To-day," and purports to be a summary of the clauses of the secret treaties delineating the Russian and Japanese spheres of influence in Manchuria and Mongolia. On a map appended to this book, a red line is drawn indicating the boundaries of the spheres.

Dr. Williams ought to know what he is talking about and the Bolshevik government, it must be assumed, did not manufacture secret documents but published what they found. The implication of all these documents is therefore that from Portsmouth to November 7, 1917 Russia and Japan had come so close to each other that they were in actual alliance. This policy was interrupted by the Russian revolution which naturally did not fill Japan with joy since it brought political and economic disturbances to her frontiers. But some seven years have passed since that event and the time has apparently come for these two nations to re-establish their friendly relations, perhaps one might surmise to take up these relations where they were left off. The cancellation of the spheres of influence in Manchuria and Mongolia implied in the new treaty is in accordance with the new dispensation devised at Versailles and Washington, but other features of the previous Russo-Japanese amity need not be and apparently are not, nullified or revised.

Now, it is the permanent diplomatic policy of China to disregard spheres of influence and to arrange for the discontinuance of the practice of marking out such spheres in China. Furthermore, at both the Versailles and Washington conference, the implication was that the spheres no longer exist. The consortium was organized to end all spheres of influence so far as financial matters are concerned. Russia has stated that she is no longer interested in this phase of diplomacy, while Japan has shown every indication of a policy of assisting China to place herself on a fully independent basis. These provisions in the new Russo-Japanese treaty, are a diplomatic victory for China, in that two nations automatically achieve for her what she herself has been unable to achieve.

Two other provisions of the new treaty are of the greatest importance. The provisions with regard to Saghalien end forever the major differences between Japan and Soviet Russia which were based on the Nicholaievsk incident and the occupation by Japan of the Russian portion of the island. The terms of the treaty are as follows :

The two high contracting parties undertake to open further negotiations as soon as the treaty takes effect, and have concluded the following items as basix principles, in accordance with which an agreement will be entered into within the next six months concerning the question of rights :—

(1) The government of the Union of Socialist Soviet Republics undertakes to accord any Japanese firm to be recommended by the Japanese government the right of operating 50 per cent. of the total area of oil-fields in North Saghalien. In order to fix the area of oil-fields to be leased to such Japanese firm, all the fields there are to be divided into the shape of squares as on a checkerboard, an area to the extent of its 50 per cent. is to be leased to Japanese, but these squares, in principle, will not be so placed as to come in contact with each other. All those oil-wells which are now either being operated or are about to be operated by Japanese, are included in the squares referred to above. In case the Soviet government intends to lease to foreign people or firms the area of oil-fields, which is not included in the said squares Japanese firms are to be accorded an equal opportunity.

(2) The government of the Union of Socialist Soviet Republics agrees to accord any Japanese firm or firms to be recommended by the Japanese government the right of prospecting an area to the extent of 1,000 Russian square miles, to be selected, on the eastern coast of North Saghalien within one year after the conclusion of an agreement on the question of rights. In the event of oil-fields being laid out as a result of the prospecting in question, the Japanese firms concerned are to be accorded the right of working an area equivalent to 50 per cent. of the said oil-fields.

(3) The government of the Union of Socialist Soviet Republics agrees to grant any Japanese firms to be recommended by the Japanese government the right of working coal-fields which exist within a special area on the western coast of North Saghalien to be provided in the agreement on the question of rights. In case the coal-fields, other than those to be included in the special area, which is to be leased to Japanese firms, are to be offered to foreign management by the government of the Union of Soviet Republics Japanese firms shall be accorded an equal opportunity.

(4) The term of the leasehold of the oil and coal-fields as provided in the foregoing clauses shall be from 40 to 50 years.

(5) The Japanese leaseholders shall pay as reward to the government of the union of socialist Soviet republics 5 to 8 per cent. of the total output of coal and 5 to 15 per cent. of the total output of oil per annum, but the reward to be paid for eruptive oil-wells can be increased up to 45 per cent. of the total output of oil from those wells. The ratio of outputs to be handed as reward to the Soviet government by the foregoing method is to be provided in the agreement of rights and may be changed according to the quantities of annual outputs.

(6) The Japanese will be permitted to cut down trees required for their enterprises as well as to make various equipments for the purpose of facilitating traffic and transportation of raw materials and products. Details in this connection are to be provided in the agreement of rights.

(7) No taxes shall be imposed upon the imports and exports of materials or articles necessary for the Japanese enterprises abovementioned, and of those which may accrue from such enterprises, in view of the reward in question and of the geographical positions and other general conditions in the districts concerned. Enterprises to be undertaken by Japanese firms shall be immune from such exhorbitant taxes as would render the business impossible to continue.

(8) The government of the Union of Socialist Soviet Republics agree to accord every reasonable protection and facility to the enterprises referred to above.

The Japanese troops are to be withdrawn from the island, while Japanese enterprises exploit the island economically. The political effects of the agreement are that Japan will have available a huge oil supply sufficient to free her navy from the necessity of purchase from abroad. At the same time, American firms which had an interest in the Saghalien situation because of the arrangements between the Soviet government and the Sinclair Oil Company can in no way interfere with the arrangements, since neither the American government nor the Russian government can be bound by the Sinclair agreement which was made in spite of the fact that Russia and the United States did not recognize each other. Besides, the Sinclair concession lapsed in time and therefore lost validity. The Saghalien agreement is the most important economic factor in the new treaty and is bound to have widespread international effects.

In passing, it is interesting to note that Japanese will be permitted to engage in enterprises involving the employment of private capital and that Japanese and Russians will be permitted to own property in either country. A bill has already been introduced in the Japanese Diet to make legally effective these provisions of the treaty. When this bill is passed, it is understood that it will contain provisions granting the right to foreigners to own property in Japan for whatever purpose if and when Japanese may own property in the country from which the foreigners come. In other words, property ownership must be reciprocal. The United States will have to consider this phase of the agreement from the standpoint of those western states which continue to antagonize the Japanese people by anti-Japanese legislation, particularly with regard to land ownership. Russia and Japan, both of which discriminated with regard to land-ownership by foreigners, has now adopted a more liberal policy. What will the United States do to meet these changing conditions not only as regards Russia, but a regards Japan and China ? What will the United States do to win the goodwill of three countriesb ordering on the Pacific whose people number 600,000,000? Can a policy ignore which ignores the new orientation on the Pacific ?

A Pioneer of Sino-Japanese Co-operation

Baron Kihachiro Okura

WITHOUT detracting from the important part played by the present and past liberal cabinets in bringing about such a remarkable improvement in the relations between Japan and China it is to the heads of big business in Japan that credit is mainly due for the impulse which compelled such a radical modification of the old military program. The Iwasakis, the Mitsuis, the Sumitomos, the Matsukatas, the Kuharas, the banking interests headed by Baron Shibusawa and Junnosuke Inouye, the chiefs of the great textile industry and others prominent in the commercial life of the empire were the driving force behind the movement which restored to Japan the full confidence and trust of the other powers. In this group stands the venerable founder of the house of Okura, an ardent advocate of Sino-Japanese friendship and co-operation, who after a life time of activity is now retiring to give his last years to the advancement of his pet hobby.

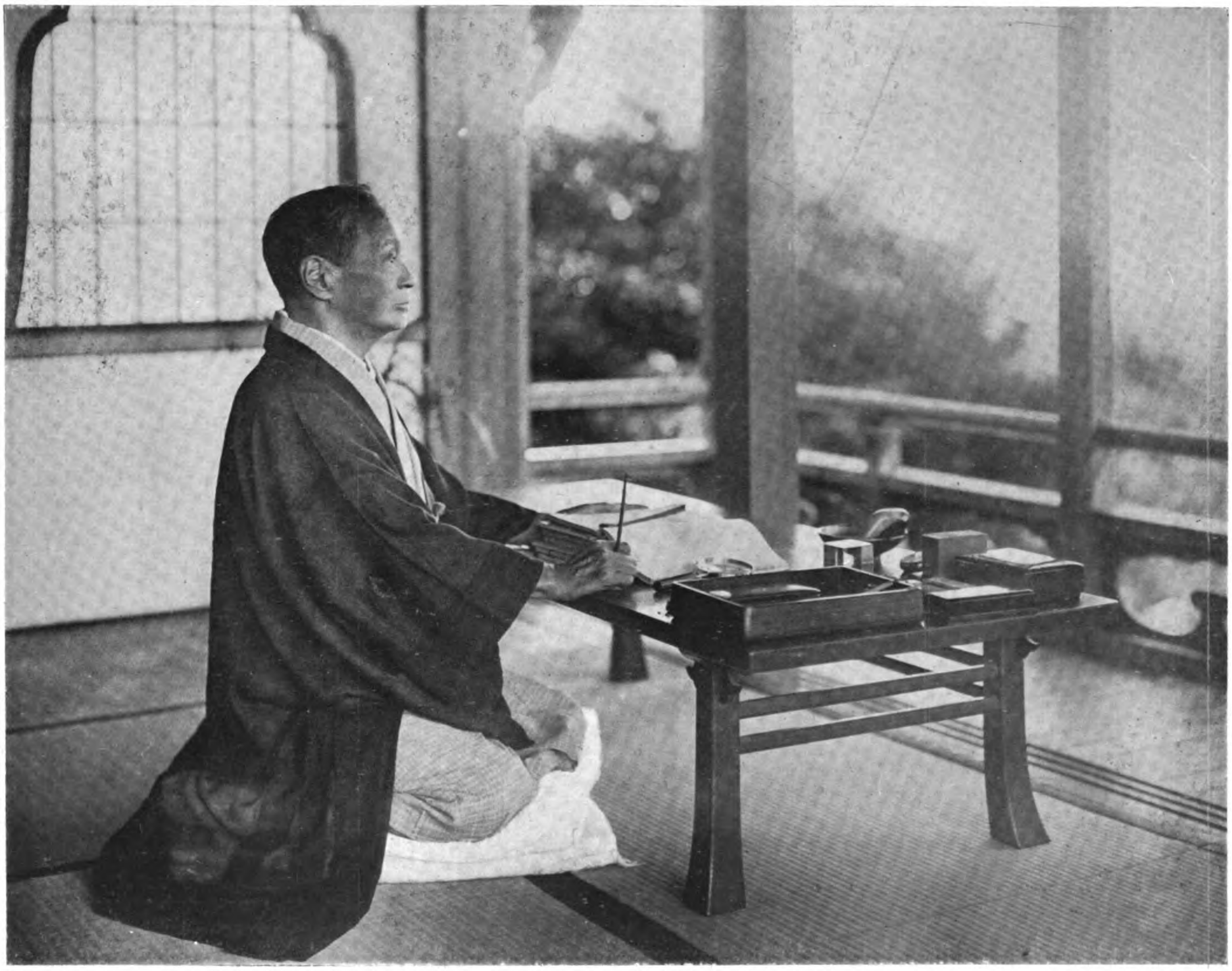
In October last, this pioneer of Japan's foreign trade, celebrated simultaneously his eighty-eighth birthday, his golden wedding and his retirement from business. After seventy years of business activity he finally decided it was time to hand over direction of his many enterprises to his son and devote his remaining years to the promotion of peace and cordial relations between his own country and the nation to which it owes so much of its culture and civilization. To celebrate the occasion fittingly and reciprocate in part the tokens of esteem received from his many Chinese admirers, this exceedingly rich man determined to spend a million and a half yen in a series of banquets and fêtes that would convey his last greetings to old friends and business associates whose good-will and good-fellowship had contributed so largely to his success in life.

In China, in America, in Europe, in other parts of Asia and in his own country, his personal friends, business associates, co-directors, shareholders and employees in his many enterprises were numbered by the thousand. The recipients of his benefactions were legion. That such a man should celebrate his retirement from active life by some testimonial of regard for this host of loyal friends and adherents may seem theatrical to the Occidental, but the sentiment behind it is so unusual and inspiring, so worthy of emulation by multi-millionaires in other countries as to command more than a passing notice. Whoever heard of an American or European financial magnate celebrating his retirement from business by a series of splendid entertainments to those who had contributed to make his life a success ?

Had this old man been a miser, a slave-driver of his men or devoid of public spirit, we could better understand the protests made by the Tokyo radicals against the expenditure of this large sum for such purposes. But Baron Kihachiro Okura, a name entwined with the development of modern business and industry in Japan and China, has given freely and spontaneously of his riches for philanthropic purposes.

On the bluff at Akasaka overlooking the city of Tokyo stands one of the finest museums in the world housing the rarest and most precious specimens of the art of Japan, of China, of Korea and of India, a veritable treasure-house of the best works of ancient and

(Continued on page 64).



Baron Kihachiro Okura, head of the great commercial house which bears his name. An ardent advocate of Sino-Japanese co-operation who at the advanced age of 88 declares his intention to devote his remaining years to the promotion of closer relations between the two countries

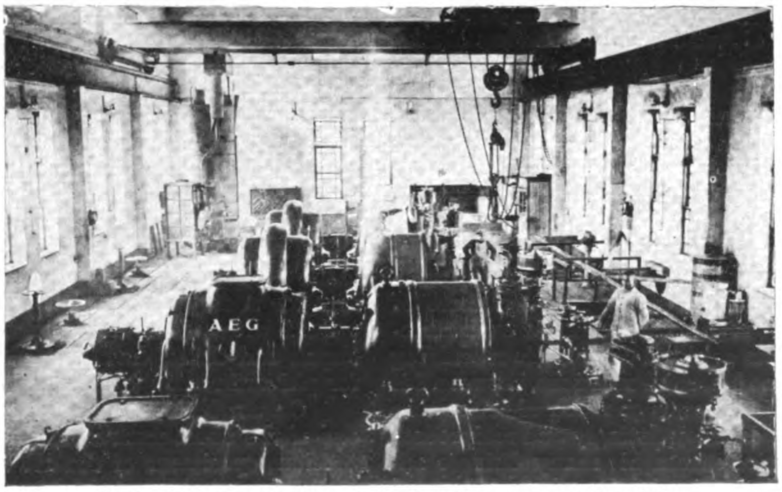
Panoramic View of the Penchihu Blast

PENCHIHU

A Sino-Japanese Co-operative Enterprise in Manchuria Organized and Developed by Baron K. Okura

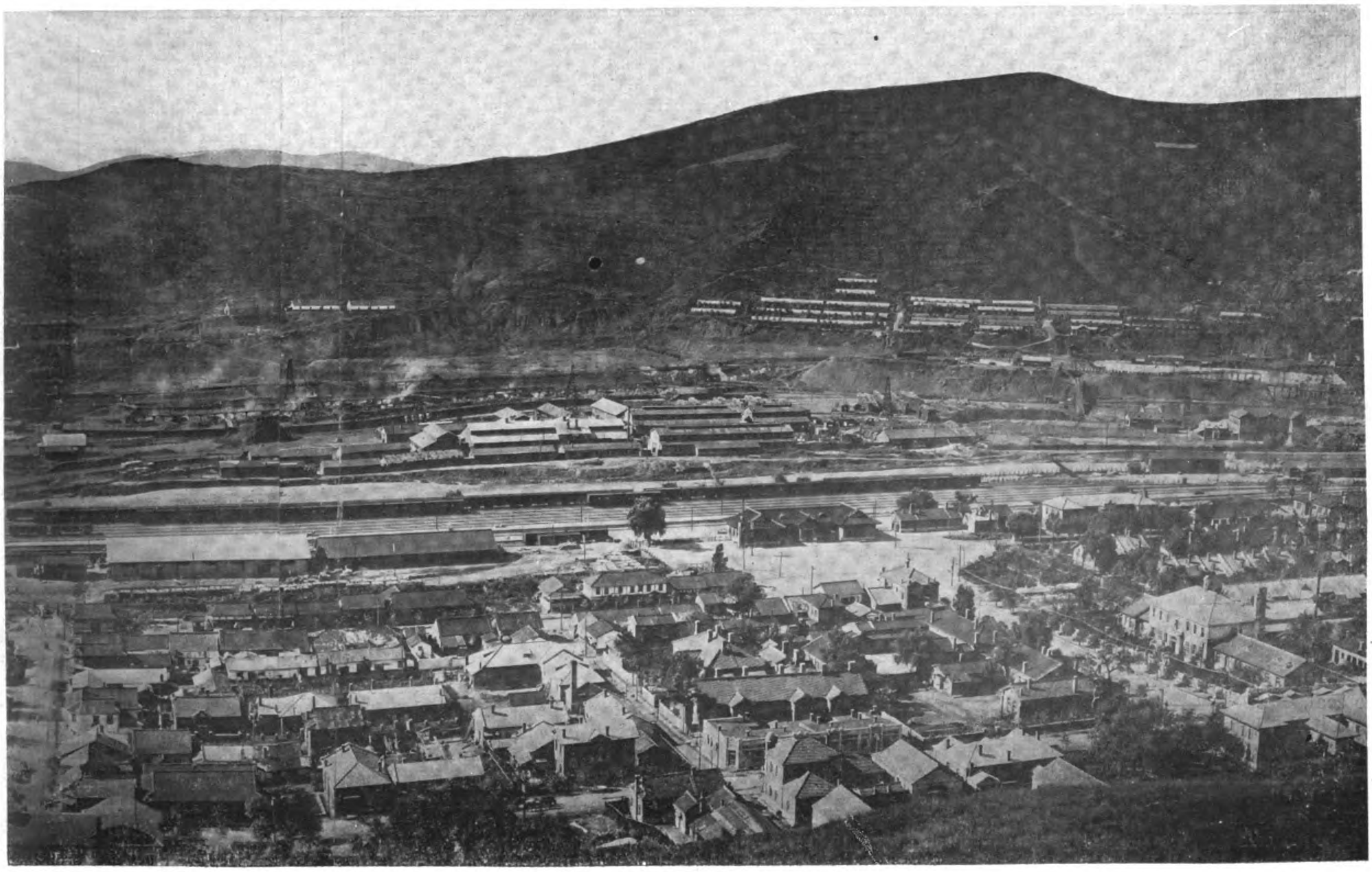
FOR centuries before they were welded into a nation, the Manchu tribes burrowed into the hills of Miaoehrkau for the ore which supplied them with iron for their arms, implements and utensils, smelting it with the coal and limestone dug from the outcrops at Penchihu, six miles distant. It is on record that sometime during the reign of the Emperor Chien Lung an imperial decree was issued conceding to the people of that region the right to operate the Penchihu workings on the payment of a stipulated royalty to the imperial treasury. Coke burned from Penchihu coal and iron ore brought from Miaoehrkau formed the basis of a crude industry whose product found a ready market throughout the Three Eastern Provinces and Korea. For a long period the Penchihu district prospered in its enjoyment of a quasi-monopoly in the supply of iron to Manchuria and North China and it was not until the latter part of the last century that circumstances arose compelling a departure from the ancient methods of mining and smelting.

At this time, the main shaft of the Penchihu coal workings became flooded to an extent that the old hand power pumps and antiquated methods of raising water could no longer cope with the inflow. On top of this disaster, large quantities of foreign iron and iron ware were imported into China at prices prohibiting native competition. The Hunghutzes put the finishing touches to the tale of woe by raiding the town and driving away the inhabitants. Then came the Russians exploring the region followed by the Russo-Japanese war bringing the district within the zone of active military operations and terminating an industry which its crude way had provided the province with coal and iron for many centuries.



Turbo-Blowing Engines for Blast Furnaces at Penchihu

The real story of Penchihu dates from this time. Baron K. Okura, head of the house which bears his name, and one of the most successful contractors to the Japanese army, was with the forces in Manchuria and grasped the great possibilities for an iron and steel industry presented by the close proximity of a high grade ore to excellent coking coal and limestone deposits. Okura did not wait for the termination of the



Furnaces and Principal Coal Workings

war to push forward his plans but applied at once to the Japanese military authorities at Liaoyang for the mining rights to these properties. Permission to commence operations was granted the following month (November 1905), and active work started in January, 1906.

The Chinese authorities, however, were closely watching the Japanese activities and as soon as the war terminated, entered a formal protest against the validity of a concession granted by the Japanese military authorities. They realized, however, the hopelessness of completely ousting the Japanese and proposed to place the coal mine under joint Sino-Japanese ownership. After three years of negotiation between Baron Okura and Viceroy Hsi Liang, a deal was effected which brought the coal properties under the Penchihu Colliery Company, organized in January 1911 with a capital of $2,000,000 half Chinese and half Japanese. The agreement, however, covered only the coal mining rights at Penchihu. Baron Okura had set his heart on establishing the larger enterprise and suggested to the Chinese that the iron mines at Miaoehrkau should also be brought under control of the company. On October 6, 1911, a new agreement was, therefore, entered into for the acquisition of the iron deposits and the erection of a blast furnace at Penchihu and the name of the company changed to The Penchihu Coal and Iron Mining Company. The capital was increased to $4,000,000, shared equally by Chinese and Japanese. In March, 1913, this was again increased to $7,000,000, where it now stands. The success attending this initial co-operative Sino-Japanese undertaking paved the way for many other similar enterprises which have brought prosperity to the Chinese in Manchuria.

Location of Mines

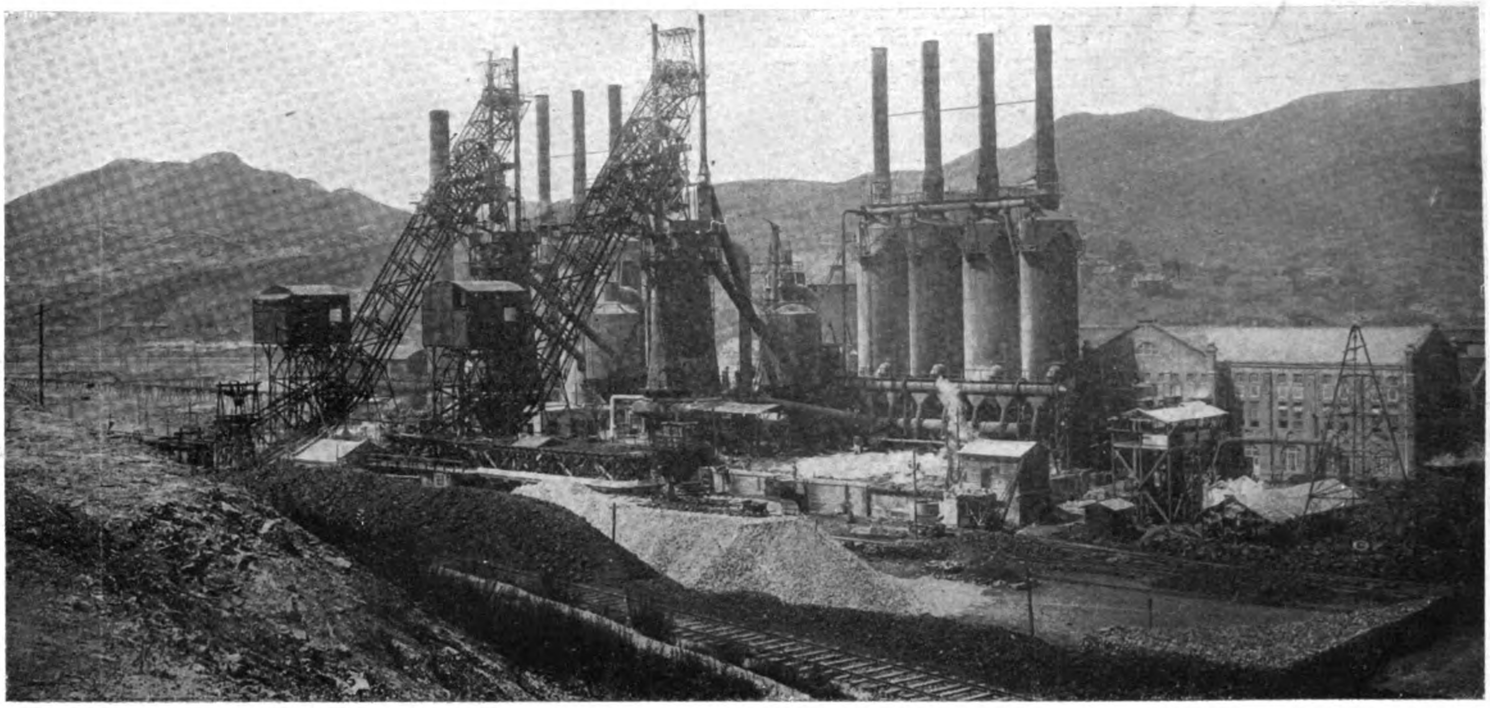
The coal mine and blast furnaces of the company are located in what is known as the Fen-chi district of Fengtien province, 47 miles east of Mukden on the Mukden-Antung division of the South Manchuria railway. Its commercial position is somewhat unfavorable, inasmuch as it is difficult for its product to compete with the superior advantages of location enjoyed by the Fushun mines of the South Manchuria railway. This was one of the compelling reasons which decided the Chinese government to give its consent to expand the original coal concession into an iron and steel enterprise. The mines being 283 miles from Dairen and 147 from Newchwang. its products are shipped to the latter port except when the Liao River is frozen over in winter and closed to navigation.

Penchihu Coal Field

The Penchihu coal field extending over an area of 9,444 acres, embraces 17 veins of varying thickness aggregating 550-ft., of which the following are being worked: the Paocha vein, 7-ft. thick, Hsiangtuan vein, 4½-ft., Choucha vein, 3½-ft., Ihsiching 5½-ft., Erhhsiching, 9-ft., Shanhiching, 3½-ft. and Wuhsiching, 4-ft., total thickness, 40-ft. The veins outcrop 900-ft. above the level of the Taitse River with a dip of about 15 degrees in the upper stratas and nearly 30 degrees in other places.

The first pit for mining the three upper veins, was sunk in April 1906, coal being struck at a depth of about 600-ft. Three inclined shafts were driven at the same time for haulage, drainage and ventilation. No. 2 pit, 12-ft. in diameter, was started in October, 1907 and sunk to a depth of 310-ft. This pit is lined with brick and serves for pumping and ventilating all the other pits and inclines. No. 3 pit was started in 1908. Originally, the Paocha and other veins were worked on the combined pillar and stall system but after various trials, sand-flushing was adopted for all the workings.

Hoisting and winding engines are used on the inclines for hauling out the coal cars and electric locos on the levels. Twenty-five pound rails are used on the inclines and twelve pound on the levels. For conveying the coal between the levels and the working places troughs made of steel plate are used in pit 1, which has a gradient of 30 degrees. In pits 2 and 3 where the gradient is only 18 degrees, baskets and sleds are used. Roller bearing steel coal

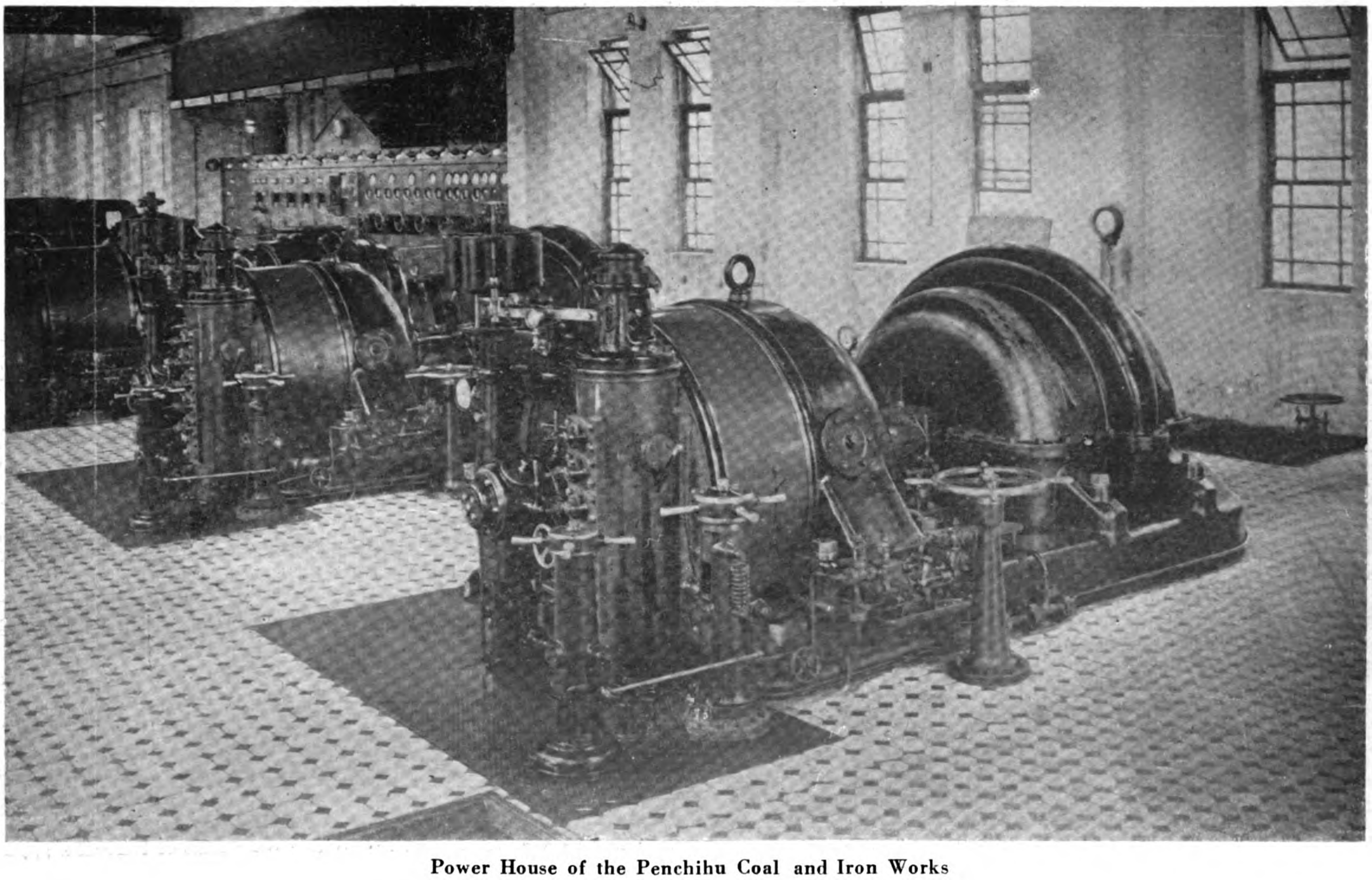


General View of the Penchihu Blast Furnaces

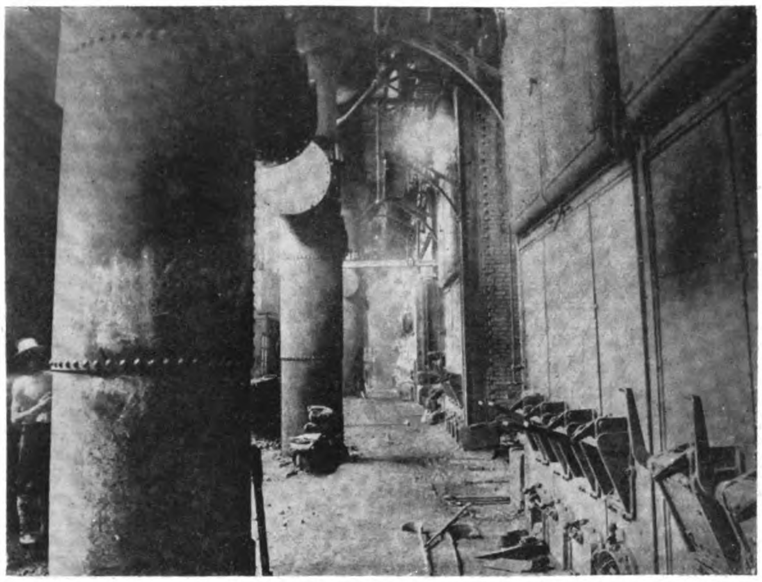
cars with a capacity of 25 cubic feet or 6 tons are used to bring out the coal.

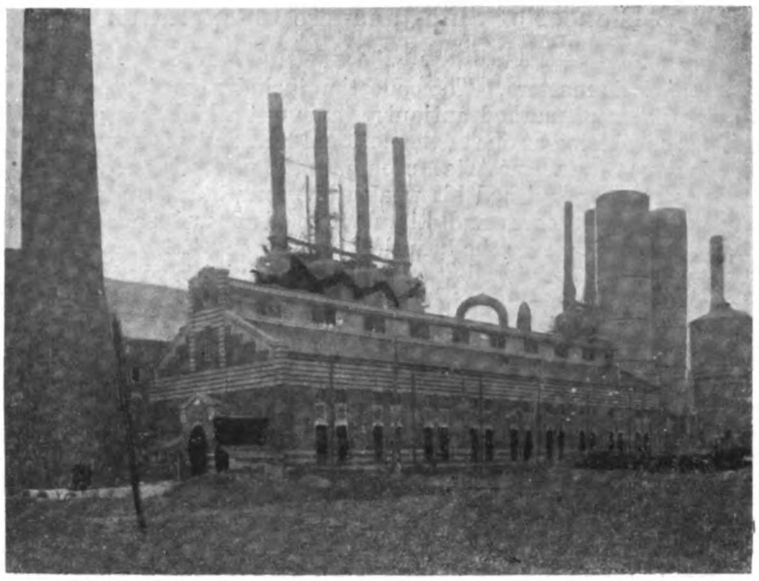
Pit No. 1 was originally operated by a cross-compound winding engine, which was a converted to a motor driven type with a cable speed of 120-ft. per minute. In pits 2 and 3 a motor driven double drum winding machine with a speed of 150-ft. per minute is employed, the coal being carried to the screening plant by means of an endless cable. One motor-driven Capell fan of 140,000 cubic feet per minute installed at the mouth of pit 2 supplies ventilation to all the pits which are connected together in the lower levels. Interior ventilation is also produced by a number of fans of 1,000 cubic feet per minute installed at each pit. Motor-driven turbine pumps keep the workings dry. Clanny lamps are used by the miners and Davy lamps by the officials. Electric current is supplied to all the pits for power and lighting. The miners work in two shifts, one from 5 a.m. to 5 p.m. the other carrying on during the night.

The present output of the mines is from 2,800 to 3,000 tons of coal per day. No. 1 pit employing about 600 coolies is giving from 700 to 900 tons per day, No. 2 pit with the same number of workers from 600 to 700 tons and No. 3 pit from 400 to 500 tons per day. In pits 1 and 3, three veins are being worked and in pit 2 five veins; a total of eight veins having a total thickness of 40 to 45-ft.



Power House of the Penchihu Coal and Iron Works

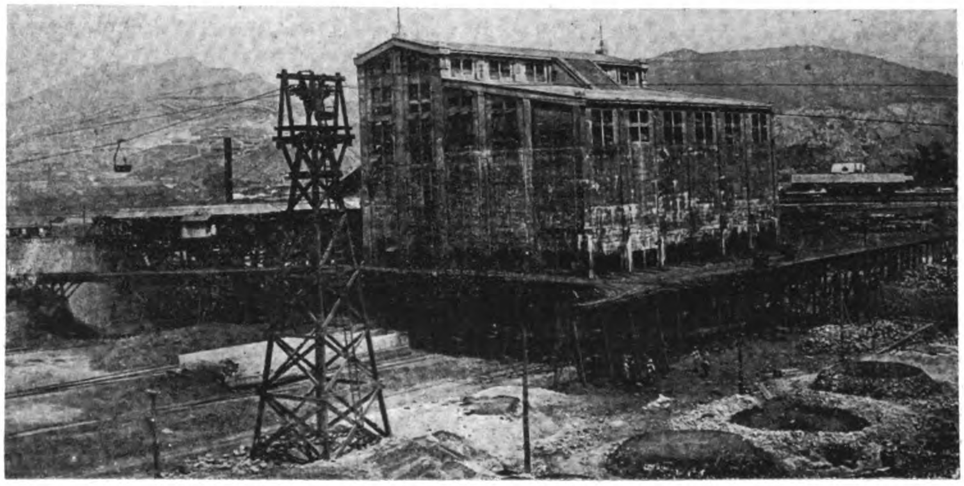




Exterior and Interior View of Boiler House at Penchihu

Electric Power Plant

Power for the various uses of the mine is generated at the company's plant attached to the works. It also supplies light for the towns of Penchihu, Kiaotao and Nanfen. The plant is equipped with one G.E., 2,500 k.w. and two A.E.G. 1,500 k.w. turbo-alternating sets. There are also two 840 h.p. A.E.G. and one 1,200 h.p. Escher-Wyss turbo-blower sets for the blast furnaces, three smaller direct current generators of Japanese make and two A.E.G. motors for driving the pit winding engines. The steam generating plant, using coal or blast furnace gas as required, has six Borsig boilers with a total of 4,300 square feet of heating surface and three B. & W. boilers with a total of 4,396 sq. feet of heating surface, working at 175 lbs, pressure superheated to 200 degrees.



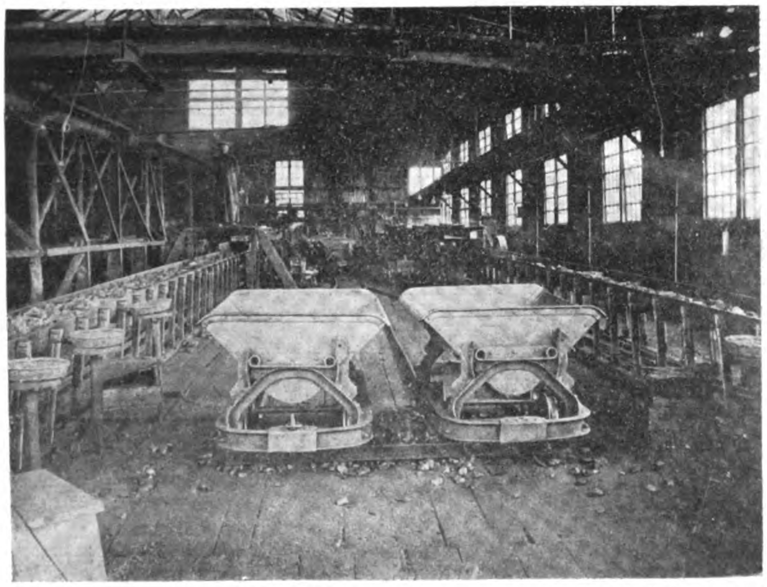
Coal Washing and Screening Plant at Penchihu

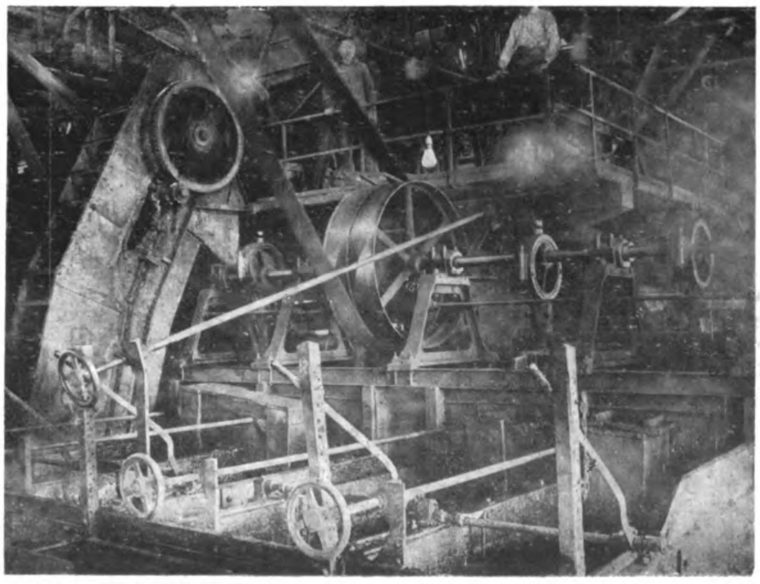
Blast Furnaces

The two blast furnaces are of 130 tons capacity each. The first furnace, blown in on June 13, 1915, was purchased in England and Germany, while the second was made at the Shakako Works of the South Manchuria railway at Dairen. These furnaces are 88-ft. high, 11-ft. $1\frac{1}{2}$-ins. in diamater at the furnace mouth and 9-ft. 10-ins. hearth diameter. The charging tower, worked on the Panlich system, is 164-ft. high.

The furnaces used to heat the blast are of triple McClure type each 20-ft. in diameter and 90-ft. high being surmounted by a 70-ft. stack. The intake for air is at the top and the waste heat of the blast furnace gases raises the air current to a high temperature before it is admitted to the tuyêres above the blast furnace bearth. The blowers operate at 2,500 revolutions a minute and furnish 720

(*Continued on page 89*)





Interior of Coal Washing and Screening Plant

A Pioneer of Sino-Japanese Co-operation

(*Continued from page 59*).

modern Asiatic masters. The collection includes carvings, pictures and porcelains of marked antiquity, amongst which is a group of Buddhas considered as one of the national treasures of Japan. This is the famous Okura Fine Arts Museum, in the perfection of which its founder not only lavished his wealth but found that same relaxation from business cares and stimulant to his energies as did J. P. Morgan in his search for the beautiful in the art galleries of Europe.

In 1898, he established at a cost of a half million yen the Okura higher commercial school, in Tokyo, from which many students have graduated and made their mark in the business and industrial world of Japan. Another million was donated in 1907 to establish similar institutions in Osaka and in Seoul. He has contributed freely to succur the sufferers from flood and famine in Japan and China and last year donated a million yen to the emperor's relief fund for the earthquake victims.

The attitude of the house of Okura towards labor is best expressed by Mr. C Kadono, vice-president and active head of the Okura interests, in an interview recently published in *The Japan Advertiser*. At a time when it is generally admitted that Japanese laborers and skilled workmen are paid entirely out of proportion to their efficiency and earning power and a general tendency to economize by reducing wages is seen on all sides, the active head of the vast Okura interests takes the saner and broader stand that labor should be encouraged to greater efficiency and increased production by shorter hours and better wages.

The proper relation between capital and labor constitutes the most vital problem confronting the captains of industry in America and Europe and has been partially solved by increasing the efficiency of labor through a betterment of its economic and social status. The same problems will have to be faced as Japan becomes more highly industrialized, and their solution will also depend largely upon the measures taken by capitalists to better the general condition of her working classes Mr. Kadono sounds the right note. The road to real prosperity and world recognition of Japan's right to equality lies in this direction.

The life of Kihachiro Okura is a romance of money-making as interesting and as worthy of high commendation as those of many better known American and European millionaires. Born in 1836 in Echigo, he came to Tokyo at the age of eighteen to seek his fortune, starting at the bottom of the ladder as an employee in a drug store. Five years later, he opened business on his own account. The wars of the restoration gave to Baron Okura his real start on the road to fortune through the importation and sale of arms to the clansmen, his business bringing him into intimate relations with the statesmen of the early Meiji period and earning for him a commanding position in the commercial world. In 1872, when Prince Ito made the first tour of foreign countries in order to investigate foreign methods and apply them to Japan, Kihachiro Okura, formed part of his large suite, the first Japanese business-man to make the tour of the world. On his return in 1874 he organized the Okura-gumi, the pioneer foreign trading company in Japan, its branch office opened in London during the same year being the first branch of a Japanese concern in a foreign country. From this beginning the activities of the Okura-gumi have expanded until now they cover nearly every line of commerce and industry with offices in all the principal cities of Japan and branches throughout China as well as in Vladivostok, Sydney, San Francisco and New York.

The civil war of 1894, the Sino-Japanese and the greater Russo-Japanese conflict found the Okura-gumi fully equipped and organized to act as the leading government contractors for the supply of arms, munitions and supplies to the military forces. The provisioning of Japan's army and navy had since constituted one of the most interesting branches of the wide-spread Okura activities, leading the firm to engage heavily in the China and Mongolia cattle trade and to acquire cold storage plants in Tsingtao, Tientsin and Manchuria. In the struggle for existence which confronts Japan, the need for beef, mutton and other meat foods is increasing rapidly from year to year and the one dependable source of near-by supply lies in Chinese territory, in the province of Shantung and the plains of Mongolia. The foundation laid by the Okura-gumi as army contractors has given the firm an exceptional advantage to utilize its organization for this purpose.

Outside of the companice which bear his name, the Okura holdings are so wide and varied that it would be difficult to enumerate them all. Sufficient to say that Baron Okura is deeply interested in the Bank of Taiwan, the Hokkaido Colonial Bank, the South Manchuria Railway, the Tokai Paper Mill, Otaru Timber Co., Japan Leather Company, Japan Chemical Industrial Co., Imperial Hotel, Imperial Theatre, Imperial Flax Co., Tokyo Rope Mfg. Co., Japan Shoe Mfg. Co., Japan Beer Brewery Co., Japan Sugar Co., Tokyo Electric Light Co., Industrial Bank of Japan, Ujigawa Hydro-Electric Co., Nlitaka Sugar Refining Co., Railway Car Mfg. Co., Tokaichi Development Co., Imperial Refrigerator Co., Tokyo Wool Factory, Akita Timber Co. and many others.

In China, he has built up the Penchihu Coal & Iron Mining Co., and is one of the largest shareholders in the Han Yeh Ping Iron and Steel Corporation. The engineering world, however, will always associate the name of Okura with the introduction of modern machinery and industrial methods into Japan. This branch of the Okura business was established in 1891 and in addition to acting as the agents and representatives of many of the best foreign manufacturers of machinery, the engineering department entered into the general contracting field undertaking all branches of public works, buildings, bridges, railway and harbor construction and reclamation work.

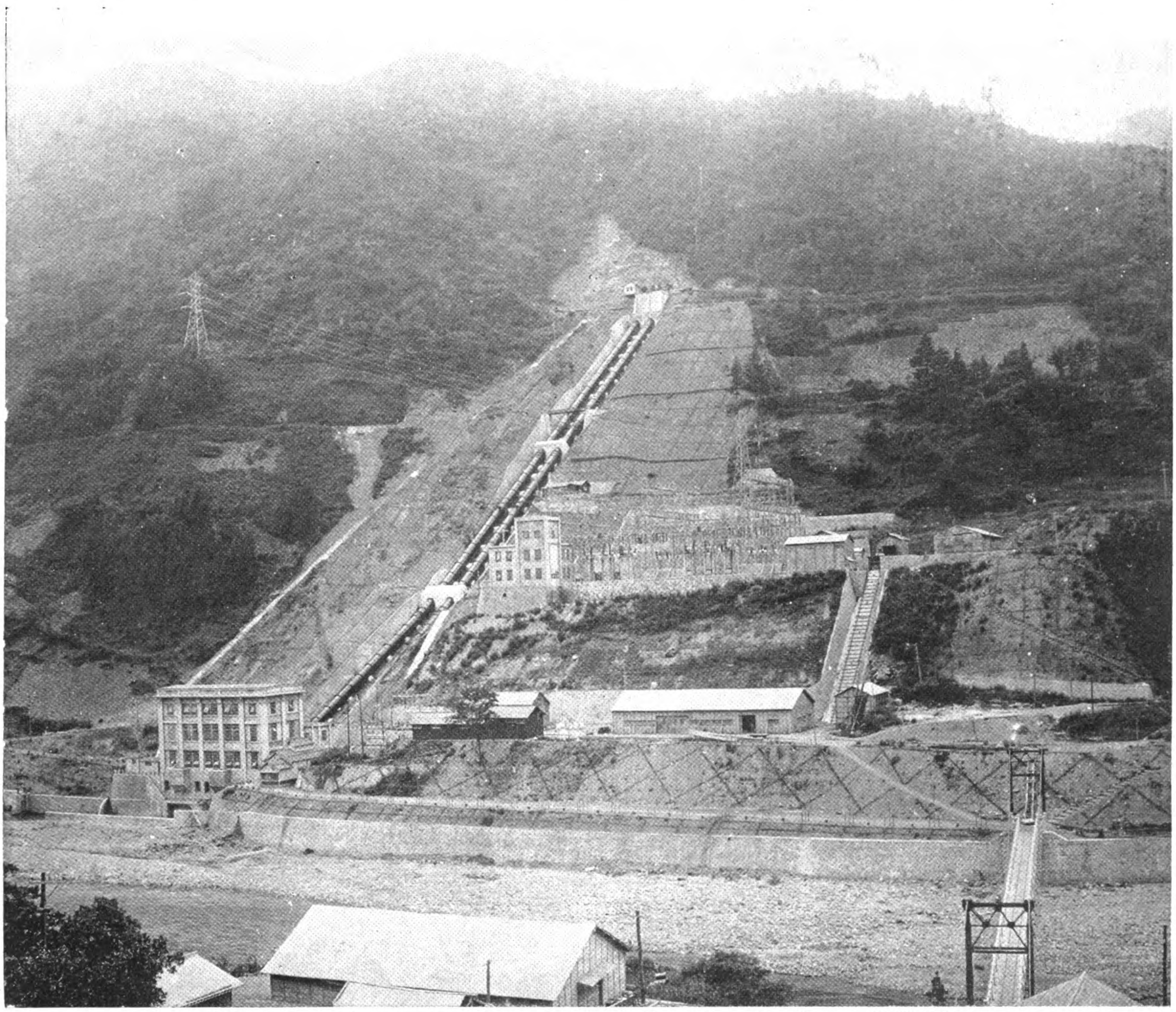
Early in life Baron Okura recognized the vital importance to Japan of the closest political and commercial relations with China and many of his years and a great part of his fortune has been spent in developing this intimate contact through the investment of Japanese money in Chinese concessions and in the establishment of joint industrial undertakings. He has always played fair with his Chinese associates and as a consequence enjoys their respect and confidence to a degree greater perhaps than any Occidental or other Japanese. A large part of his energy has been expended in developing the various resources of Manchuria and Mongolia.

Although these investments have not always proved profitable and the successful operation of various enterprises has been hampered by Chinese ignorance, hostility and official interference, Baron Okura remains firm in his belief that it is in this region that Sino-Japanese business co-operation will bring the greatest and most lasting benefits to both countries. The prosperity that has come to Manchuria, filling the pockets and swelling the bank accounts of Chinese of all classes, is due primarily to the operation of the South Manchuria Railway but the many independent Japanese enterprises in that region have also played a large part in creating these riches. Foremost amongst the latter has been the firm directed by the optimistic Baron whose faith in the country has brought many millions into it on which the Chinese alone have so far drawn down dividends.

His Chinese friends with their profound veneration for age and characteristic lavishness in making presents to those they respect, deluged the Baron with such costly gifts on the occasion of his recent birthday that many had to be returned to their senders because of the prohibitive luxury tax now in force in Japan. It was largely to reciprocate this expression of good-fellowship and entertain his Chinese friends in a proper manner that he planned the gala fêtes that met with such opposition from the Radicals of his own country.

The incident, however, closed happily with a series of receptions held at the Imperial Threatre in Tokyo (in which Baron Okura is the chief shareholder) in honor of the occasion. Thousands gathered to pay their respects to this last of those leaders of Old Japan who had the foresight and courage to pry their country out of the rut of ages and elevate her through industry and commerce to her present proud position amongst the nations. The premier and members of his cabinet, officials of all grades and ranks in the service of the Mikado, bankers, manufacturers and merchants, whose names are famous in international trade and finance, members of the diplomatic corps, foreign and Chinese business men, noted educationalists, men of science and letters, and friends in many other walks of life gathered to honor him. The most nted actors of the Japanese stage and the famous Mei Lang-fang entertained them. It took five days to hold the receptions, a remarkable tribute to the esteem in which he is held not only in Japan but in other countries.

His business career ended, he now bravely announces his determination to pass the remaining years of his life in promoting friendship and closer relations between Japan and China. He very wisely declares that if permanent friendship is to exist between the two countries it must be based on economic co-operation and to place these ideas into practice he says that notwithstanding his advanced age he will make a visit to Mongolia this spring to arrange the details of a new undertaking.



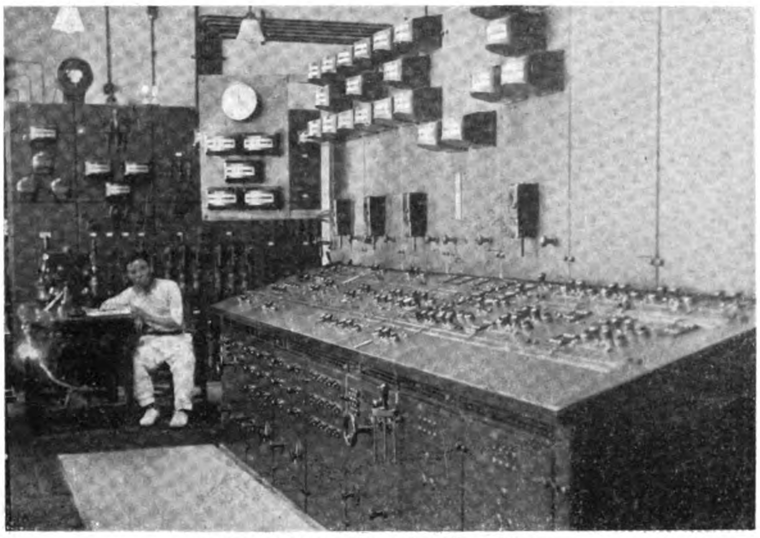
View of the Ryushima Generating Station of the Keihin Electric Power Co. Capacity 26,000 KVA.

Power Development of the Keihin Electric Power Company

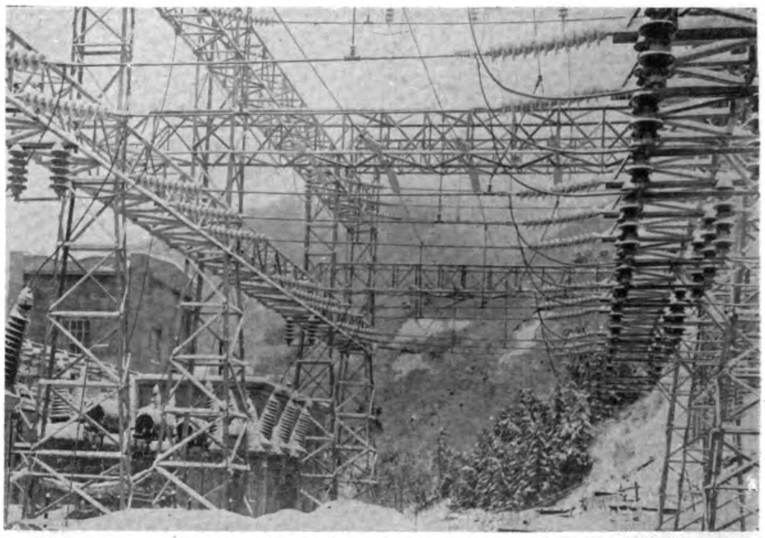
From Notes Supplied by Y. Yamada, Chief Engineer of the Keihin Denryoku K. K.

IN the development of high voltage transmission for tying together the scattered plants of large super-power systems in Japan, 154,000 volts has been determined as the standard voltage for the step-up transformers at the generating stations, with a secondary distribution at the receiving stations in the Tokyo district of 66,000 volts. One of the pioneer companies to adopt the new standard was the Keihin Denryoku Kabushiki Kaisha, whose power stations in Nagano prefecture have been transmitting current at this pressure to Yokohama and Yokasuka since 1923. The first unit of the system, known as the Ryushima generating station located on the Saikawa River has a capacity of 20,050 k.w. The receiving station at Yokohama is equipped for 66,000 k.v.a. and the two are connected by 125 miles of double circuit transmission line.

The power for this station is obtained from the Saikawa River which has its source on the Japanese alps. The normal flow is 720 cubic feet per second and 400 cubic feet minimum with an effective head of 430-ft. The water, led through a canal 5.78 miles long (97 per cent. tunnels) takes in the Oshirokawa and Kurokawa rivers on its way to the head tank at Ryushima. Two lines of riveted steel pipe, 810-ft. long, 7-ft. 6-in. and 7-ft. in diameter. $\frac{5}{16}$-in. and $\frac{15}{16}$-in. minimum and maximum thickness, convey the water from the head tank to the station. There are also two regulating ponds with storage capacities of 1,920,000 and 2,260,000 cubic feet for assuring the peak load during the winter months.



Control Switchboard at Ryushima



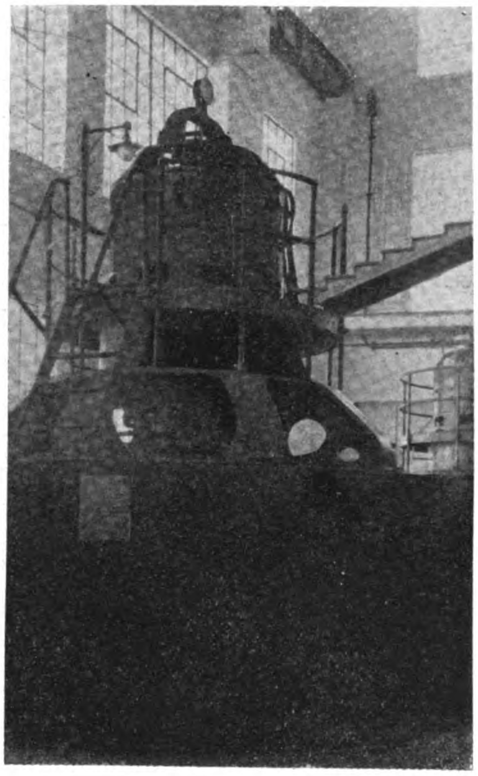
Outdoor Switching Station at Ryushima

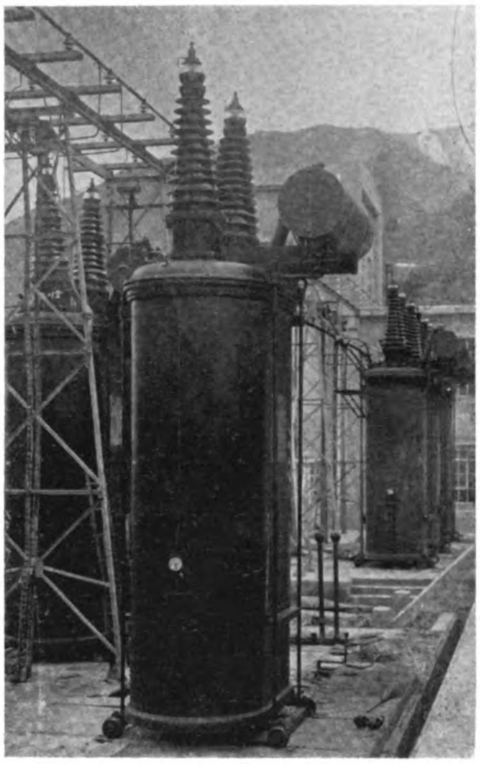
Power House

As will be seen from the illustration, the power station consists of an indoor and outdoor installation, the latter being located half way up the hill. The power house of reinforced concrete construction is equipped with two Allis-Chalmers vertical shaft, Francis type turbines, developing a maximum of 18,000 horse-power at 375 r.p.m. These turbines are provided with water cooled lignum-vitæ bearings and telescopic draft tubes for easy handling and inspection of the runners. The governors, installed on the switchboard floor for convenience of attendance, are fitted with shaft flyballs. Pressure regulators of 60 per cent. discharge capacity are also provided for safety.

The turbines are coupled direct to General Electric generators, each 13,000 k.v.a. 6,600 volts, 50 cycles with flywheel effect of 1,100,000-ft.-lbs. These generators are fitted with spring thrust bearings. The direct coupled exciters are of 180 k.w. 250 volts, direct current, shunt type with commutating poles, each capable of exciting two generators.

The main control board is of the G. E. bench type, double bus system arranged on bus bar compartments. The 6,600 volt circuit breaker is of the H. 6 oil type made by the General Electric Company, their interrupting capacities being guaranteed to 20,000 amperes at 15,000 volts normal frequency.





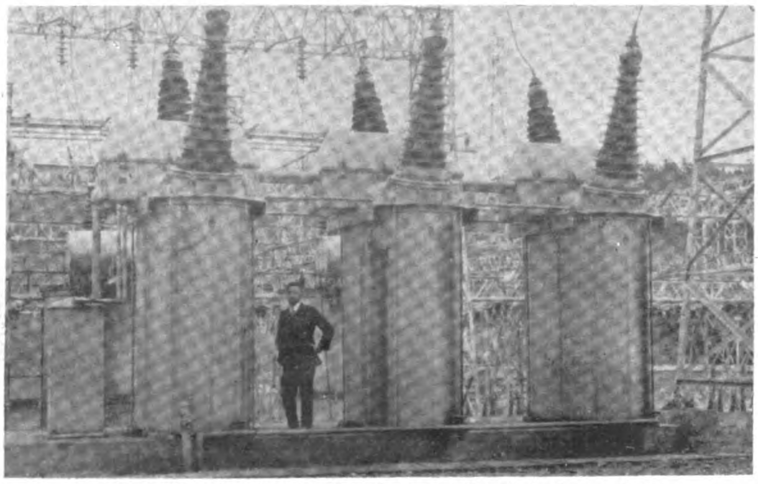
RYUSHIMA POWER STATION

One of the 13,000 KVA, G.E. Waterwheel Driven Alternators

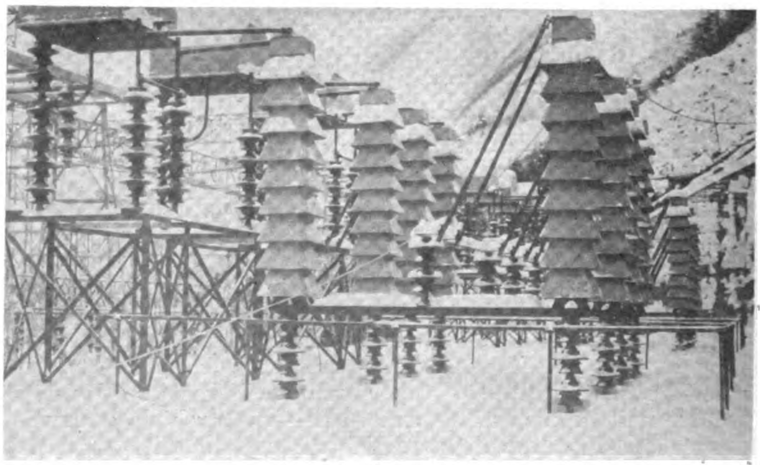
6,000 KVA Transformers, 6,600-154,000 Volts.

Outdoor Installation

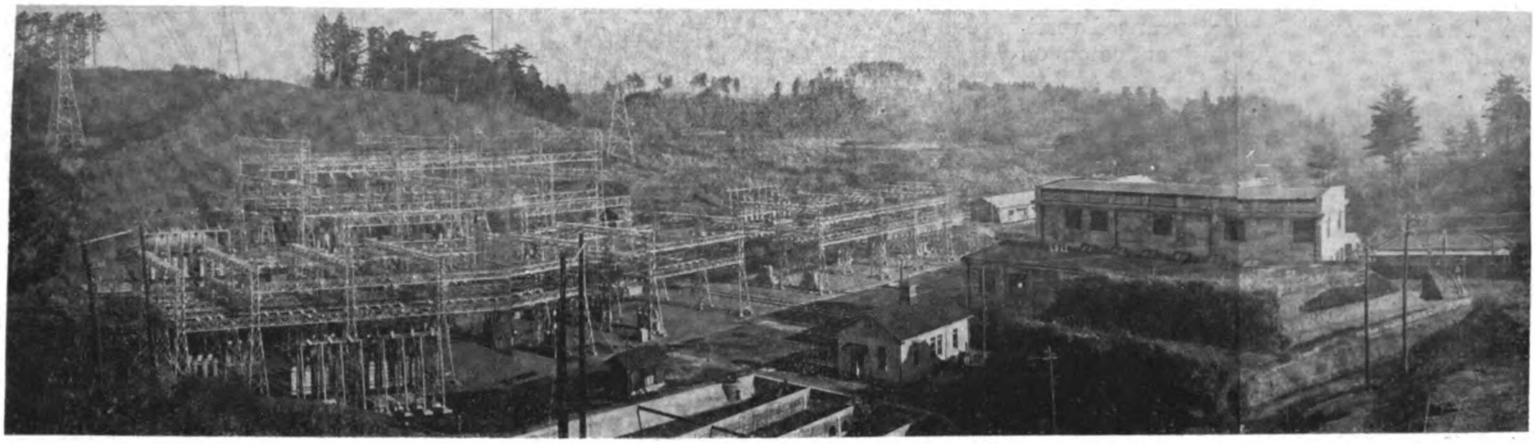
This consists of two G. E. step-up transformers, each single phase, water-cooled, 6,000 k.v.a. 6,600-89,000 volts, 50 cycle, connected up delta-star, the neutral point being grounded through 900 ohms



154,000 Volt Oil Circuit Breakers on the Yokohama Line



Oxide Film Arresters on the Yokohama Line



The Yokohama Receiving Station of the Keihin Electric Power Company at Totsuka

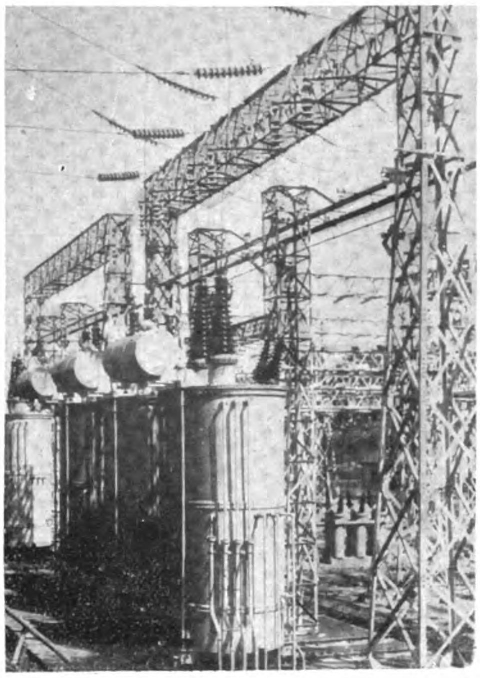
resistance. The double bus arrangement is on a steel frame structure. The oil circuit breakers for 154 k.v. are of the FHKO-36-42 B type made by the G. E. Company, the interrupting capacities being guaranteed at 2,300 amperes at rated voltage and frequency. The first oxide film lightning arresters for such high voltages to be used in Japan have also been installed.

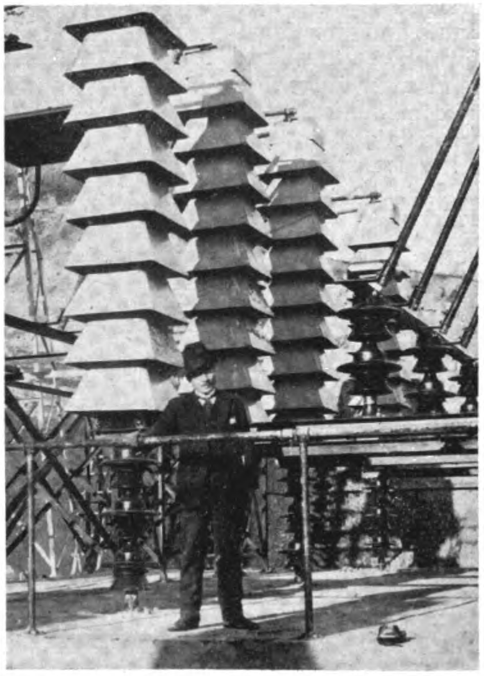
Transmission Line

The transmission line extending from Ryushima to Totsuka near Yokohama, 125 miles in length, cost Y.10,000,000 or about fifty per cent. of the total installation cost. The line not only transmits power from the Ryushima station but takes 17,000 k.w. from the Momayama generating station of the Daido Electric Power Company, and 34,000 k.w. from the Takasegawa station of the Toshin Electric Company at the Shioziri switching station, distributing 25,000 k.w. of this power to Tokyo at the Hashimoto switching station.

The conductors used are steel reinforced aluminum cables 409,000 c.m. from the American Aluminum Company and 400,192 c.m. copper cables of Japanese manufacture. The aluminum cables are used on the first ten mile section where transmitted power is assumed to be less than in the further sections.

There are 942 galvanized steel towers set on concrete foundation, including 689 standard towers, 168 angle towers, 68 strain towers, 8 transposition towers and 9 special towers carrying three phase single circuit on each side and a ground cable on their

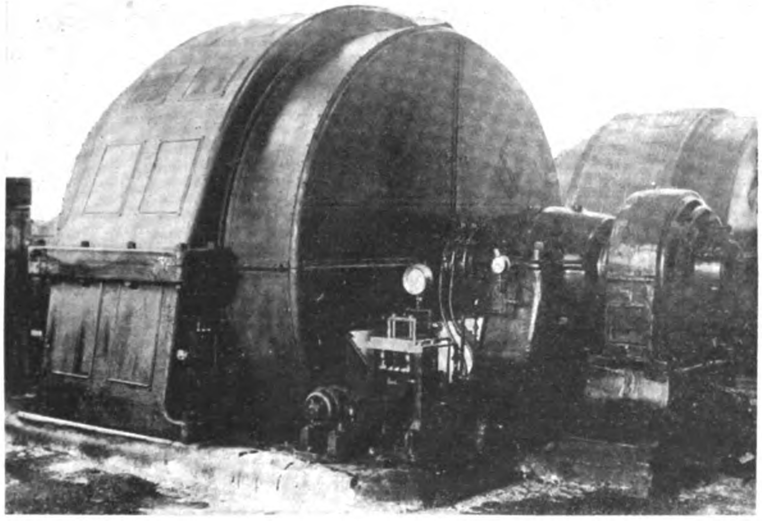


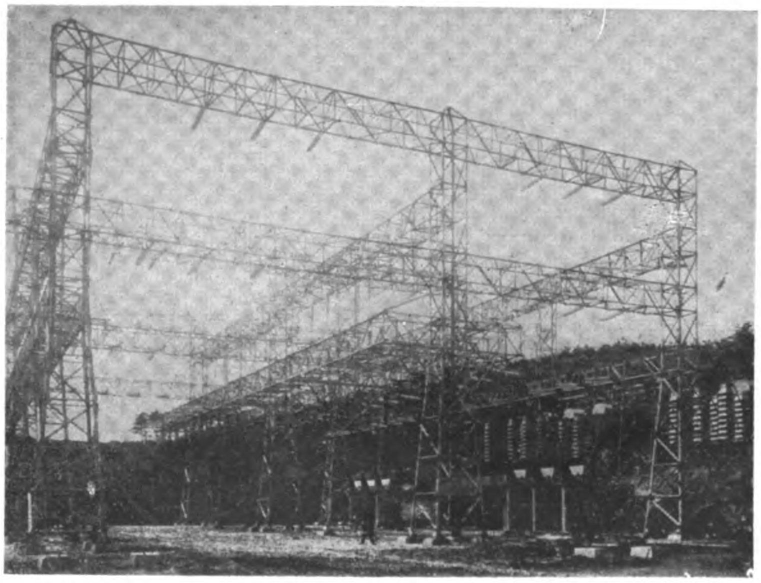


YOKOHAMA RECEIVING STATION

6,000 k.v.a. Step-Down Transformers, 140-000—66,000 volts, with Tertiary Windings for Syn-Chronous Condensers

154,000 volt Arrester Stacks





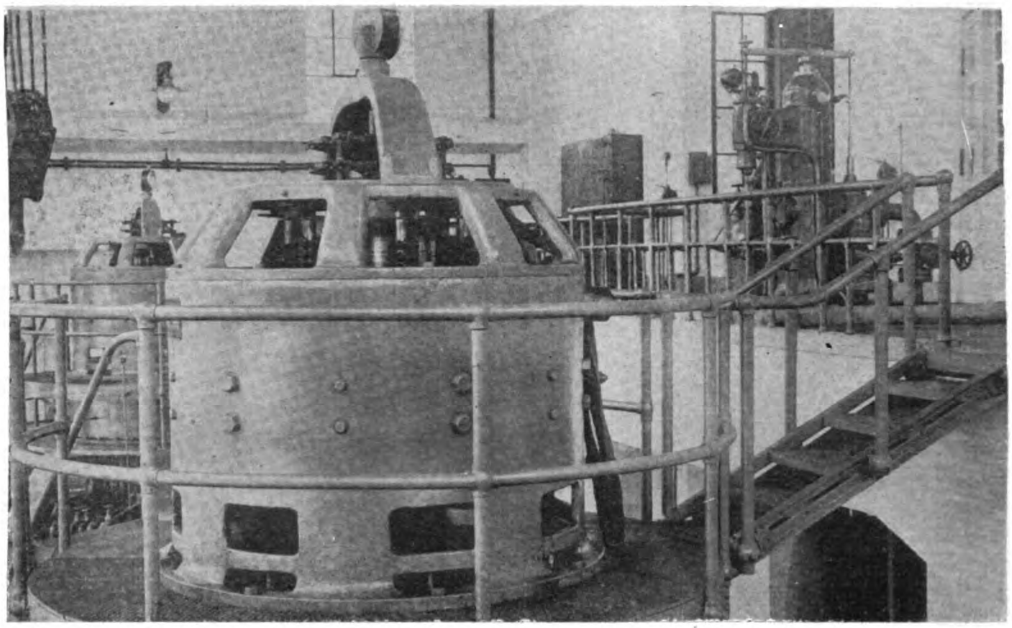
YOKOHAMA RECEIVING STATION

15,000 k.v.a. Synchronous Condensers

Outdoor Sub-Station, 154,000 volt side

tops. The line conductors are arranged vertically, the upper and lower laying conductors on a vertical plane with a horizontal offset of 2-ft. 5-in. for the middle conductor and vertical spacing of 13.5 feet. The line, transposed four complete turns in the total length, is subdivided in five sections by switching stations where future incoming and outgoing lines will be connected.

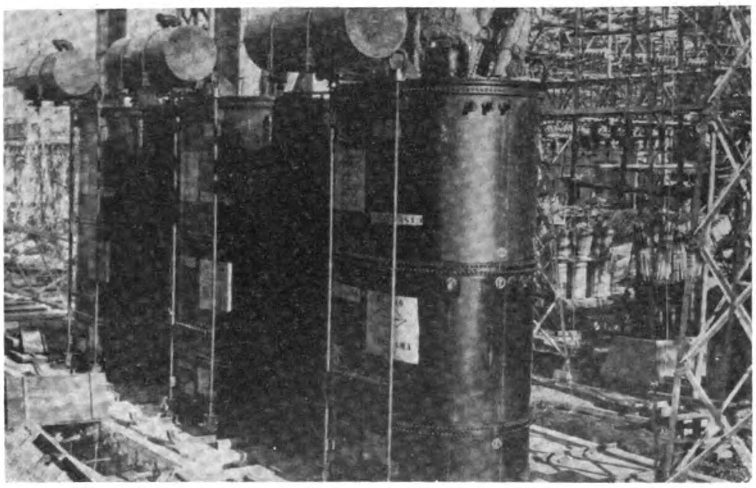
Insulators are of the suspension type, ten inches in diameter, part manufactured by the Ohio Brass Co. and part in Japan. There are ten units for standard towers and eleven units for angle and strain towers, etc. Care has been taken that eleven unit stringing is used for high altitudes (4,000-ft. above sea level) along the line. Four circuits of telephone lines are on separate wooden poles and satisfactory communication is obtained. A relay combination of 6 inverse time limit overload relays IA-101, an auxiliary relay PQ-3, and a duo directional over current relay IB-Y2 furnished by General Electric Co. is used at the sending end for line protection. Another relay combination of 3 inverse time limit overload relay, a reverse power relay IK-105, and a low current inverse time limit overload relay IA-103, is used at the receiving end for line protection.



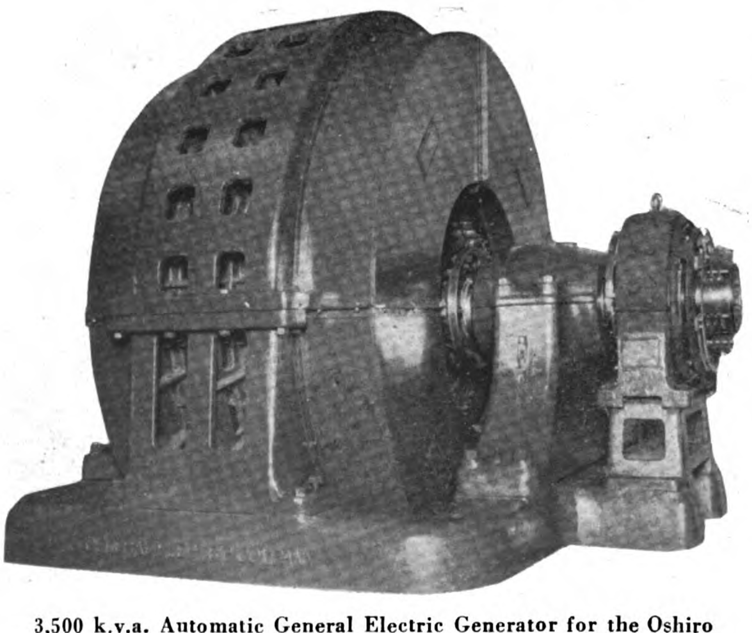
Direct Coupled Exciters at the Ryushima Station, showing also the Allis-Chalmers Turbine Governor in Switchboard Floor

Receiving Station

At the receiving station, the transmited power is stepped down from the transmission voltage of 140,000 volts to the feeder voltage of 66,000 volts and combining the power from the Hakone power stations of Tokyo Dento Kabushiki Kaisha, is distributed to Tokyo, Yokohama and Yokosuka. Two banks of G. E. step-down transformers, each single phase, water-cooled, 10,000 k.v.a., 11,000 k.v.a., 5,000 k.v.a., 80,900-38,1,000-11,000 volt, 50 cycle are connected up star-star-delta, the tertiary windings of 11,000 volt being provided for synchronous condensers.



Additional 11,000 k.v.a. Transformers at Tutsuka



3,500 k.v.a. Automatic General Electric Generator for the Oshiro Power Station of the Keihin Electric Power Co.

Two G. E. Synchronous condensers, each 15,000 k.v.a., 11,000 v., 3 phase 50 cycle, 600 r.p.m., are installed. Condensers are started by starting compensators. Buses for 140 k.v. and 66 k.v. are arranged on outdoor steel structures. Bus for 11 k.v. is arranged in bus bar compartment.

All switching equipments are manufactured by the General Electric Co. The station will supply power to a substation of imperial government railway near future and play an important role in the railway electrification.

The Keihin Denryoku has also ordered from the General Electric Company the electrical equipment for what will be the largest automatic hydro-electric power generating station in Japan. The station, to be constructed on the Oshiro River, will consist of a 3,500 k.v.a. generator driven by a J. M. Voith Company water wheel with full automatic control designed to perform automatically and in proper sequence all of the operations of starting, running, and shutting down ordinarily performed by the station attendant in a manually operated station. By simply energizing the transmission line from the controlling power station, the wheel is started, the generator is synchronized, and assumes its load.

The equipment includes in addition to the usual protective device of a manually operated station, protection against sustained overloads, hot bearings, low voltage, underspeed, overspeed, and other irregularities usually cared for by the station attendant.

A similar equipment except of smaller capacity has been operating very successfully in a Toho Denryoku power station in Kyushu.

New Holt Liner for Far Eastern Trade

The new holt liner *Antenor* has just been launched by Messrs. Palmer Shipbuilding Co., of Jarrow-on-Tyne. She is the last of four specially built by this firm for the service between London and China. The *Antenor* will have accommodation for 100 first-class passengers. The carriage of frozen produce is being specially catered to as 20 per cent. of her cargo space is set apart for that purpose, the remaining 80 per cent. being devoted to general cargo requirements. Considerable satisfaction is being expressed in Liverpool, where the head office of the Holt line is situated, that a service between the Thames and the Far East will at last be controlled from that city (London).

The Penang Municipal Power Station

Some Notes on its Construction

Paper Read Before the Engineering Association of Malaya

By T. A. Owles, Assoc. M. Inst. C.E.

SOME 2½ yeare ago the Penang municipality foresaw the need of greatly enlarging their electric power supplies, the existing installation in Penang being out of date and insufficient for the rapidly increasing demands.

There being no suitable site in Penang, inland, owing to the impossibility of obtaining an adequate supply of circulating water and on the available ground on the foreshore, owing to excessive cost of long intake culverts for the circulating water, necessitated by a low muddy foreshore : a site further afield was therefore considered.

At this time the F.M.S. railways were proposing to erect and equip a power station at Prai for the supply of power and lighting to the new wharves there, and an agreement was arrived at between the F.M.S. government and the Penang municipality whereby the latter should build and equip the station at Prai, supply the current required by the railways and other probable users in province Wellesley, and convey current to Penang by submarine cable to the island.

The engineers for the electrical installation are Messrs. Preece, Cardew & Rider, and Messrs. Coode, Fitzmaurice, Wilson & Mitchell are responsible for the design and construction of the foundations, circulating culverts, and building.

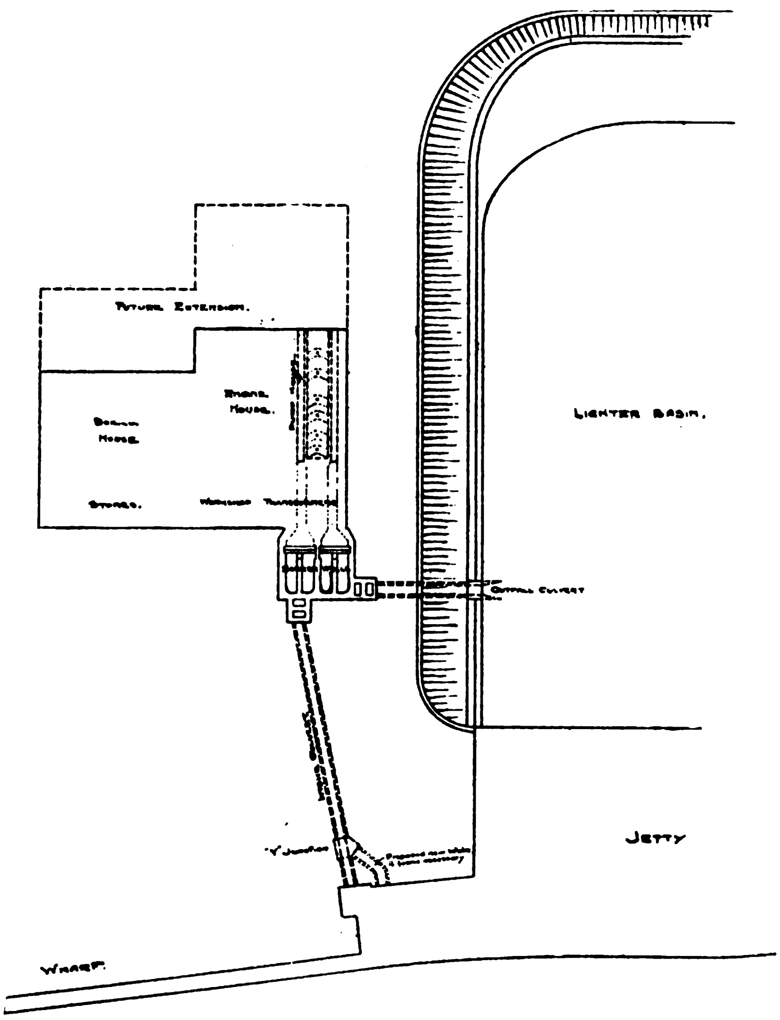
Situation

The site decided on was on the reclaimed ground at the east end of the lighter basin and an area of 70,000 sq. ft. reserved for the purpose ; of this area about 24,500 sq. ft. are taken up by the first instalment now in progress of construction. This site is particularly suitable from the point of view of the circulating water supply, as comparatively short culverts give acess to the river through the wharf wall and to the lighter basin.

The first instalment of the installation now in progress consists of foundations and building for three sets of generating plant:—

(*a*) 1,500 K.W. Parsons set
(*b*) 3,000 K.W. do.
(*c*) 5,000 K.W.

with necessary boiler, coal bunker, stores, and transformer accommodation ; pump wells for circulating water connected by culverts to the screen wells on the north end, which in turn are in communication with the lighter basin on the west, and the river on the north by pipe culverts.



General Plan of the Penang Municipal Power Station at Prai: Scale 120-ft. to an inch

The plans are prepared for a possible extension to take in a further 5,000 k.w. set and a 10,000 k.w. set.

Foundations

As the whole area of Prai consists of a layer of soft river mud 50-ft. to 60-ft. thick overlying a thick sand strata, the problem of supporting a building and machinery weighing about 20,000 tons needs careful consideration, as it is essential that the machinery should be on a rigid bed: it was therefore decided to carry the whole structure on reinforced concrete piles carried well into the sand.

Test piles were driven and later borings put down on the site and sand was found at a uniform level of 52 feet below L.W.O.S.T.

The test piles showed that a sufficient set could be obtained by driving 5 feet into the sand strata, and piles were designed accordingly: this necessitated piles of 70 feet length for the main building and 50 feet length under the pump wells, screen wells, and culverts.

The calculated ultimate load which each pile will bear under a final set of ½-in. under a blow of a 2-ton monkey falling 5 feet is about 120 tons, and no pile in the foundation is loaded to more than 45 tons, and the majority to 30 tons and less.

The contract for the construction of the first instalment of the foundations, screen wells, and intake and outfall culverts was elt to Messrs. Topham, Jones & Railton, Ltd. on May 24, 1923, and work started on pile making as soon as steel arrived, and an average of 470 lin. ft. of pile made per day soon reached : the best week's work being 2,910 lin. ft. moulded.

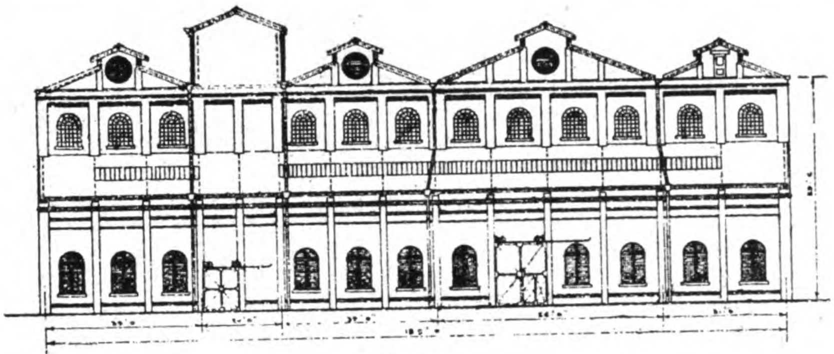
Piles

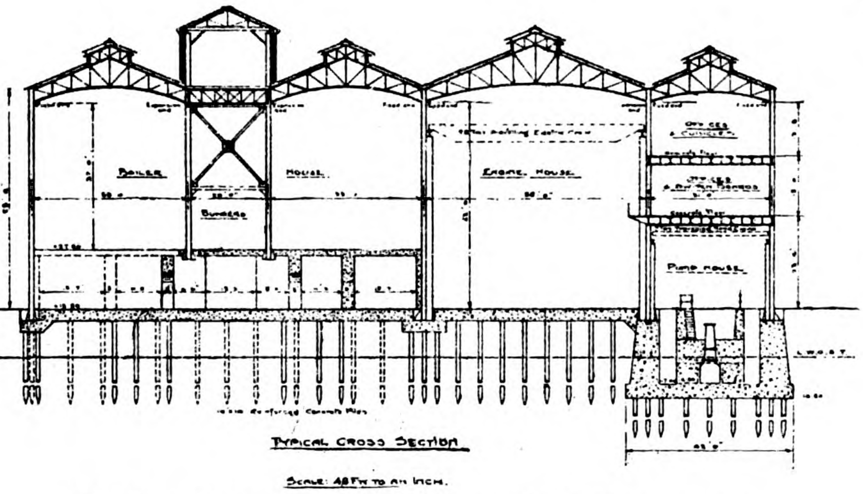
Piles are made of the Hennebique type 14-in. square with 4 main bars 1¼-in. dia. for the 50-ft. length, and 1⅜-in. dia. for the 70-ft., kept in position with ⅜-in. diagonal spreaders every 5-ft. 0-in. and with steel wire ¼-in. dia. links spaced 2-in. apart at ends, and 7½-in. at centre, and shod with a cast iron shoe. Owing to difficulties of transporting long lengths of steel bar, the main bars were designed in two lengths, to break joint near the centre ; joints being staggered a minimum of 4-ft. 0-in.

The concrete in the piles is in the proportion of 2⅝ stone ⅜-in. and under ; and 1¼ sand to 1 cub. ft. or 90-lb. of cement ; minimum cover over bars 2-in.

Piles were moulded on a level floor and remained on the mould bottom for 10 days when they were canted clear, not lifted; after a further there weeks they were lifted and stacked for a further period of a month before being driven.

The piles are transported to the site on cradles fitted on two flat trucks and supported every 5 feet, this being found more suitable than supporting them at the points of lifting only, owing to irregularities in the track jarring the piles and tending to crack them.





Prai Power Station: Typical Cross Section: Scale 48 feet to an inch

On arrival at the site the piles are handled by 15-ton double bond derrick cranes, specially designed for this class of work, which lift and rear the pile up vertical and place it in the leaders of the pileframe.

In the case of the 70-ft. piles a strongback or stiffener is bolted to the pile before it is reared up as the additional strain in bringing it to the vertical position was found to develop slight cracks.

In driving, the heads are protected by a M. S. helmet packed with old rope and belting and fitted with a short timber dolly; this has proved very effective and the pile heads are quite undamaged after severe driving.

In the case of the 70-ft. piles driven from ground level, which is incidentally, I believe, a record for piledriving in Malaya, the crust of red earth and filling hold up the piles from the start and they have to be driven all the way: with the 50-ft. piles driven from the bottom of the trenches however, the pile when pitched penetrates the mud from 8 to 15 feet, giving a skin friction of about $1\frac{3}{4}$ cwt. per sq. foot: they then drive quite steadily till the sand level is reached, hard driving being necessary to penetrate the sand crust which once penetrated gives an average of $\frac{1}{2}$-in., penetration per blow.

Wooden chocks bolted into the pile were tried, but it was found impossible to make these penetrate the sand without excessive punishment to the pile, and they were abandoned.

The final set obtained on piles varies from $\frac{1}{4}$-in. to $\frac{13}{16}$-in. per 5-ft. 0-in. blow of a 2-ton monkey. Tests carried out by loading a group of 4 piles with C. I. Kentledge two weeks after driving showed that with a load of 180 tons (45 tons a pile) a settlement of $\frac{1}{8}$-in. to $\frac{3}{16}$-in. took place, and on increasing this load to 240 tons (60 tons a pile) a total settlement of $\frac{1}{4}$-in. to $\frac{9}{16}$-in. occurred; settlement ceasing 12 hours after the load was applied.

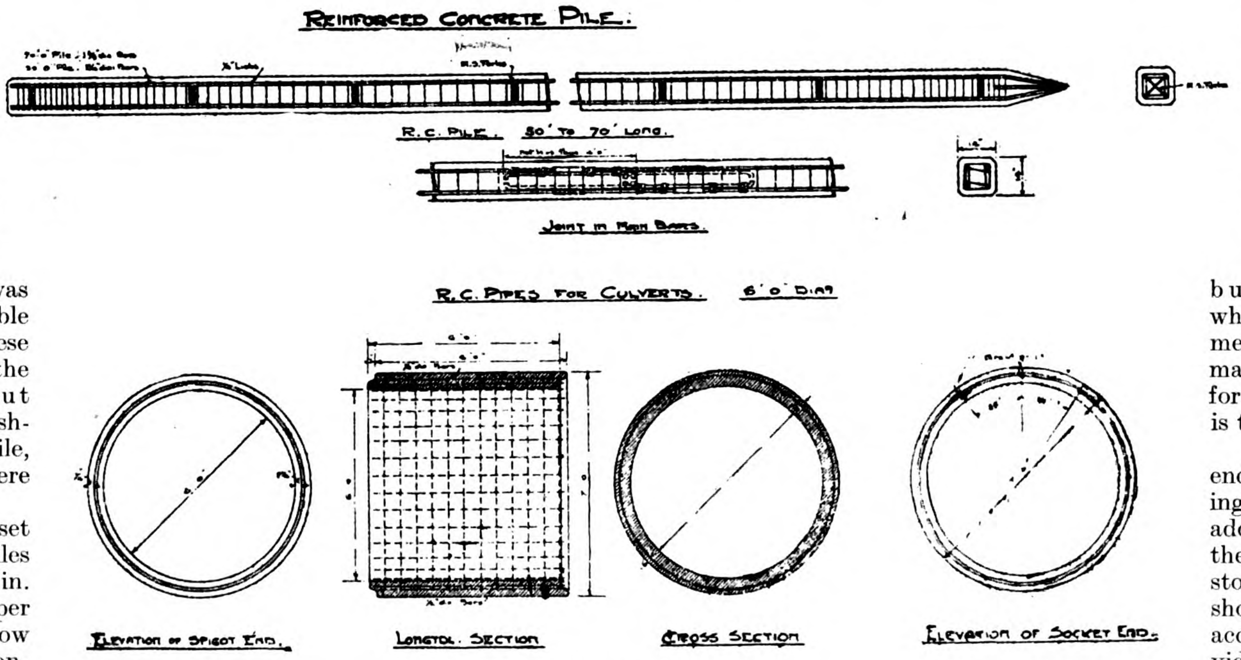
A further test of redriving three piles was made which gave very satisfactory results; these piles had been driven one month previously with sets of $\frac{13}{16}$-in., $\frac{9}{16}$-in. and $\frac{7}{16}$-in. per blow, and after 20 blows gave sets of $\frac{1}{21}$-in., $\frac{1}{42}$-in. and $\frac{1}{84}$-in. showing that the skin friction of the mud is quite a valuable asset in the supporting power of the piles.

The foundations for the first instalment of the building itself consist of 424 piles 70-ft. long, driven from ground level, covered with a mattress of 7 to 1 concrete in mass 3-ft. 6-in. thick, in which the top two feet of the piles are embodied: 18-in. of the steel being bared and bent over to obtain a good bond.

Under all walls these foundations are stepped down 3-ft. 0-in. below the general floor level to allow for the stanchions and footings of the brickwork filling.

The whole area being covered with a 3-in. layer of granolithic concrete after the erection of the building.

The building is of a heavy steel frame structure, with brick filling to the walls, and corrugated iron roofing with ample glazed areas for lighting purposes: it consists of five spans, that on the west side over the pump wells having two upper stories for offices and quarters for the staff. Next to this is the engine house of 56-in. span, this being equipped with a 25-ton overhead traveling crane.



Scale $\frac{1}{2}$ inch to 3 feet

The boilers are arranged in two rows separated by the coal bunkers, for which all arrangements are being made, although for a start oil fuel is to be used.

The north end of the building has a lean to addition covering the transformers, stores and workshop: railway access being provided for by a short spur from

the F.M.S. railway lines leading on to the jetty.

The whole building is surrounded with a concrete drain, leading all storm water from the building into the lighter basin.

The south end of the building is closed with a semi-temporary screen end to allow for future extensions.

Pump Wells and Screen Wells

The pump wells, coming under the west span of the building, consist of three parallel walls of concrete, built on a similar mattress of concrete, capping 50-ft. piles driven into the sand.

The spaces between the three walls forming the culverts for the circulating water; these culverts being arched over under the transformers and leading into the screen wells.

The centre wall is designed with cross culverts connecting the two main channels fitted with sluices at both ends, so that either channel may be used as intake or discharge.

This centre wall forms the seating for the circulating pumps themselves; tapered cast iron pipes passing through the floor of the pump well proper, into the cross culverts.

As the floor of the pump room is only 4-ft. 3-in. above low water, the necessity of keeping these watertight is essential. This is achieved by a 1-in. layer of Seyssel asphalte being incorporated in the concrete floor, this being brought up into the light side walls enclosing it: these walls being only 2-ft. 0-in. thick some experiments were made to obtain a dense waterproof concrete: tests were made with short cylinders of 3 to 1 concrete, with and without the addition of " Pudlo " and Ironite, briquettes being also made for tensile tests.

Results showed that a properly mixed and graded concrete of such rich proportions was preferable to a similar mixture with the addition of either 3 or 5 per cent. of " Pudlo " both for strength and imperviousness. The specimens with an addition of 20 per cent. of " Ironite " however gave almost as good results as the plain concrete, and in the briquettes showed an increased tensile strength to cement: the best use for this material, however, seems to be for a surfacing of floors, as a slurry of one part " Ironite " to three parts cement laid on to a granolithic floor when still green, undoubtedly gives a much stronger wearing surface, the skin of ironite and cement being quite difficult to scratch.

The screen wells consist of a concrete chamber divided into four compartments by light concrete baffle walls; with accommodation for four revolving screens, two of which are being installed at present.

The culverts consist of 6 feet internal diam. reinforced concrete pipes 6 inches thick cast in 6-ft. 0-in. lengths with a spigot and socket joint: these are laid on moulded concrete seating blocks set on a 2 feet mass concrete bed capping 50-ft. piles driven in pairs at 6 feet intervals.

Joints are grouted up through holes moulded for that purpose and concrete deposited round the pipes to keep all in position.

In the river culvert some trouble is anticipated at the back of the abutment where the culvert has already been built in the blockwork: the backing and foundation of the wall consists of heavy rubble and though this was kept down to allow for the linking up of the culvert later, it is expected that a length of this will have to be done under water as it will be very difficult to get a water-tight trench on this stone, and also to drive the supporting piles through it.

To overcome this, the design has been slightly altered; piles being omitted and a heavy bed of richer concrete deposited on the rubble; pipes then laid and the whole covered with concrete in mass.

The actual intake for this culvert consists of a tunnel 5-ft. 6-in. wide 7-ft. 6-in. high built in the blockwork during the construction of the wharf, this leads into a vertical shaft in the back of the abutment, covered with a chequer plate cover and fitted with a heavy galvanized grid.

The culvert to the basin is taken out direct through the rubble slope and the outlet consists of a 20 feet length of mild steel pipe covered with concrete and fitted with a heavy steel grid.

Either culvert may be used as intake as the arrangement of sluices in the pump wells permits the drawing of water from either source of supply.

The whole of the concrete in the walls and floors of screen wells and pump wells is of 7 to 1 mixture, with a 6-in. facing of 4 to 1 fine concrete brought up simultaneously with the 7 to 1.

The 7 to 1 was graded in the following proportions :—

Stone $1\frac{1}{2}$-in. to $\frac{5}{8}$-in.	5.6 c. ft.
Sand	3.1 c. ft.
Cement	1. c. ft.

The 4 to 1 fine concrete :—

Stone $\frac{5}{8}$-in. to dust	4. c. ft.
Cement	1. c. ft.

This stone, screened from the crusher run was found to contain 42 per cent. below $\frac{1}{4}$-in. to dust and the voids amounted to $36\frac{1}{2}$ per cent.: the fine concrete, therefore, required no sand added to make a very dense concrete.

The concrete deposited under water, below the culvert pipes is of 4 to 1, and around and over them, of 6 to 1 : this will be deposited in skips with double doors opening outwards to avoid washing of cement from the aggregate.

A few remarks on the difficulties so far encountered may be of interest: all the excavation for the pump and screen wells and culverts having to be carried down to 10-ft. 6-in. below low water, the whole has had to be done inside close sheet piling. In the case of the pump wells, a width of over 42-ft. had to be removed and the timbering for such a trench would have been very heavy and would have prevented the driving of the piles in their correct positions.

The whole area of the pump and screen wells was divided up into six separate trenches of an average width of 23-ft. 0-in. and these excavated in rotation: even with these precautions a lot of trouble was experienced with the first two trenches; considerable settlement occurred, combined with a tendency for the bottom of the trench to close in, and 14-in. by 14-in. timbers began to crack in an alarming manner. Extra timbers were put in and no further trouble experienced; piledriving and concreting being successfully carried out.

A further source of trouble has been the discovery of two or three old tongkangs buried in the mud under the area of the main building, and it was found impossible to drive the 70-foot piles through them as the timber is in a well preserved state: these are being exposed and removed when piling will be completed.

Equipment

A few words on the plant which is to be installed will no doubt be of interest.

The first instalment as at present being constructed is capable of accommodating :

One 1,500 kilowatt turbo-generator
One 3,000 do.
One 5,000 do.

making a total of 9,500 kilowatt, and provision is made for extending in the future for a further 5,000 and 10,000 k.w. sets.

The boiler houses are arranged to house five boilers, these being of the Babcock & Wilcox water tube marine cross drum type, each evaporating 32,000-lb. of water per hour and generating steam at 170-lb. per sq. in. press.: provided with a self-contained super-heater having tube heating surface of 1,266 sq. ft., and feed water heater with tube heating surface of 2,566 sq. ft.

A complete oil-burning plant is to be provided and the boilers also equipped with mechanical stokers of the continuous traveling chain grate type which will be capable of efficiently burning small Malayan coal: effective grate area 224 sq. ft. per boiler.

A steel chimney stack complete with induced draught fans is arranged for each bank of two boilers.

The first 1,500 kilowatt machine had been ordered before it was decided to change the Penang system from direct to alternating current generation and it was designed to run as a direct current machine through reduction gearing: as it was too late to alter the design of the turbine it was decided to instal a slow speed alternator to replace the direct current machine and instal a second turbine of 3,000 kilowatt capacity.

These machines will generate alternating current at 6,600 volts 3-phase 50-cycles per second and fed direct into step-up transformers which raise the voltage to 11,000 volts for long-distance transmission.

The circulating pumps to the condenser are of the horizontal centrifugal type, coupled direct to electric motors: the 12-in. diam. pump being capable of delivering 2,750 galls. per minute.

Malaya's Hydro-Electric Scheme

IT has been known for some months that a representative of Sir W. G. Armstrong, Whitworth & Company, Ltd., has been investigating the possibilities for furnishing the mines in the Perak district of Malaya with electric power derived from the South Perak River. This expert, Mr. F. Bolton, former electrical adviser to the F.M.S. government, has completed his studies and is now on his way home. Before leaving Malaya he furnished *The Malay Mail* with a very interesting outline of the project whose realization seems to depend largely upon the willingness of the F.M.S. government to guarantee debentures amounting to $20,000,000 (silver). The home government at London has approved the scheme but the F.M.S. authorities having been called upon to make good its guarantee on other ventures is inclined to be shy of any new proposition that might increase its financial burden.

In commenting upon the scheme *The Malay Mail* points out that in Tasmania the government carried out a very extensive hydro-electric scheme without any demand for power at all, later advertising the power for sale and succeeding in attracting applications sufficient to justify the foresight of the government. In Perak are located the richest alluvial tin fields in the world and a prosperous and prospering industry on which the government depends largely for revenue and a fair section of the population for a living. An enormous amount of capital has been sunk in the industry, and the extent to which it may progress in the future is yet unknown, but it may be said with some degree of certainty that for another half a century at least the tin fields of Perak will not be exhausted. Like all other industries, modern machinery has revolutionised the tin industry in Malaya and every year more machinery is being installed. That machinery requires power to be driven, and at present the power is obtained by expensive and in many cases unreliable methods. The timber resources of the country are being heavily depleted to supply a part of that power, giving serious anxiety to those who have to conserve those resources. It would, therefore, be a boon to the industry if it could secure all the power it required cheaply, regularly, and from a reliable source. The most important benefit it would bestow on the industry would be the saving of a very large sum of money annually—a sum which cannot be stated definitely but which would be sufficient, in many cases, to double the dividends which are now being paid and to increase the royalty which the government is now receiving considerably. The source for such power has been discovered in the Perak river which is situated in a very favorable position so far as the Perak miners are concerned. The scheme is to establish a hydro-electric plant on the Perak river and to supply power to the mines in the Larut, Kinta, Kuala Kangsar, and Batang Padang districts.

One of the first things which Mr. Bolton did was to ascertain the demand for power which would exist if a cheap supply were available. He circularised almost every mine in the Larut and Kinta districts, and the applications for cheap power which he received astounded him. The minimum which would have to be supplied amounted to a round hundred million units per annum, which is very little less than the actual demand in Manchester. Mr. Bolton found out by further enquiry that if the power became dearer the demand would be considerably reduced. Cheap power can only be supplied to the industry if the company which will be formed ultimately to undertake the scheme can raise the money it requires on cheap interest. Power would be comparatively dearer, by about 65 per cent. roughly, if the money could not be so raised. The capital of the company would have to be so large that it is unreasonable, in the present state of the money market, to suppose that the whole of it could be raised by the issue of ordinary shares.

Mr. Bolton thinks that if the full demand for power is to be satisfied they would have to form a company with a capital of $25,000,000, $20,000,000 of which would have to be raised on debentures and the balance in ordinary shares. He is aware that although it is difficult to attract new money for ordinary shares, there is a large amount of money in England awaiting safe investments, that is to say investments which would give sure returns though they may be comparatively low. The whole of the $20,000,000 required for the Perak hydro-electric scheme, in Mr. Bolton's opinion, could be easily raised from these sources if government would guarantee the interest on the debentures. Four or five years ago a guarantee would have been impossible, but the imperial government passed the trade facilities bill in order to help on the development of the dominions with borrowed money. What the sponsors of the Perak scheme ask is a guarantee only, but the home government has been ready to go much further, and has actually gone much further in the case of one Malayan tin company. In connection with the trade facilities bill the secretary of state sent a despatch to all the crown colonies, protectorates, and dominions, some time ago. One paragraph in that despatch is as follows :—

> "In order to facilitate the anticipation of public utility works such as communications, power, lighting, water, etc., which otherwise would not be undertaken for some years, the imperial government proposes to give contributions towards interest charges on loans raised for capital expenditure of this description. These undertakings may be under either public or private control or management. Assistance would be in respect of expenditure or orders placed in Great Britain and would be applicable only to schemes approved by the local government and certified to be in anticipation of normal expenditure. It is proposed that the maximum assistance given should be a free grant of three-puarters of the interest charges for a period of five years. To qualify for the imperial contribution the scheme must be accepted by the imperial government within the next three years. Approval of the imperial government would be given after consultation with the treasurer, the colonial secretary and the board of trade. Priority would be given to schemes involving the earliest placing of orders."

Ceylon has already taken advantage of this concession in respect of its hydro-electric scheme.

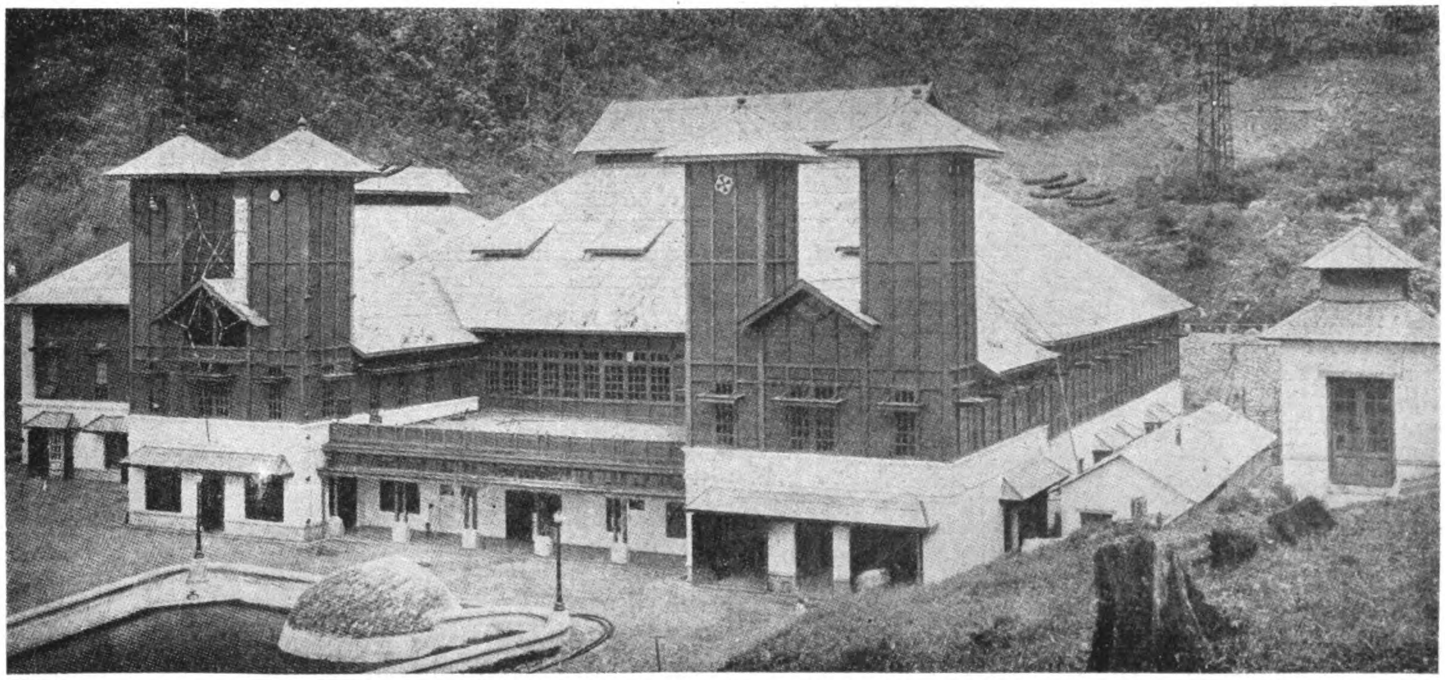
It is fortunate that the one large source of water power in Malaya which can be developed commercially, occurs close to the most important centres of mining activity, Kinta and Larut. While carrying out his enquiries in 1920 on behalf of the government Mr. Bolton found that the estimated amount of power used in 1919 on the mines in these two districts alone, if converted into electricity, would be sufficient to supply twice over the full demands for electricity for domestic use to the whole of the rest of an electrified Malaya. If all the tin mines in Kinta and Larut were electrified and worked as in 1919 the amount of electricity used on the mines would be over half of the full amount estimated for all purposes in all towns and other districts of importance in the country. It is estimated by Mr. Bolton that the consumption of electricity in Kinta would be three times that in Larut, and as it appears that the mines in Kinta will have a life of at least double those of Larut, it indicates how very important the Kinta district is. Mr. Bolton has drawn up the scheme to embrace Kamunting and Taiping in the north-west to Tapah in the south-east. Mr. Bolton now thinks, after close investigation, that the Perak river can be harnessed to produce sufficient power to supply electricity to meet all the present and probable future requirements of Kinta and Larut by building one dam across it. To show how the demand for power has increased during the last four years it may be noted that in 1920 Mr. Bolton was of opinion that if all the mines in Kinta and Larut were electrified, which at present burn fuel to produce power, the amount of electricity consumed would be about 60,200,000 units. Now he finds that the European mines alone will require and take 65,000,000 units per annum if cheap power were available.

Although the guarantee which it is asked to provide might be nominal the local government will be responsible to the public for the risk which it undertakes in providing that guarantee. Therefore it is bound to act with caution. The natural question is whether the benefit which the country at large and the mining industry will derive will be immeasurably greater than anything that the government stands to lose by undertaking the risk. Mr. Bolton has proved to the best of his ability that a keen demand for cheap power exists to-day and that the scheme is bound to be a success. It is quite

plain after the loss of millions by the F.M.S. government in the muddy waters of Prai its advisers are to accept any responsibility for a course of action which might result in further loss to government.

One of the strongest assurances that the government will hava that the scheme will be carried out fully and effectively is the interest that Armstrong, Whitworths are taking in the project. They have wide and vast experience in similar and bigger undertakings elsewhere and are not likely to bring discredit to their name by butting into a scheme which will not be a credit to their enterprise.

Mr. Bolton thinks that even if the guarantee is forthcoming when he arrives home it would not be possible to start real work on the Perak river for about a year, which time would be spent in getting together the material, staff, the formation of the company, and other preliminaries. About three years would be taken for the completion of the work. Of the total capital to be raised he thinks that about half would be spent in England on machinery, etc., and a good portion of the balance in Malaya, etc. The laying of the transmission lines which he thinks would come to about 60 miles would cost a considerable amount of money in the way of wages to laborers. The area embraced by the whole scheme is roughly from 600 to 800 square miles.



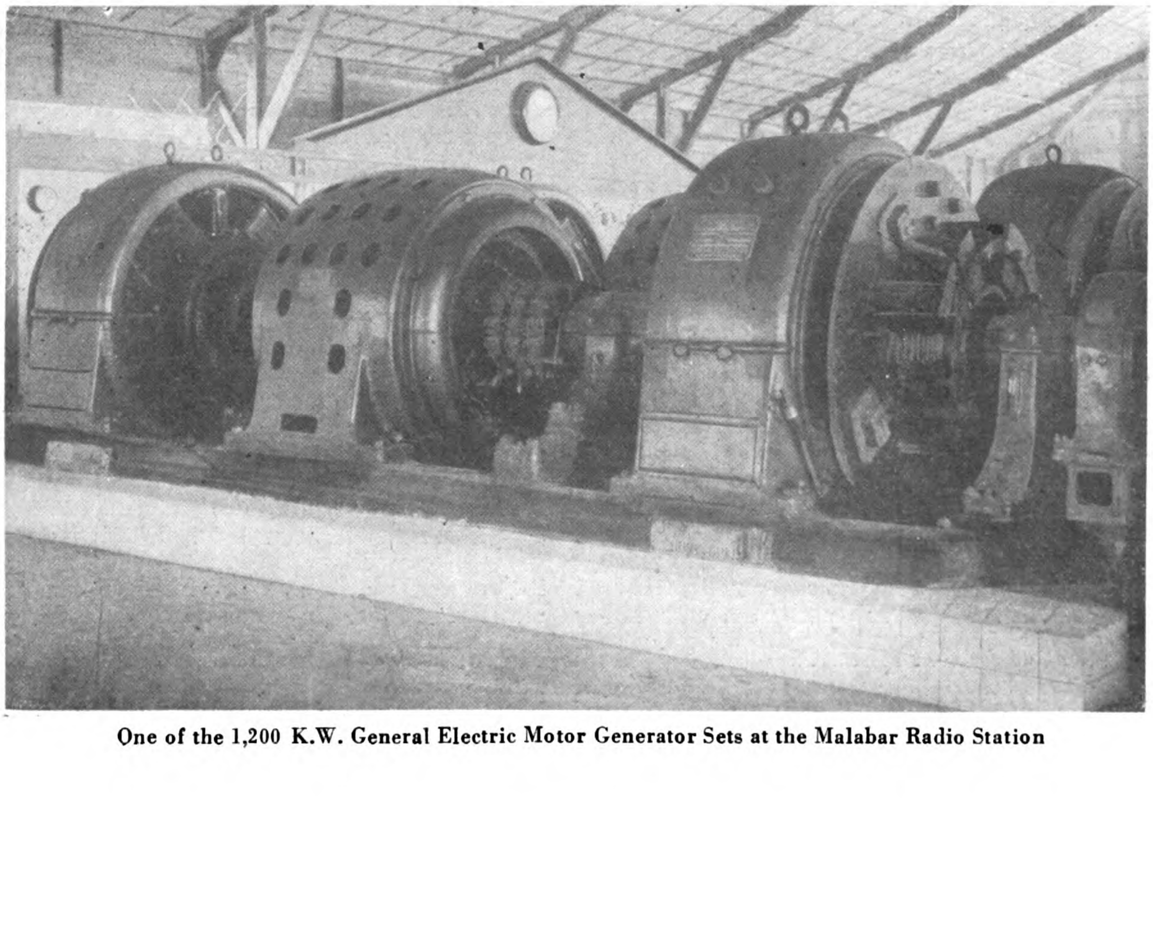
High Power Radio Transmission Station at Malabar, near Bandoeng, Java

High Power Radio Station in Java

AT Malabar, near Bandoeng in the island of Java, there is one of the world's most powerful radio transmission stations. It was installed for the purpose of insuring direct communication with Holland, the mother country, and is capable of radiating a continuous wavelength of from five to twenty kilometres.

The Poulson arc system is used and the equipment of the power plant includes, at present, two motor-generator sets of twelve hundred kilowatts each. Each set includes an induction motor rated at 1,760 h.p., 6,000 volts, 50 cycles, driving two 600-kw., 1,500-1,750 - volt direct - current generators, connected in series.

The two motor - generator sets are operated in parallel to supply 2,400 kw. to a Poulson arc generator, which is the largest in the world, and was produced entirely in the Dutch East Indies in accordance with the design, and under the supervision of Dr. C. J. De-Groot, the chief of the Dutch East Indian wireless department. Two additional motor-generator sets, duplicating the above, are now being built. One of these will be kept as a spare, but the other will be used in parallel with the first two sets to give a total energy at the arc of 3,600 kw. and a high frequency radiating energy of 1,800 kw. from the antenna.



One of the 1,200 K.W. General Electric Motor Generator Sets at the Malabar Radio Station

All the motor-generator sets with switchboard, transformers, aluminium arresters, high speed circuit breakers of the JR type, Hewlett insulators and high voltage wall bushings are of General Electric make.

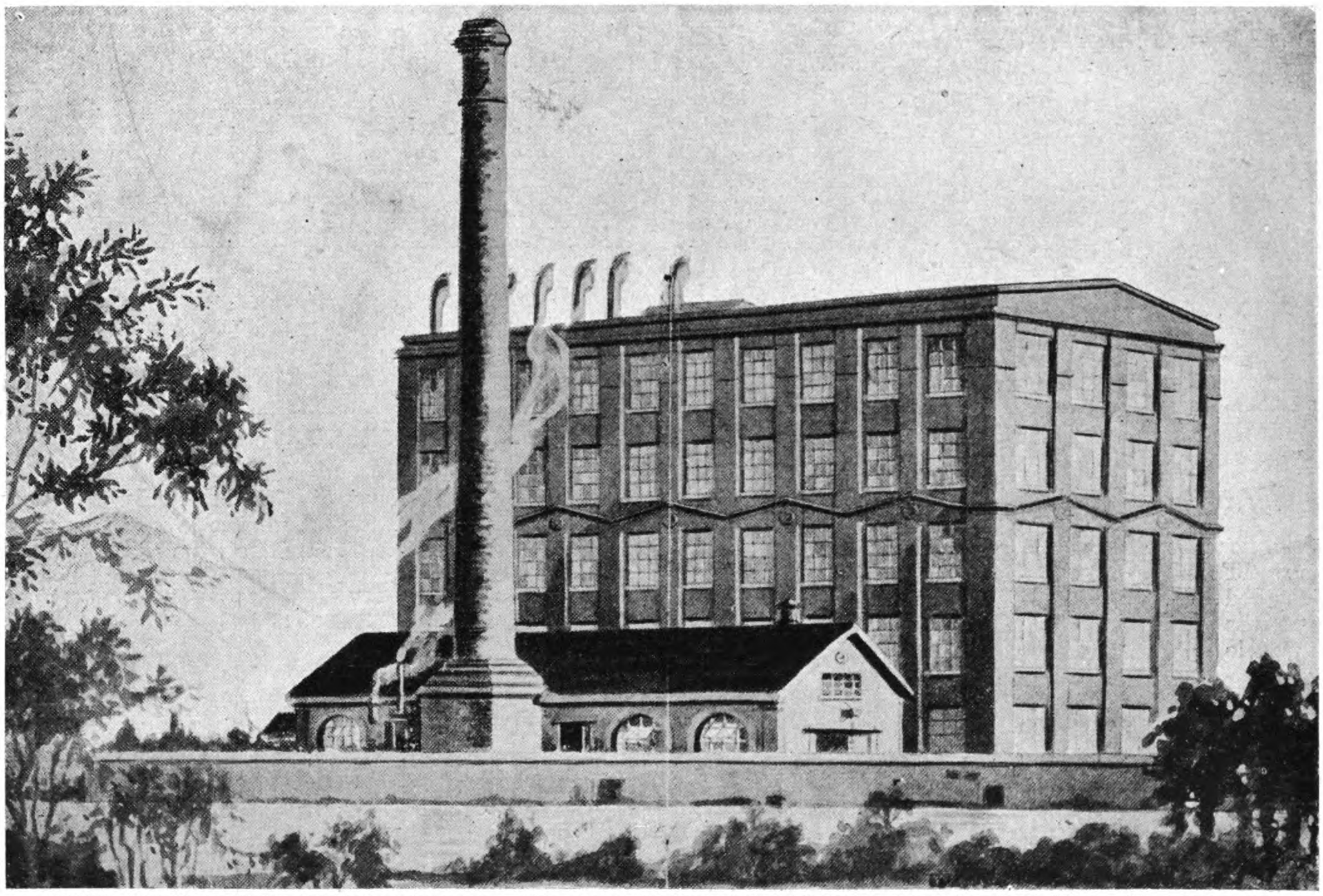
The antenna is suspended from steel cables between two mountain sides, about two miles apart, and hangs two thousand feet above the station.

Advance in Flour Milling in China

New Modern Mill at Tsinanfu Equipped with Unique Milling Machinery

CHINA is rapidly taking its place among the flour producing countries of the world. There are already a number of fine mills of large capacity located in different parts of the country and from present indications many new mills will be built in the future.

These flour mills are all of the latest design and construction and are completely equipped with modern machinery. China has gone into milling whole-heartedly and for this reason the art and methods of flour milling have advanced to a much greater extent than any other single line of industry carried on in this country. This fact can be credited mainly to the foresight and ability of men of high calibre and business integrity such as Miao Yin-tsin and Miao Sing-yuen of the Chen Foong Flour Mills Company, the main office and plant of which is situated at Tsinanfu, China.



CHEN FOONG FLOUR MILLS at Tsinantu.—Capacity 1,300 Barrels Per Day; Designed by the Robinson Manufacturing Company, Jardine Engineering Corporation, Agents

The Chen Foong Flour Mills Company was organized during the early months of 1922, by Messrs. Miao Yin-tsin and Miao Sing-yuen together with a number of their associates. They immediately laid plans for the construction of a complete and modern flouring milling plant with a capacity of 1,300 barrels of wheat flour per day. The plans included the main office, godowns, mill and power plant. The contract for the entire mill equipment was awarded the Robinson Manufacturing Company, of Muncy, Pa, through their agents, Messrs. Jardine, Matheson & Co., Ltd., of Shanghai, China. The complete plant was designed by the Robinson Manufacturing Company's staff of engineers and the installation was supervised by their special milling engineer and representative. The plant has been in continuous operation for nearly a year, producing very satisfactory results and permitting the company to market products that have created a large demand.

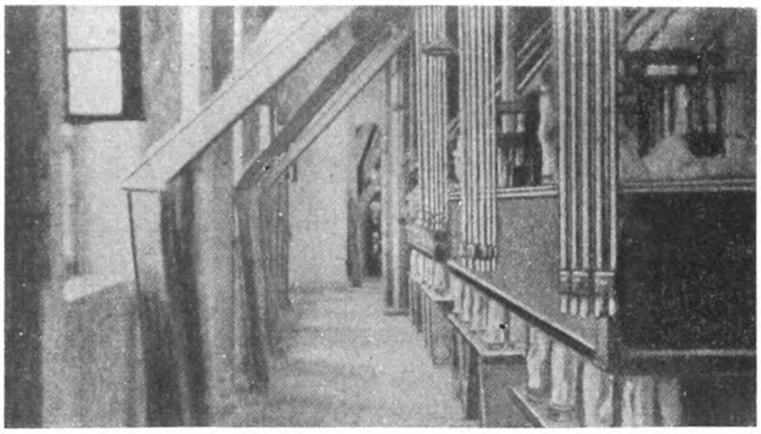
Miao Yin-tsin is managing director of the company and establishes the business policy of the concern. He is a native of Shantung province and is a very influential and highly respected citizen. His regular business is that of grain merchant and buyer of Chinese produce. That he is a very capable executive is shown by the amount of business he transacts, that of handling peanuts alone amounting to over $5,000,000 during the year 1922.

Miao Sing-yuen is business manager of the flour mill. Before taking over the managership, he also was very active in the grain business. He was a very notable figure in relief work during the recent famine and is held in high esteem by his countrymen. He is a very keen student of modern methods of flour milling and is at all times in close touch with the operations of every department of the mill.

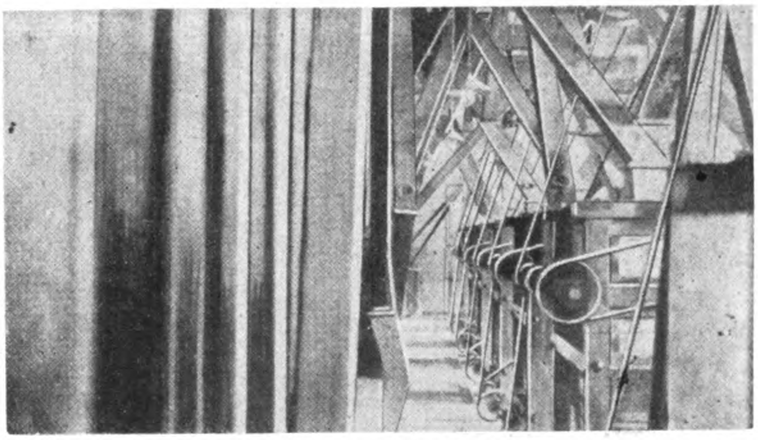
In addition to the ability of these men, the company has the financial backing and able support of a number of shareholders who were selected from among the leading and most successful business men of the community. They all show a pronounced interest in the new milling venture. It is safe to say that with such men to carry on the business, and with the mill equipped with an entire line of Unique machinery, the Chen Foong Flour Mills Company is assured of a long and successful career.

After the organization of executives and shareholders, and the selection of high-grade equipment, comes the very important problem of selecting a suitable crew, and in this the managers have shown unusual ability and foresight. Through their thorough acquaintance with the milling field in China, Miao Yin-tsin and Miao Sing-yuen have been able to assemble a crew of experienced millers and helpers who will materially aid the progress and success of the business.

The office of the concern is large and spacious and is very elaborately decorated in accord with the Chinese style of architecture. On the first floor are three private offices, a large general



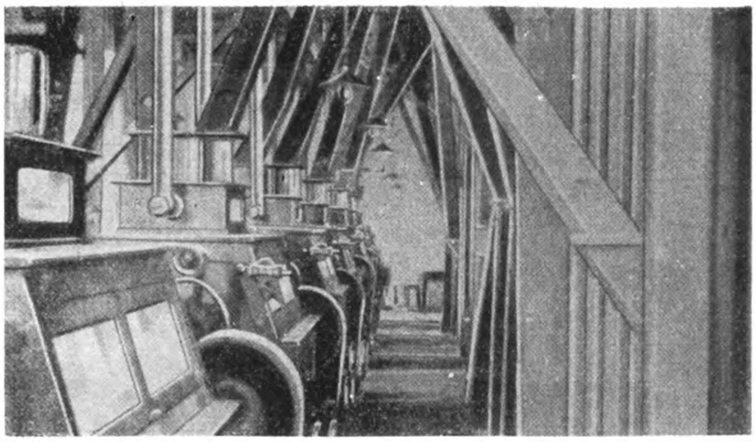
A Section of the Bolting Floor



Some of the Purifiers

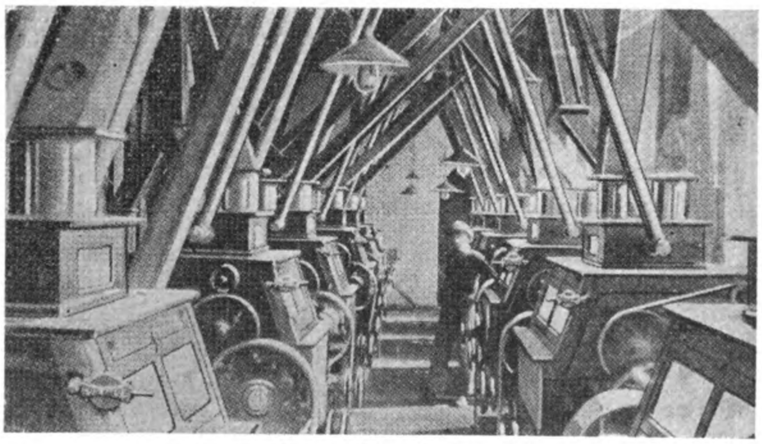
office and a sample room. The second floor is composed of a commodious general reception and dining room for large gatherings of shareholders and friends, and a private office for the milling engineer. On both ends of the second floor will be found large dormitories used as sleeping quarters for the office employees which is customary in large Chinese business offices.

The mill is of brick construction consisting of five stories and basement and has a capacity of over 1,300 barrels of flour per day. Plans for machinery installation and flow sheets were prepared by the Robinson Manufacturing Company and specified a complete



Grinding Floor

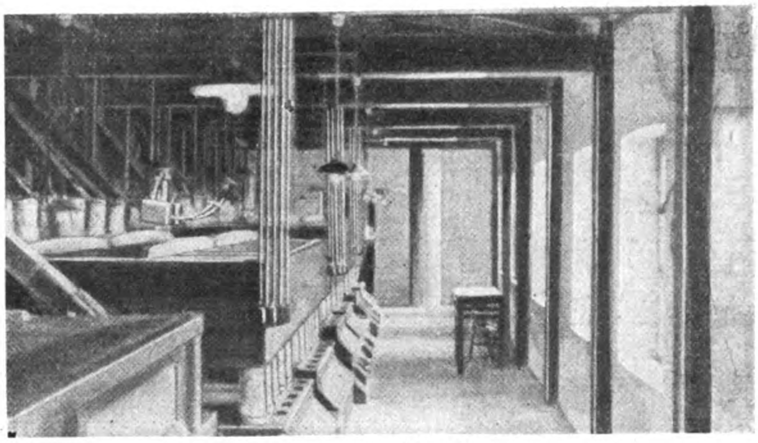
line of Unique machinery. It is hardly necessary to enumerate all machines included in the specifications so we will merely mention that the grinding floor is divided in two units made up of 13 stands of 9 by 30 and six stands of 9 by 36 Unique collar oiling double roller mills of latest design. The bolting floor is also divided into two units and is made up of seven Unique self-balancing ball-bearing sifters with level sieves. The purifiers, reels, bran dusters, packers, dust collectors, etc., are all arranged to conform to the high standard of quality and efficiency for which the Robinson Manufacturing Company is noted. The mill is a model of efficiency



Another View of the Grinding Floor

throughout and adds credit to American-made milling machinery. In fact, the mill made such a favorable impression in Chinese milling circles that another contract for complete Unique equipment for a 1,000-barrel wheat flour mill and a 2,500-bushel corn mill has been awarded the Robinson Manufacturing Company.

Although the art of milling in China is being modernized by leaps and bounds, other activities such as the raising of wheat, threshing, and delivery of wheat to the mill are carried on in much the same manner as they were done by the ancients. We show a number of interesting scenes photographed by the company's re-



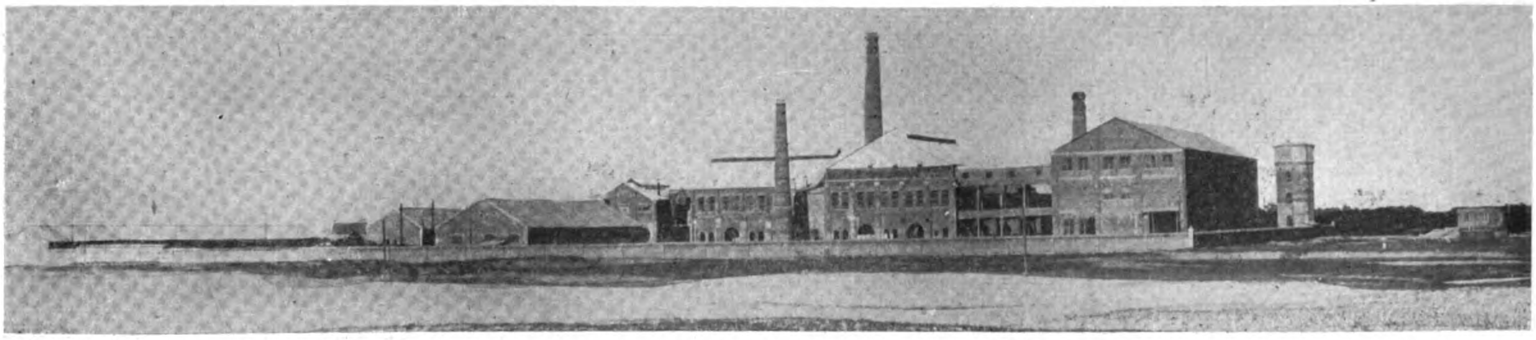
Bolters on the Top Floor

presentative during his travels, which will give an idea of how these activities were carried on. The methods used by the Chinese will probably strike the average American miller as being very inefficient (and so they would be in America), but in China, with a surplus of labor to draw from and with a pronounced lack of modern machinery, they are considered most economical and efficient.

Flowing is done by means of mixed teams such as donkey and ox, and often a Chinese coolie will be coupled up with a donkey or an ox to furnish the motive power. In one of the accompanying

(Continued on page 79).

A Native Mill



General View of the Yao Hua Mechanical Glass Works at Chinwangtao.

A Modern Glass Factory in China

The Plant of the Yao Hua Mechanical Glass Company, Chinwangtao

THE completion of the factory of the Yao Hua Mechanical Glass Co., Ltd., at Chinwangtao and the manufacture, on a commercial scale, of window glass by means of the Fourcault process marks the commencement of a new era in this industry in China.

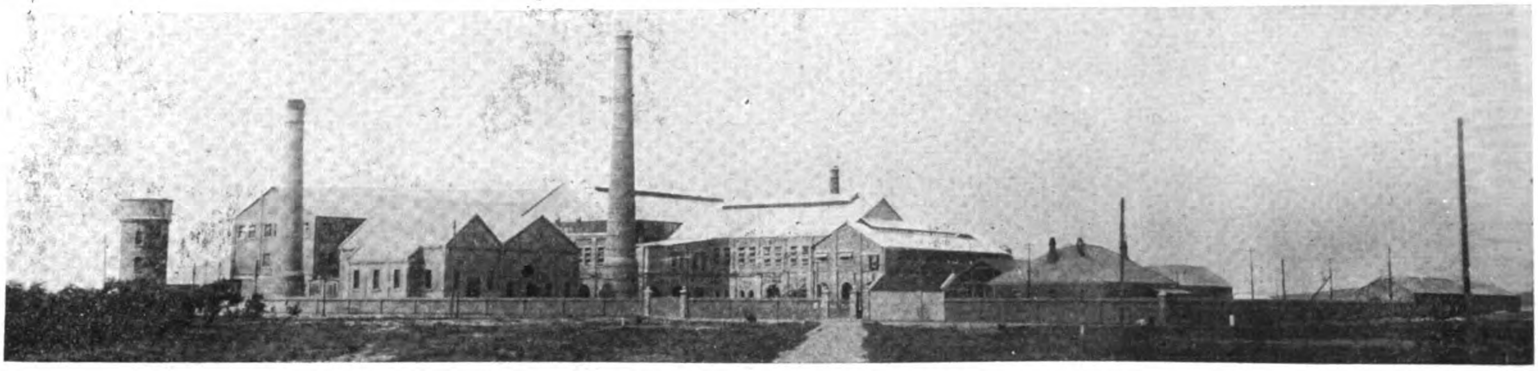
The question of manufacturing glass in China by this process was first brought up during the year 1919 by the Chinwangtao Glass Co., which, in 1920, acquired from the holder of the Fourcault patents, all rights to exploit them in China, Hongkong and Macao. In the year 1921, the Yao Hua Mechanical Glass Co., Ltd., representing Sino-Belgian interests was formed and with the active co-operation and assistance of the Kailan Mining Administration, the erection of a factory was commenced.

Its construction was supervised by experts and the present imposing factory—of which we reproduce several illustrations—is the first and only one of its kind in China : and is one of, if not actually, the largest Fourcault factory in the world : the annual production being expected to reach 150,000 cases.

Apart entirely from its size, it is the most modern installation of its kind, being equipped with all the latest improvements and labor-saving devices perfected in connection with the Fourcault process. In fact, so anxious has the company been to keep abreast of the times that numerous details have been altered during the course of construction in order to ensure the introduction of the latest inventions.

The process embodied in the inventions of Fourcault is admitted to be the most up-to-date method of producing machine-made sheet glass. Glass produced by this process is very much superior to that manufactured by the complicated and indirect method of hand production and the Fourcault process produces an excellent quallity of sheet glass with a marked absence of the flaws, bubbles and strings so noticeable in hand-made glass, and an absolute regularity of thickness throughout.

A certain quantity of selected Yao Hua glass is made into mirror glass, by a special foreign process of silvering, and as the glass used for this purpose is absolutely flawless, Yao Hua mirrors are a much superior product to that heretofore sold in the Far Eastern markets.



General View of the Yao Hua Mechanical Glass Works, Showing Main Entrance.

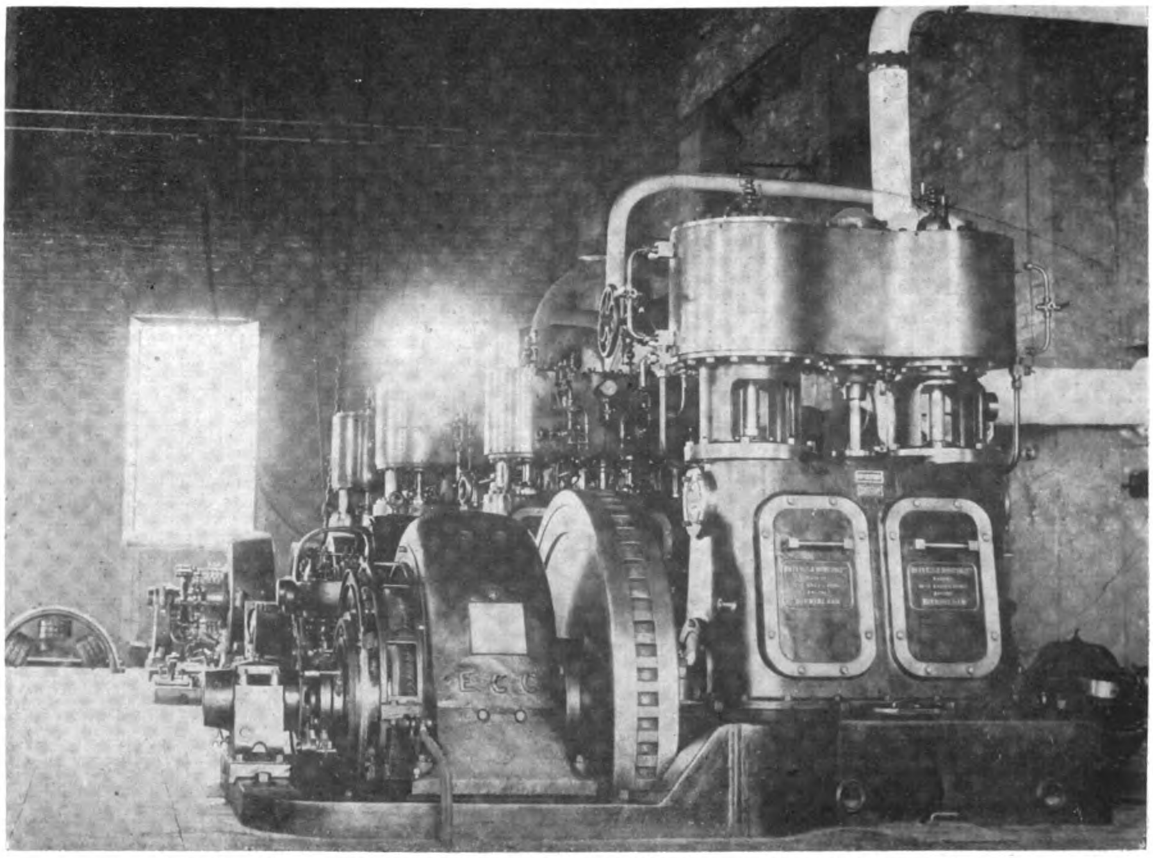
Description of the Plant

The principal building of the factory contains the gasogenes, furnace and the drawing machines. At the extreme north of this building are located six "Morgan Gasogenes" which supply the gas for heating the furnace. Immediately next to the gasogenes is the "Fusion Tank," a vest refractory basin 28 metres long by 5.50 metres wide, whose contents approximate 500 tons of molten glass. A composition is placed in this tank in the form of a mixture of the various raw materials necessary for the manufacture of sheet glass, and is therein subjected to a temperature of over 1,400° centigrade ; at which temperature the mixture melts and its component parts react chemically, the one with other, with the result that the mixture becomes an homogeneous body and becomes molten glass. At this temperature the glass is liquid and floats towards an opening in the furnace which leads out into a canal and thence to

Chinese Staff Quarters: Yao Hua Mechanical Glass Works.

a "drawing basin," 30 metres long by 2 metres wide, above which stand eight drawing machines.

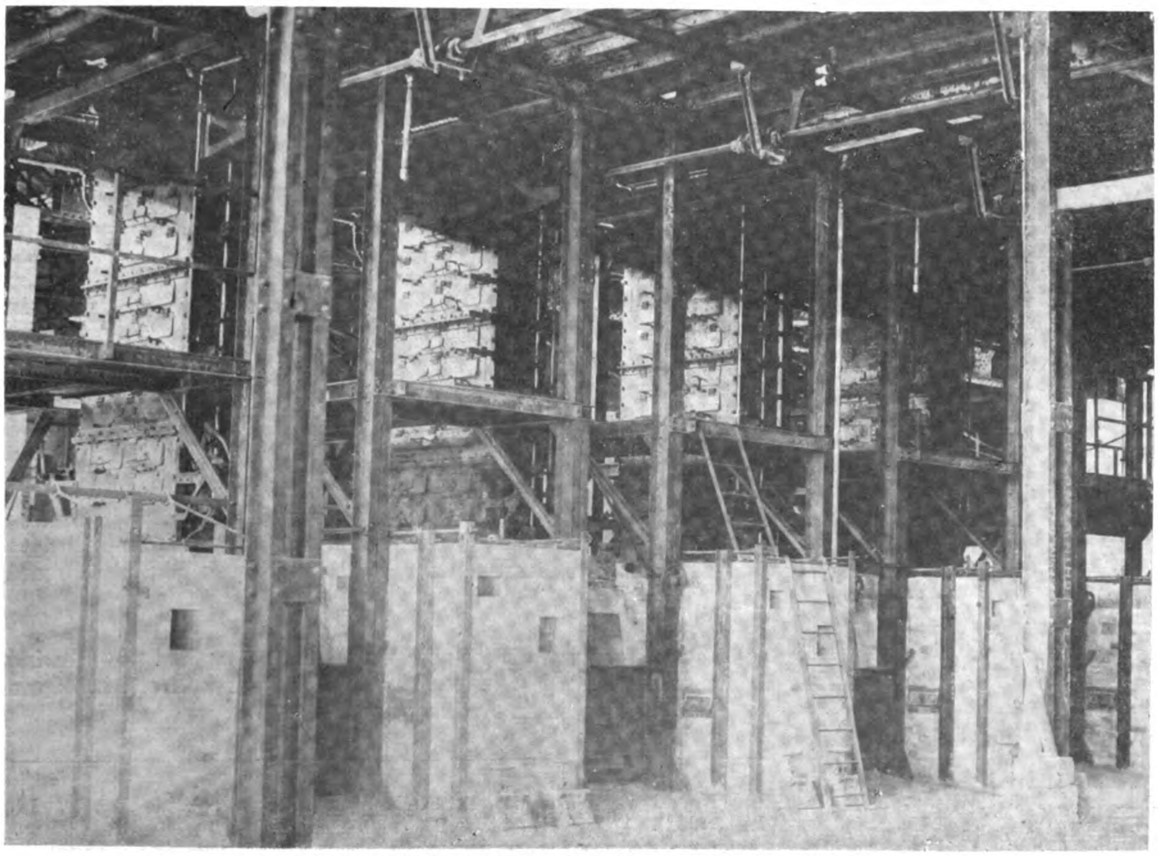
Below each machine the drawing basin is closed by refractory blocks, which form what is known as the "Well." Inside of the well a special refractory block known as the "Debiteuse" is placed in the liquid glass where it floats. Each debiteuse has running through its centre a long and narrow horizontal fissure and in drawing the glass the debiteuse is sunk into the well to a depth sufficient for the lips of the fissure to dip below the level of the molten glass; simultaneously an iron frame with a series of teeth at its lower end is let down to meet the gush of glass forced up through the debiteuse. The teeth of the frame cling to the glass and the frame is then drawn upwards, drawing in its train a continuous sheet of glass. Water jackets, placed on either side of the sheet, cool and solidify it, and it is then seized by a set of twin rollers covered with asbestos and guided by these rollers, which are tractors merely and not flatteners, is passed through a metallic box which serves as an annealing chamber. The sheet continues to be drawn upward, cooling all the time, and eventually arrives at the upper floor and from there is passed to the "Receiving Table" where, for the first time, it is touched by human hands.



Interior of Power House.—Belliss and Morcom Engines and Electric Construction Company's Generators.

Each drawing machine is worked separately by an electric motor and it is therefore possible to regulate exactly the revolving speed of the rollers, it being on this speed that the thickness of the glass depends.

The glass has now arrived from the machines and is deposited on the receiving tables. At this point it has thoroughly hardened and is ready for cutting. The "Cutting Shop" is situated on the second story of a building built at right angles to the pincipal building, and it is here that the sheet glass is cut up into whatever sizes are desired. The cut glass is then packed into cases containing 100 sq. feet, and lowered by elevator to the ground floor, where the store-rooms are located. On the ground floor of this building the box-making plant is situated, and the "Pottery," where the special refractory pieces required by the factory are manufactured, is also in this building.



Yao Hua Mechanical Glass Works: Drawing Machines.

Apart from these principal buildings, there is in addition a waterworks supplying 150,000 gallons of water per 24 hours, an electric power station with three Babcock boilers and two Galloway boilers, a composition room where the raw materials are mixed, a general stores, and the administrative offices.

Mention must also be made of the living quarters of the foreign personnel which consists of 19 bungalows erected on property adjacent to the works compound. The company has also erected 120 houses for the use of their Chinese staff.

The head office of the company is situated at Tientsin, where also the general management is in the hands of the Kailan Mining Administration. The administration has also undertaken the sale and distribution of the products of the Yao Hua Glass Company throughout China and the Far East.

The Chemical Trade of the Far East

German Synthetic Ammonium Sulphate in Japan

THE amount of sulphate of ammonia imported into Japan during 1923 reached the high total of 2,428,840 piculs* valued at Y.24,947,000 as compared with 1,550,376 piculs, valued at Y.12,742,145 in the previous year. This commodity, and artificial fertilisers in general, enjoy a growing popularity in Japan, but there has been much erratic purchasing of sulphate of ammonia both during 1923 and in the first part of 1924, the total value of the imports up to the end of May being Y.17,912,000. German synthetic sulphate of ammonia, which began to arrive towards the end of 1923, has a high reputation among the Japanese on account of its whiteness and excellent quality, and the German share of the import business in this line is steadily growing. The following official figures indicate the main sources of supplies in the past two years. It will be seen that Great Britain's share increased enormously during 1923.

	1923		1922	
	Quantity (piculs).	Value (yen).	Quantity (piculs).	Value (yen).
Great Britain ..	760,325	7,804,452	36,114	307,164
United States ..	1,440,892	14,631,750	1,394,964	11,433,913
Other countries ..	227,623	2,514,407	119,298	1,001,068

Japan herself produces about 100,000 tons of sulphate of ammonia per annum, from 5 to 10 per cent. of which is roughly the output of the gas works. The amount of nitrate of soda imported during 1923 was 1,116,888 piculs, valued at Y.8,196,171—a material increase over the corresponding figures for 1922 which were 881,106 piculs, valued at Y.6,540,094.

Although such official statistics as are available show a decrease in the value of the imports during 1923 of the two most important heavy chemicals, caustic soda and soda ash, which are taken together in the special post-earthquake returns, there was no marked change in the quantity bought, the difference being accounted for by a substantial decrease in the price. There has been a further reduction during the first half of the present year.

The business in soda ash is now practically monopolised by Great Britain. The Asahi Glass Company produces a small quantity for consumption in its own factories. In the case of caustic soda the annual import is roughly 15,000 tons, of which two-thirds come from the United Kingdom and the remainder from the United States. There is also a domestic production of some 5-6,000 tons per month, about 80 per cent. of which is made by the Dai Nippon Jinzo Kaisha (Artificial Fertiliser Company), the remainder being the combined share of the smaller factories.

The United States and the Japanese Cyanide Trade

The United States have recently captured a part of the import trade in cyanide of potash and soda, which are used in gold mining, and the whole supply of which formerly came from the United Kingdom. German manufacturers are making a serious effort, by cutting prices, to get into this market for such chemicals as muriate of ammonia, carbonate of ammonia, bichromate of potash, etc. In view of the destruction of stocks in the earthquake, importers took advantage of the remission of the import duties to make large and somewhat speculative purchases of drugs and fine chemicals, and new import business was accordingly at a standstill by the end of April of this year. During 1923 German drugs were cheap, but by the spring of 1924 there was little difference between German and British prices. The quality of German drugs is considered to have depreciated in the past twelve months.

The Dyestuffs Trade Position

Germany now supplies 85 per cent. of the dyestuffs imported into Japan. The speculative buying which followed the Ruhr occupation was followed by depression in the summer of 1923, and despite the loss of large stocks in the earthquake there was inactivity at the end of the year and in the spring of 1924. The total amount of coal tar dyes imported during 1923 was eight million *kin*† as against 7 million in 1922; the value, however, decreased from Y.13,652,024 to about 9,986,000. Germany's share was 6,874,766 *kin*, and that of Switzerland, which specialises in the increasingly popular chrome colors, rose from 116,814 *kin* in 1922 to 484,938 in 1923.

Early in June, 1924, the Japanese government yielded to the pressure which has been exerted for some time by the Japanese dye manufacturers for additional protection against cheap and popular imported dyes to the extent of issuing an ordinance so worded as to make an import licence necessary in the case of dyes imported from all countries, except where such restrictions conflict with a treaty of commerce—*i.e.*, in the case of Great Britain, France, and Italy.

Depression in Japanese Match Trade

The match industry is another Japanese export business which, once flourishing, is now in difficulties. Exports fell from 15¼ million yen in 1922 to 10½ million yen in 1923, and the match manufacturers are finding it hard to compete in India and in China with European goods, and with the goods now manufactured in those countries. Attempts have been made by Japanese to start match factories in India in co-operation with Indian capitalists and similarly a proposal to start match factories in China has recently been mooted—the idea being to take advantage of cheap labor and low overhead costs there, as has already been done by Japanese cotton mill owners in Shanghai and elsewhere. This depression in the Japanese match industry has had the effect of reducing imports from the United Kingdom into Japan of potassium chlorate.

Chemical Trade of Formosa

Mr. G. M. Phipps (H. M. Consul, Tamsui), in an appendix on Formosa, states that the demand for chemical fertilisers has undergone considerable development in recent years, the import in 1923 reaching 74,112,902 *kin*, valued at Y.5,287,074. Of this, five-sixths was supplied from (or through) Japan. The principal chemical fertiliser is sulphate of ammonia, and of this all of the direct import from abroad in the year 1922, was of American origin. In 1923 over one-half was British and one-third American, while for the first three months of 1924 the entire import was British. The fertiliser chiefly used, however, is bean-cake, imported wholly from China, to the value in 1923 of over 5 million yen. Camphor in Formosa had a somewhat unsatisfactory year owing to the reduction in exports to most foreign countries, notably the United States, while those to Japan and also France showed a slight increase. The total exports amounted to some 428 million lbs., of which over one-third went to Japan, just under one-third to the United States, one-sixth to France, and the remainder mainly to the United Kingdom. The first three months of 1924 showed a further big drop to all foreign countries except France, while Japan's share underwent an increase. Exports of alcohol rose by one-third to over 1¼ million gallons. The first three months of 1924 showed a heavy falling off in exports as compared with the corresponding period of 1923.

The following statistics are taken from a general table showing the value (in Y.1,000) of certain imports into and exports from Japan during 1923, and January/May, 1924, compared with 1922.

*1 picul (100 *kin*) equals 132.27-lb. 1 *yen* (100 *sen*) equals about 1s. 11d. (July, 1924).

†1 *kin* equals 1,3237-lb.

Exports From Japan (Value in Y.1,000).

Jan./May,	1924	1923	1922
Starches	91	201	1,436
Vegetable Oils	2,475	2,633	4,113
Camphor	2,934	8,879	7,248
Menthol	4,181	3,452	3,323
Soaps	1,735	2,871	2,341
Cement	882	2,010	3,907
Imports Into Japan (Value in Y.1,000).			
Salt	735	2,612	7,322
Chile Nitrate	3,381	8,195	6,535
Ammonium Sulphate	17,912	24,947	12,737
Phosphate Rock	4,456	4,855	8,984
Caustic Soda and Soda Ash	2,365	7,584	8,978
Coal-tar Dyes	3,973	9,986	13,649

Germany and the Chinese Dyestuffs Market

In his report on China, Mr. H. J. Brett states that during the second half of 1923 shipments of synthetic indigo from Germany practically ceased owing to the restrictions imposed by the army of occupation on the Rhine, and imports from other countries increased to a corresponding extent. Towards the end of the year, however, shipments from Germany were resumed, and with her re-entry into the market prices have fallen rapidly to their former level. The indigo situation in China is one of considerable difficulty to all the manufacturers concerned owing to the fact that the world's capacity for output is greatly in excess of the demand, and we find therefore an overstocked market, a general low price level, and little if any profit for the manufacturer, the importer or the dealer. Imports of American indigo have increased very considerably during the past twelve months ; Swiss shipments were normal, and French indigo has also reappeared in the China market. After an absence of two years, shipments of British indigo again appear in the returns for 1923, but the quantity is small in comparison with those from Germany, the United States and Switzerland.

In other coal-tar dyestuffs the German hold on the Chinese market is still stronger than in the case of indigo, this trade being a good instance of the value still attaching in China to old-established ' chops " or brands. In such trade as is not dependent on " chops," amounting possibly to one-fifth of the whole, British and American dyes are better represented. Owing, however, to the disturbed situation throughout many parts of China, the high price of cotton goods and other adverse conditions, the demand for dyes during the period under review has been far from satisfactory.

On the export side, the Chinese wood oil trade is of growing importance, the demand in the United States and other countries, where it is used extensively in the manufacture of varnishes and for other industrial purposes, showing a marked increase. The demand for camphor was inactive during 1924 and it would appear that the genuine article from China is to a great extent being supplanted by synthetic camphor.

In conclusion the following Chinese overseas trade statistics selected from a comprehensive table compiled by Mr. Brett should be of interest. Among the principal articles of Chinese products exported from China, antimony regulus fell in quantity from 201,031 piculs in 1922 to 48,406 piculs in 1923. Exports of bean cake, however, rose from 21,590,000 to 24,785,000 piculs in the same period. With regard to oils, the total exports (vegetable and essential) rose from 2,669,596 piculs in 1922 to 3,515,000 piculs in 1923. On the import side, the quantity of cement shipped into China rose from 19,156,192 piculs in 1922 to 22,434,962 piculs in 1923. Imports of soap and soap-making materials which represented a value of 2,563,000 Haikwan Taels in 1922, represented a value of 2,323,000 Haikwan Taels in 1923.

British Trade Report

Large Contract for Irak

The development of cotton production in Irak has resulted in important cotton-growing concessions having recently been secured by a large British syndicate, and as a result a contract worth £500,000 is shortly to be offered to a selected number of engineering firms. This is to provide the first section of the huge irrigation works which will be necessary. The complete scheme, which is estimated to cost upwards of £17,000,000, will include a barrage of the Euphrates, the formation of large storage reservoirs, and the construction of a vast system of canals.

Advance in Flour Milling in China

(Continued from page 75.)

illustrations we show a four-man team which was used for harrowing and seeding. This is a very common scene throughout the agricultural districts of the country and the continued use of this method lies in the fact that unemployed coolies are so numerous that any number of them can be secured for a mere pittance in wages.

The threshing of wheat is accomplished by the use of a stone roller about two feet in diameter and about two and one-half feet long. This device is usually hitched to a donkey and the wheat is scattered over what is called a threshing floor. The donkey runs around in a continuous circle and the stone roller crushes the wheat berries from the heads. After this the straw is thrown high into the air where the wind carries away the chaff. The wheat is then placed in bags, and if the farmer delivers his wheat direct to the mill, he usually piles a number of bags on donkeys and leads them to the mill ; or if it is to be delivered to the wheat market, it is piled on large wheel-barrows which are pushed by coolies.

Practically all of the coal and most of the wheat is delivered to the Chen Foong Flour Mills by coolies with the aid of wheel-barrows and practically all of the flour and bran is hauled away from the mill in the same manner. As idea of the brawn and ability of these fellows to stand up under severe labor conditions will be had from the fact that a very common load taken away from the mill by one coolie consists of about 20 50-pound bags which are often carried as far as five miles or more. Another common method is to load a large truck with bags of flour and have a number of coolies for both pushing and pulling the loaded truck to the market. The trucks carry a load as heavy as some of our large motor trucks can haul, but still nine or ten coolies can move it at a fairly good rate of speed and, considering the condition of most of the country roads throughout China, the coolies probably make better time and deliver the goods with less expense than could be done with motor trucks. The country roads are hardly more than deep ruts worn down by continuous travel through the centuries and would be impassable for many of the modern motor trucks.

These conditions not only apply to the handling of wheat and mill products, but they also apply to practically every commodity that is transported.

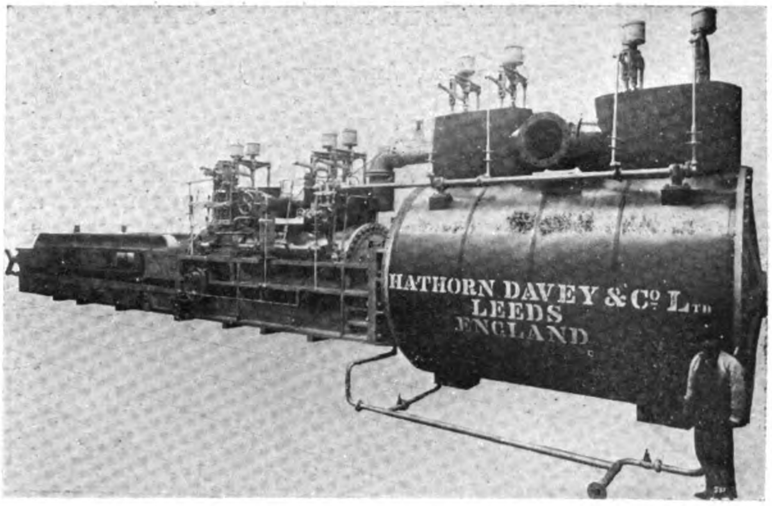
Singapore Dock Project

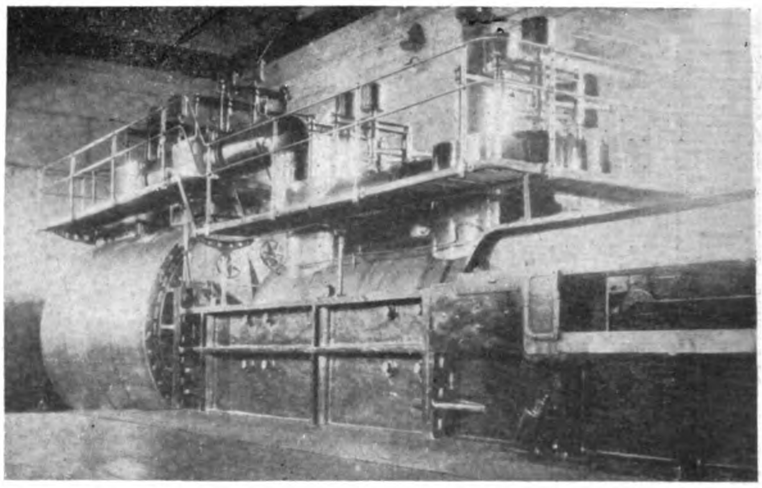
Cost of Improvements

The estimate for dockyard improvements at Singapore is made up of the following items, states a naval correspondent of a home paper :—

1. Works common to all departments, viz., wharfs, basins, railways, roads, dredging berth for floating dock, etc.	£5,100,000
2. Graving dock	1,000,000
3. Offices, dwellings, and other buildings	420,000
4. Workshops, storehouses, magazines	1,780,000
5. Contingencies	1,200,000
6. Machinery	1,000,000
	£10,500,000

While most naval men favor the establishment of a large fixed base at Singapore, service opinion is not entirely unanimous on this question. In a paper read before the institution of naval architects last June, jointly written by Captain D. J. Munro, R.N., and a civilian member, an alternative plan was mooted. The authors' idea was that a great deal of money could be saved and equally good results obtained if a floating base were substituted for the permanent works favored by the admiralty. They estimated the cost of a floating base to be £1,400,000, expended as follows : Large floating dock, £500,000 ; small floating dock, £50,000 ; floating crane, £200,000 ; floating workshop, £500,000 ; mooring lighter, £50,000 ; launches, etc., £100,000 ; total £1,400,000.





Hathorn, Davy Pumping Engine at the Pekin Syndicate Mines in Honan, 170,000 gallons per hour, 700-ft. head

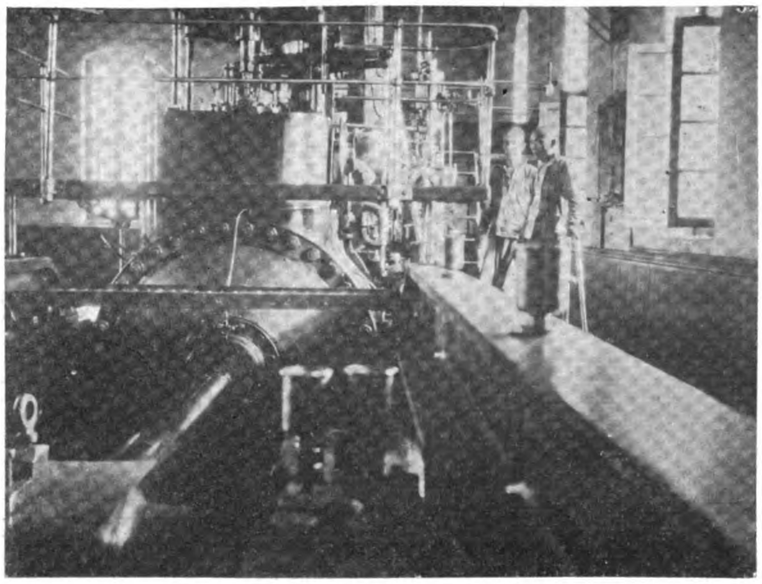
British Pumping Engines for Peking Syndicate Mines

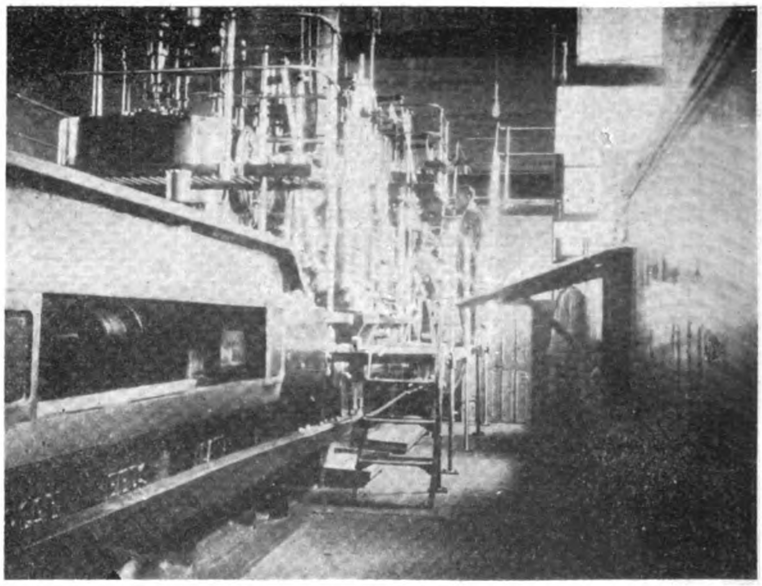
THE Peking syndicate collieries have purchased an additional pumping plant from Messrs. Hathorn, Davey & Company for use in their mines in China.

Over 20 years ago the Chinese Engineering and Mining Company ordered a large pumping plant for their collieries from Messrs. Hathorn, Davey & Co,. Leeds. Other mines, not far from Tientsin, followed suit, and when the Peking syndicate began opening up its coal property, in 1910, it was found that plant must be provided to deal with large quantities of water. After careful consideration by the engineers, it was decided to instal a compound, overground, condensing pumping engine of the largest size, capable of raising 174,000 gallons per hour from a depth of 600-ft. with steam at a presure of 100-lbs. to 120-lbs. per square inch.

The pumping plant consists of one horizontal compound, tandem, surface condensing pumping engine controlled by Davey's patent differential gear. The engine is on the surface and operates two pump rams 26-in. diameter, by means of quadrants. The engine cylinders are 56-in. and 110-in. diameter, and both the engine and the pumps are of 10-ft. stroke.

The plant was complete with surface condenser and double-acting ram type air pump, and an oil separator was fitted to the exhaust steam range so that the air pump discharge could be used for boiler feeding. The plant included the rising main and the necessary spear rods from the main caps to the pump ram heads, and the total weight of machinery supplied was approximately 685 tons.





Other Views of the Hathorn, Davy Pumping Engine Installed in the Pekin Syndicate Collieries

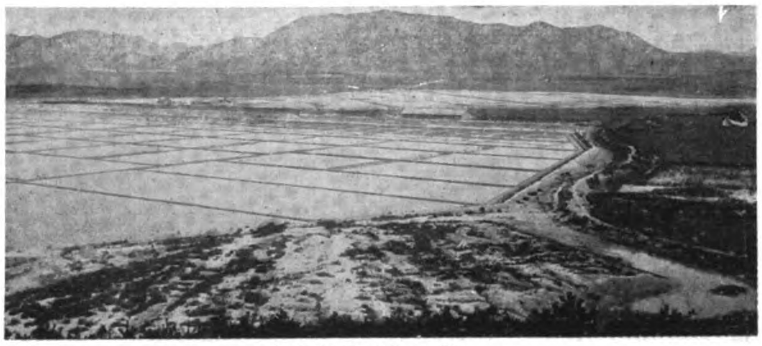
Sternbush Boring Machine for China

A contract for a Sternbush boring machine for use in China has just been placed with Messrs. John W. Barnes, Ltd., of Rock Ferry, Cheshire. A similar machine has just been completed for one of the large British shipbuilding yards.

Two New Motor Ships for Siam

Announcement has just been made that Siam will require two twin-screw motor ships of about 3,000 tons register each. Tenders for these are required by the ministry of commerce by June 30 next.

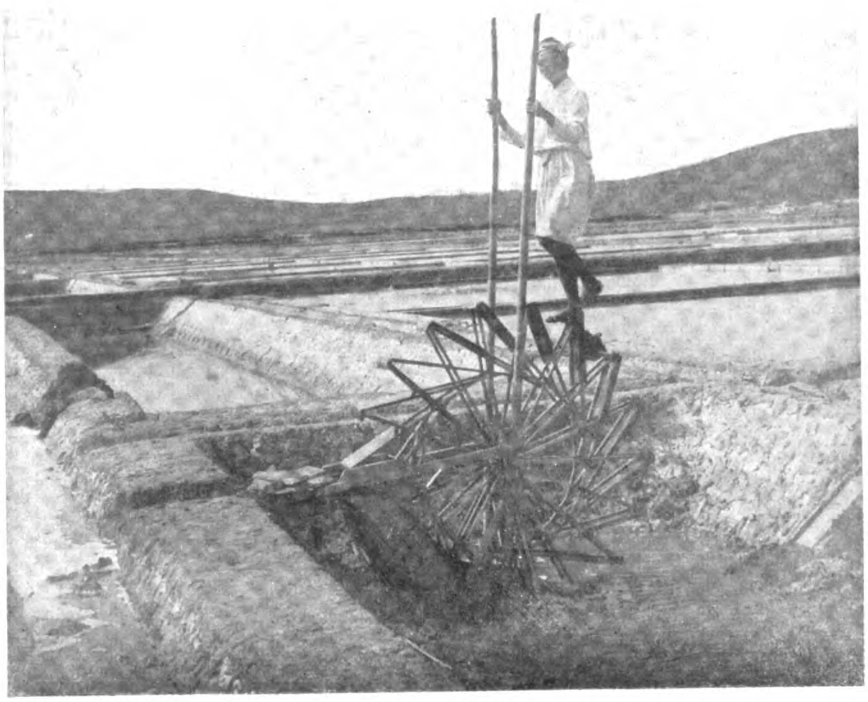
Gathering the Salt



A Salt Field at Shuan

The Salt Industry of Korea

FOR centuries, the Koreans found manufactured salt along their coast by the primitive method of parching. This method requires a large amount of fuel and labor and results in a high cost of production for the commodity. Chinese salt, which is produced by evaporation, was introduced into Korea at the beginning of the present century and was able to undersell the native product. The result was that the amount of salt imported constantly increased, while the native industry retrograded. In 1907, the Chosen government made investigations into the conditions of the salt industry in Ryuko, Keisho-nando, at the same time experimenting in the production of salt by the process of natural evaporation at Shuan, Keikido. The results showed that by this process, a better and cheaper salt could be produced. The new method was therefore adopted and widely introduced. Between 1917 and 1919, salt installations, using the new method, were erected as follows:



Bringing up the Brine

Koryowan, Heian-do	774 square *cho**	(1912—1914)	completed
Shuan, Keikido ..	88 ,, ,,	(1907—1911	,,
Tokudo, Heian-do ..	223 ,, ,,	(1919—1920)	,,
Shuan, Keikido ..	124 ,, ,,	(In 1919)	,,
Total	1,209 ,, ,,		

It is expected that when these fields reach their maximum maturity, more than 100,000,000 *kin* of salt will be produced. The present output of parched salt is about 70,000,000 *kin*. The total of 170,000,000 *kin* of salt produced by both methods will, however, be insufficient to meet the estimated consumption of salt which is about 400,000,000 *kin*. The government has. therefore, decided to extend the salt fields an additional 2,600 square *cho*, the development being spread over a period of nine years beginning with 1920. The locations of the new fields are as follows:

Nando, Keikido, 300 square *cho* (1920—1922) completed

Kijo, Heian-do, 149 square *cho* (In 1921)

Nanshi, Heian-hokudo, 217 square *cho* (1922—1924) completed

Kunshi, Keikido, 575 square *cho* (works started in 1921)

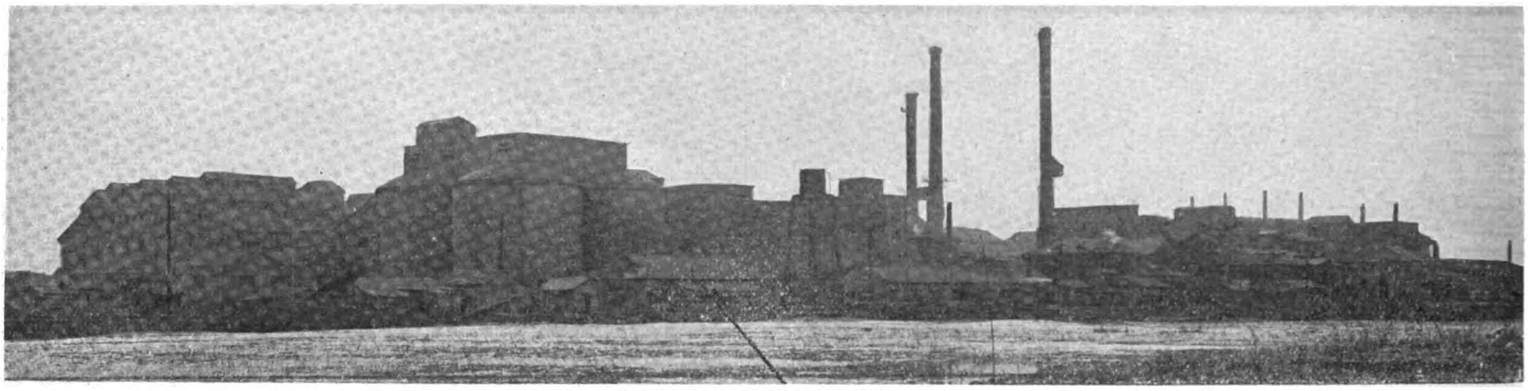
Each field, the year following construction, is capable of producing approximately 10,000 *kin* of salt per square *cho*. At maturity, the fields are capable of producing about 90,000 *kin* per square *cho*.

THE SALT MANUFACTURE AND IMPORT OF KOREA.

		1921-22	1910-11
		Acre	*Acre*
Area of Salt Pans	Shuan	1,060.85	78.40
	Koryowan	2,834.65	139.65
	Total	3,895.50	218.05
		Kin	*Kin*
Amount of Salt Manufactured	Shuan ..	10,682,846	737,580
	Koryowan ..	82,138.000	258,043
	Total ..	93,120,346	995,623
		Kin	*Kin*
Amount Imported	Japan Proper	26,794	5,289,418
	Formosa	—	4,680,000
	Kwanto-Shu	17,905,611	—
	China	168,182,417	83,324,783
	Others	—	547
	Total	186,116,822	93,294,748

Gathering Salt by Primitive Methods in Korea

*Approximately 2½ acres.



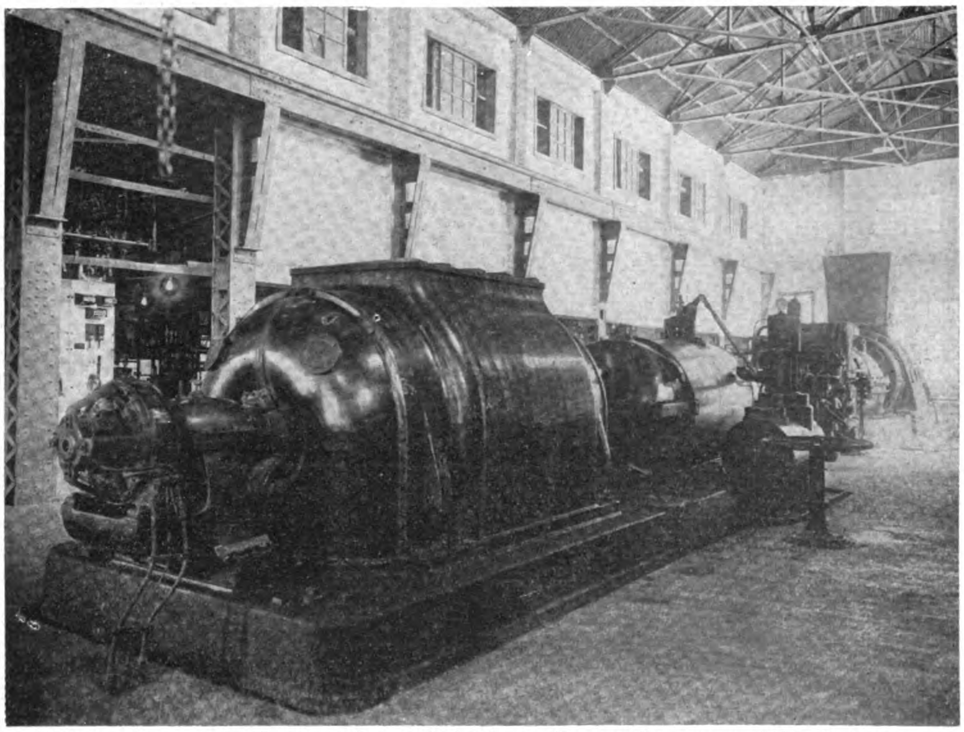
General View of the Kawasaki Plant of the Asano Cement Company.

A Modern Japanese Cement Plant

The Kawasaki Works of the Asano Cement Company, Ltd.

The Japanese Cement Industry

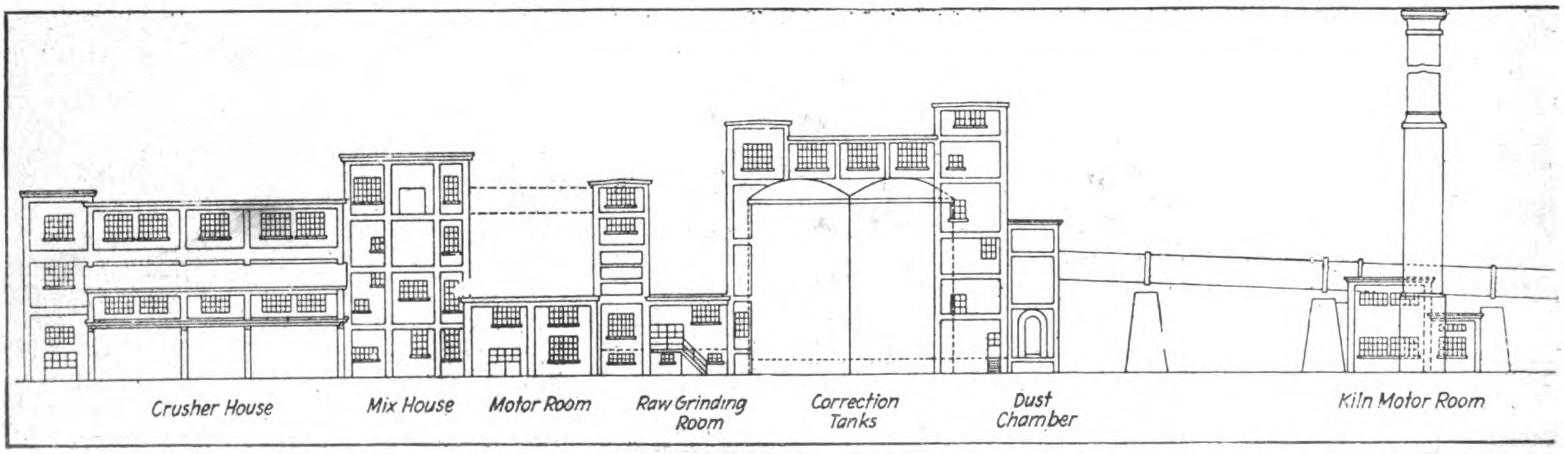
COMMENTING on the growth of the cement industry in Japan, Mr. Ryozo Asano, who has succeeded his father in the active management of the Asano enterprises in Japan, says that the first cement factory in Japan was built at Fukagawa, Tokyo, in 1871 as a government undertaking but for several years was operated at a loss. It was about to be discontinued when Mr. Soichiro Asano, whose name is familiar as the organizer of the Toyo Kisen Kaisha, stepped forward and took it over with the determination to make the industry a success. The factory at that time had a daily output of only a few hundred barrels sold mostly to the government. The growth of the industry was slow, but by 1908 production had reached 1,750,000 barrels. By 1914 there were 12 companies manufacturing cement in Japan, with total capital of Y.32,000,000, which produced some 3,625,000 barrels yearly. By 1919 the production had reached 6,500,000 barrels, produced by 20 companies, capitalized at Y.44,500,000 and employing some 7,000 laborers, about one-tenth of whom were female. Most of the output is produced by the dry process.



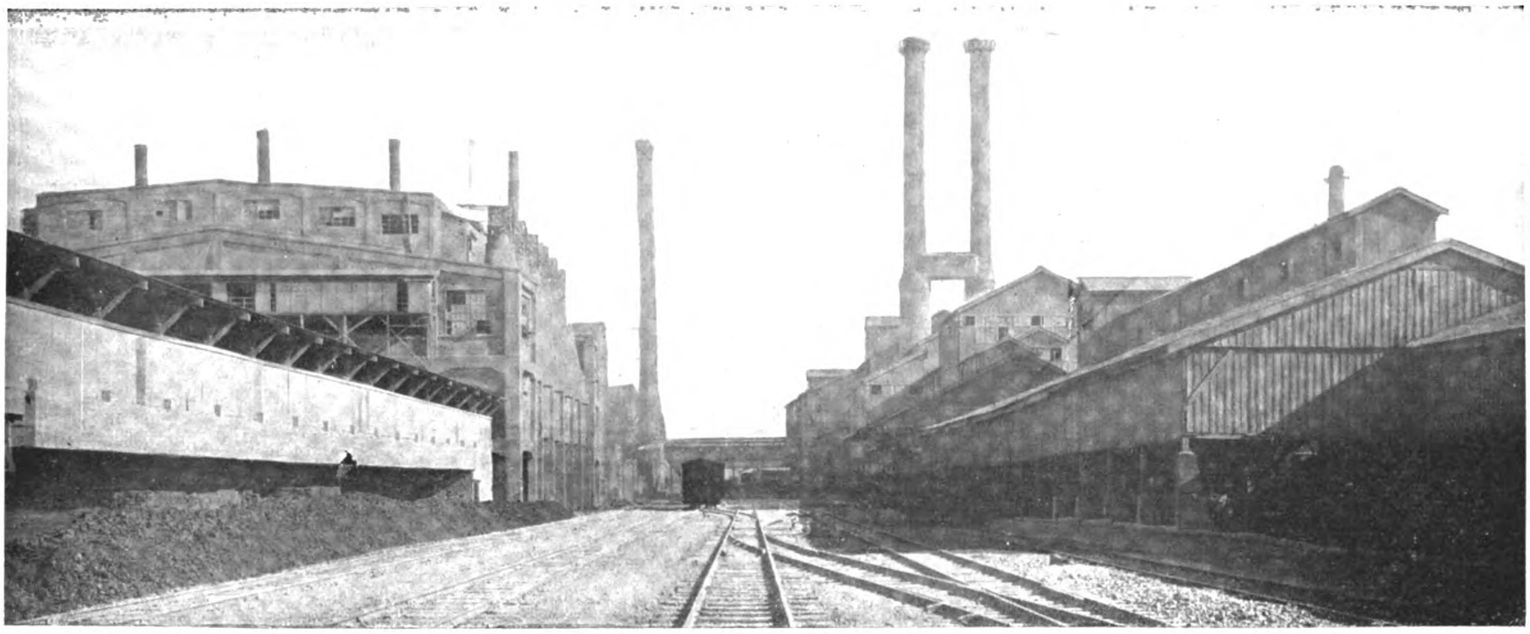
Power House of the Kawasaki Plant of the Asano Cement Company: Allis-Chalmers Turbo-Generating Sets.

During the war the cement industry, like all other industries in Japan, grew rapidly, benefiting by the markets which were opened to it through the inability of the European countries to supply the usual amount. Moreover, large quantities were being used in Japan itself in new hydraulic installations and in the construction of modern plants for the manufacture of war materials.

The exportation of cement from Japan began in 1913, when 149,000 barrels were shipped abroad. By 1916 the exports had increased to 667,000 barrels and in 1919 to 997,000 barrels. The production of cement in Japan from 1920



General Elevation of all Buildings in Plant



Kawasaki Plant of the Asano Cement Company: View from Train Yard.

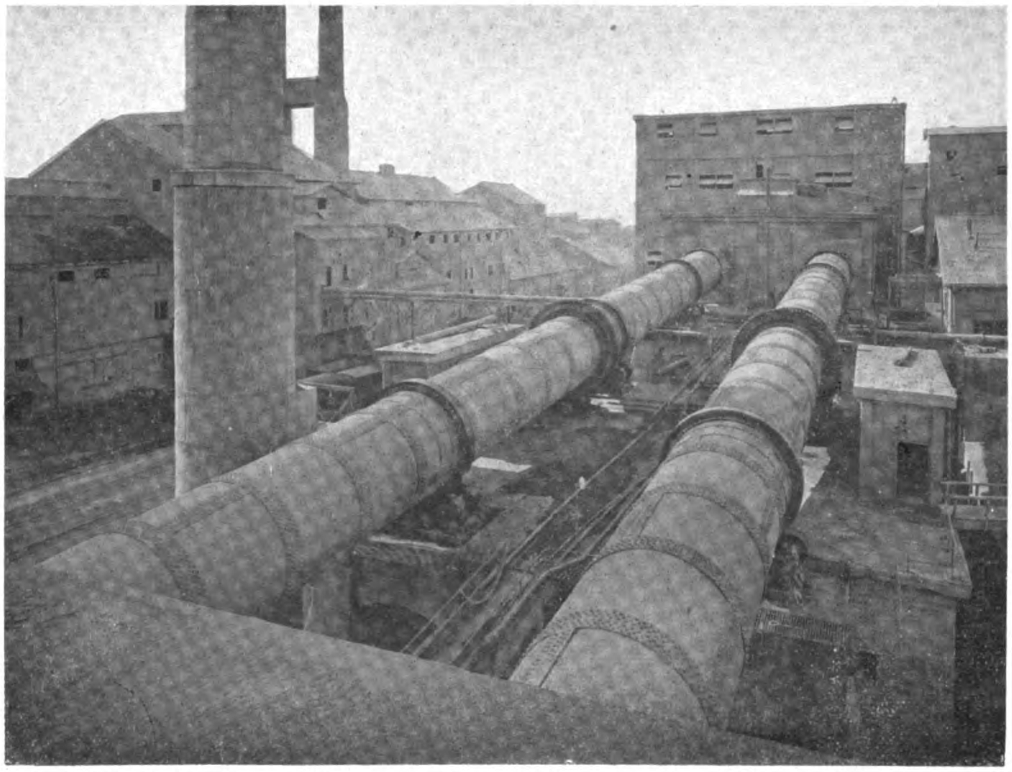
to 1923 is shown in the following statement:

	Barrels
1920 ..	9,300,000
1921 ..	10,000,000
1922 ..	11,200,000
1923 estim.	11,800,000

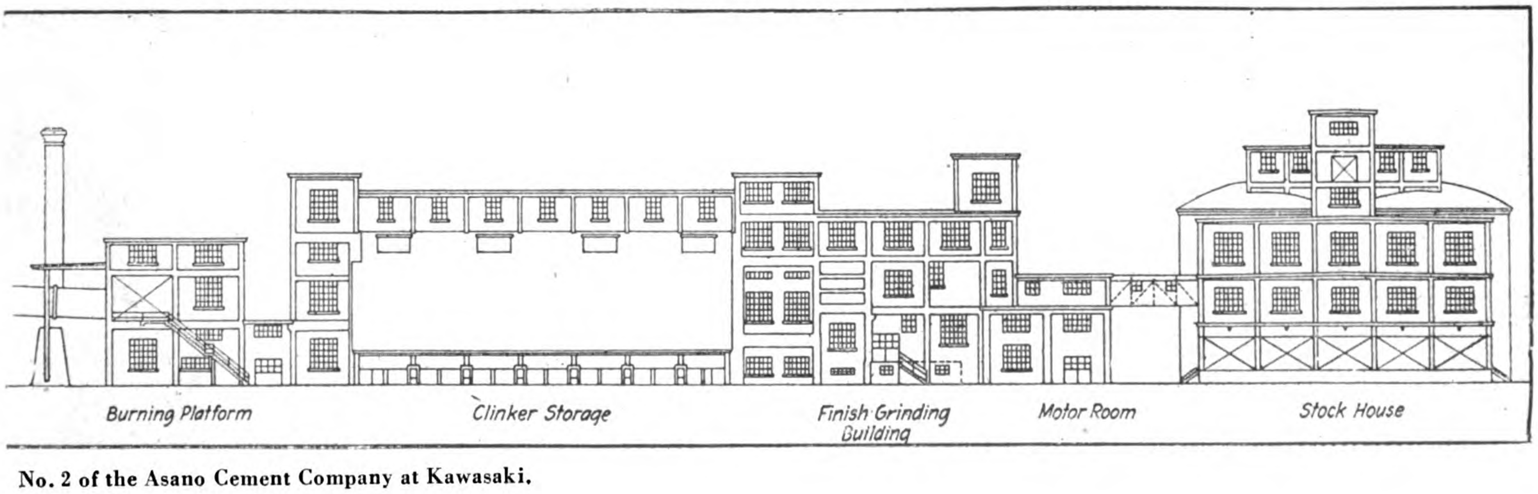
Prior to the earthquake there was a cement manufacturing capacity of about 14,000,000 barrels, computed on the basis that the plants were running full time without loss of the efficiency in machinery, labor, etc., but it is doubtful if this capacity would have ever been reached even if the earthquake had not occurred.

The principal concerns manufacturing cement in Japan are the Asano Cement Manufacturing Co., founded in 1912, capital Y.9,130,-000 paid up, with plants at Tokyo and Moji; the Onoda Cement Manufacturing Co., founded in 1881, capital Y. 1,600,000 paid up, with plants at Yamaguchi and Dairen; the Sakura Portland Cement Co., founded 1907, capital Y.504,-000, with plant at Osaka; the Toa Cement Manufacturing Co., founded by amalgamation of lesser companies in 1918, capital Y.4,000,-000, with plant at Miye-ken; and the Aichi Cement Manufacturing Co., founded in 1889, capital Y.1,600,000 paid up, with plant at Nagoya.

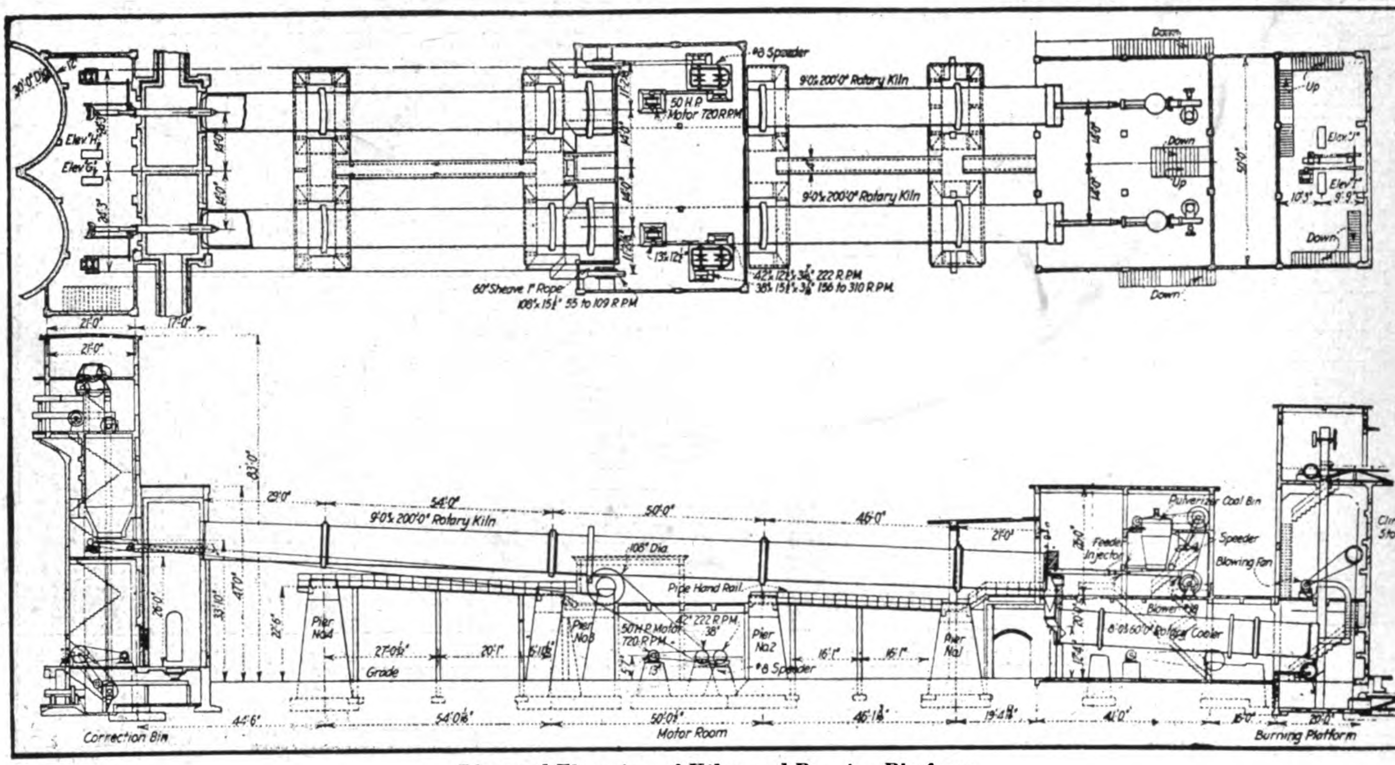
Of the total production of cement from 85 to 90 per cent. is consumed in



Allis-Chalmers Rotary Kilns at the Kawasaki Plant of the Asano Cement Company.



No. 2 of the Asano Cement Company at Kawasaki.



Plan and Elevation of Kilns and Burning Platform

Japan, the balance being exported principally to the Philippine Islands, Java, British India and other parts of the Orient. The cement usually sold by the Japanese is of two grades, Asano and Onoda cement being in the first grade and Toa, Sakura, and Chuo cement in the second. The first grade compares favorably with the best grade of cement manufactured in the United States.

The following table shows the annual production, annual sales and the amounts carried forward to the next year for the years 1911 to 1914 and from 1919 to 1922 :

(In thousands of barrels)

Year	Annual output	Annual sales	Carried to next year	Year	Annual output	Annual sales	Carried to next year
1911 ..	3,193	2,370	482	1919 ..	6,445	6,236	666
1912 ..	3,804	3,305	981	1920 ..	*7,852	7,767	894
1913 ..	3,742	3,678	1,044	1921 ..	8,300	7,900	934
1914 ..	3,625	3,861	809	1922 ..	†10,723	—	—

The output for 1921 showed an increase of some 500,000 barrels and the sales also an increase of about 140,000, barrels, as compared with those of 1920. The annual demand figures, shown by sales in the above table, can be divided as domestic demand and foreign demand or the consumptive volume at home and for export. Cement exportations in 1921 showed an increase of 189,000 barrels and home demand an increase of 56,000 barrels over those of 1920. Further figures are given in the following table :

[In thousands of barrels]

Year	A. Total sales	B. Exports	B's per cent. of A	C. Domestic consumption	C's per cent. of A
1913 ..	3,678	303	8.2	3,375	91.7
1914 ..	3,862	436	11.3	3,426	87.6
1919 ..	6,236	1,256	20.1	4,891	79.8
1920 ..	7,767	1,285	16.5	6,482	83.4
1921 ..	7,900	1,474	18.6	6,426	81.3

From the above table it can be seen that demand for cement for consumption in foreign countries and in Japan has been on the increase since the termination of the European war. In 1919 and later years considerable amounts were used in the establishment of hydroelectric systems in Japan. After a temporary depression in this field domestic demand for cement was again increased in the latter part of 1921, resulting in an advance in price.

*Approximate output.
†Estimated requirements.

As a result of the recent disaster in Japan the demand for cement will increase to such an extent that the former exportable surplus will be consumed at home. As most of the cement mills are situated in Kyushu and Kwansai, only 8.2 per cent. of the whole producing capacity was affected by the earthquake. The annual productive capacity of the Kawasaki mill of the Asano Cement Co., near Yokohama, is about 1,500,000 barrels. Fortunately, very small damages to this mill were reported, only two smokestacks and two kilns being destroyed. The Fukagawa mill, controlled by the Asano Cement Co., however, did not fare so well, being completely burned. The yearly producing capacity of this mill was about 700,000 barrels, and the loss is estimated at Y.3,000,000. The mill operated by the Suzuki Cement Co. (Ltd.), located in Sunamura, Oshima, Tokyo-fu, was also completely burned. The productive capacity of this mill was aboutl 80,000 barrels a year. The loss is estimated at from Y.500,000 to 600,000.

Before the Japanese disaster cement was used principally in the construction of office buildings, warehouses, and hydroelectric plants. Japan was also planning an extensive system of highways in which cement was to figure prominently.

In the present situation of domestic and foreign demand for cement more output and more demand is expected for the coming year, both in connection with the reconstruction of the devastated area and in the carrying out of new projects.

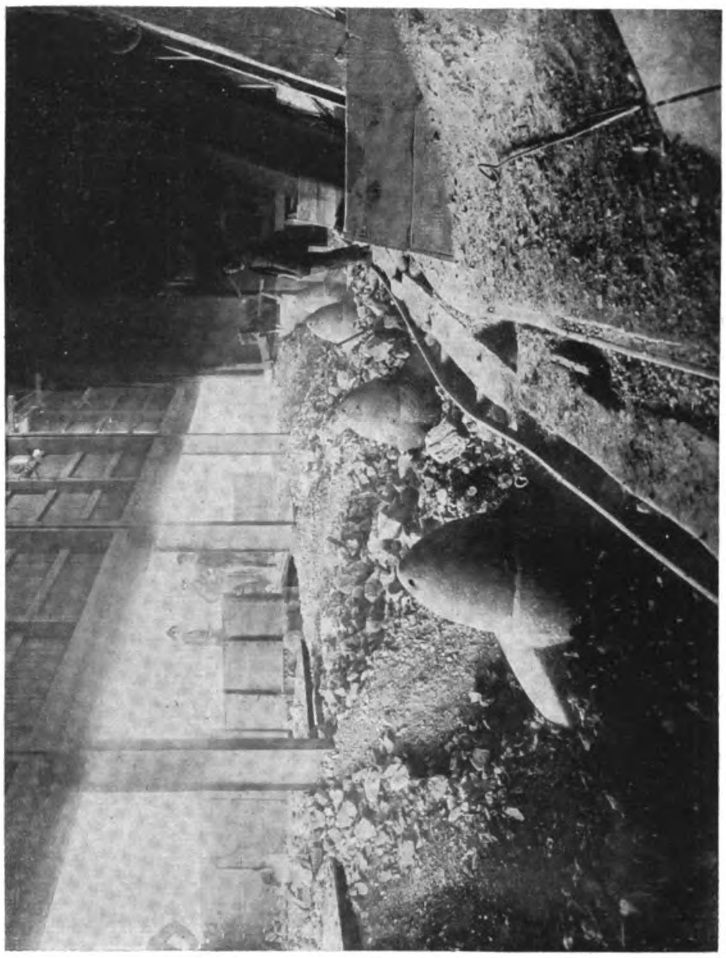
Exports

The annual return of the foreign trade of Japan shows that exports have gained considerably each year since 1911. During the years 1911 to 1914 Japan exported on an average of 51,085,000 pounds of cement, valued at $280,860. The Kwangtung province in China was the best customer during this period, purchasing about 27,257,000 pounds, with a value of $159,004, or 53 per cent. of the total quantity and 57 per cent. of the value. The Philippine Islands took 10,905,000 pounds, valued at $51,125, or 21 per cent. of the amount exported and 18 per cent. of the value. The United States imported only a trival amount, 12,000 pounds, valued at $16 during this period.

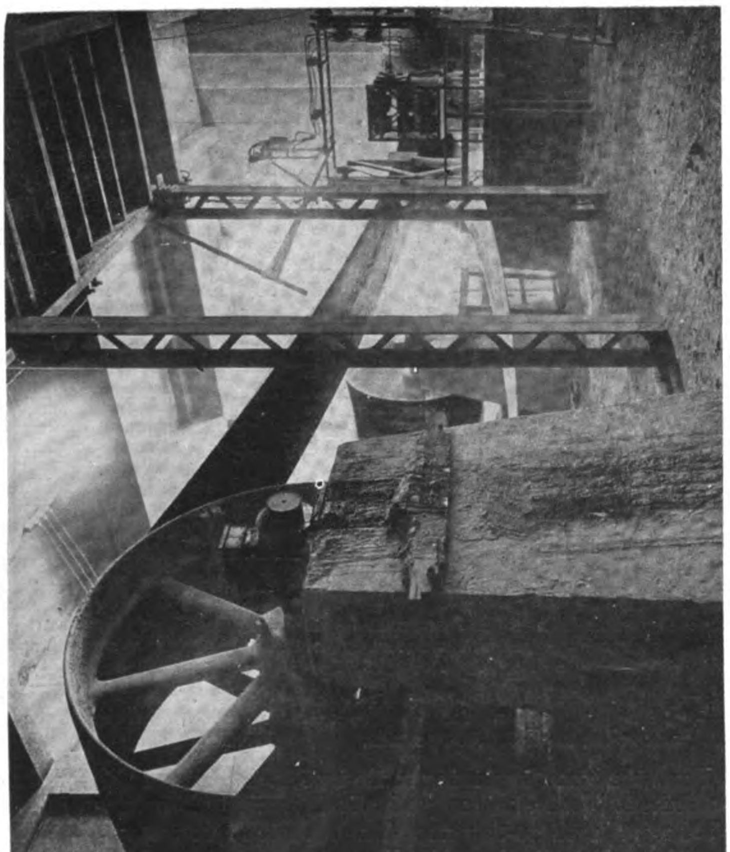
In 1919 Japan increased its exports over the average for the years 1911 to 1914 by 747 per cent. The exports amounted to 381,824,000 pounds, of which the Kwangtung province took 157,-140,000 pounds, or 41 per cent. of the total. The Dutch East Indies was the next best customer, importing 92,490,000 pounds, or 24 per cent. of the total.

In 1920 there was a considerable increase over the export figures for 1911-1914, amounting to 851 per cent. Of the total exports of 441,161,000 pounds the Dutch East Indies took 163,059,000

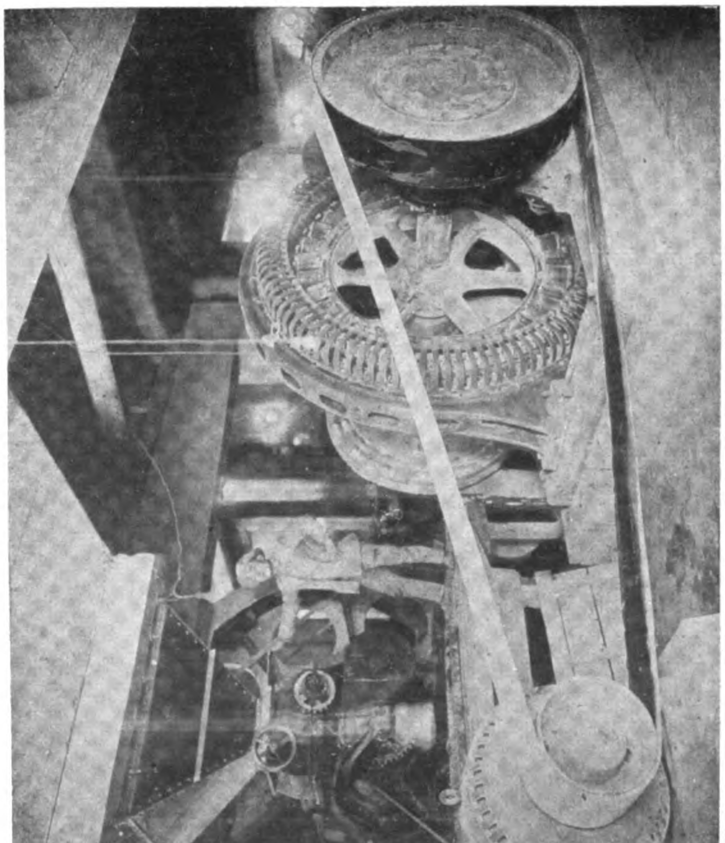
Allis-Chalmers Compeb Mill, Feed End.



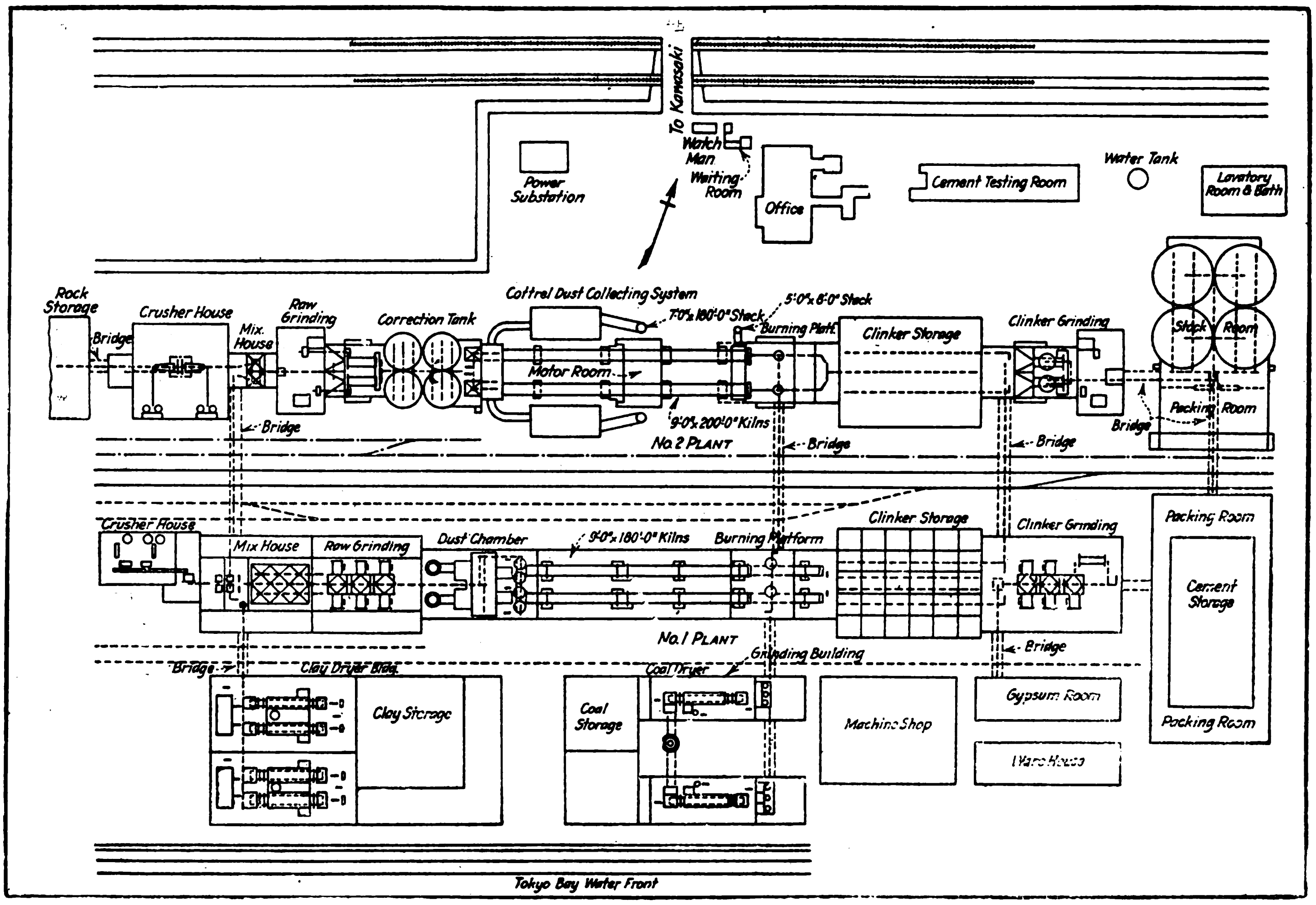
Allis-Chalmers Gyratory Crushers.



Compeb Mill Belt Drive from Allis-Chalmers Motor.



Allis-Chalmers Synchronous Motor (Driving Compeb Mill through Magnetic Clutch) with Belt Driven Exciter.



General Layout of Plants Nos. 1 and 2 of the Asano Cement Co. at Kawasaki.

pounds, or 37 per cent. of the total, while the Philippine Islands purchased 146,893,000 pounds, or 33 per cent. Kwangtung province during this year took only 61,337,000 pounds, or 14 per cent.

During 1921 the Dutch East Indies purchased about 118,457,000 pounds, or 31 per cent. out of a total export from Japan of 378,451,000 pounds. During the next year, 1922, the Philippine Islands again was Japan's best customer, buying about 62,753,000 pounds, or 27 per cent. of a total of 231,680,000 pounds. The United States has not figured in the cement export trade of Japan since the war.

VALUE OF EXPORTS OF PORTLAND CEMENT FROM JAPAN, 1911-1914

Exported to—	1911	1912	1913	1914	Average, 1911-1914
China	$37,716	$17,510	$22,630	$57,061	$33,729
Kwangtung province	116,547	89,961	223,625	205,884	159,004
Hongkong	—	—	2,832	19,151	5,496
British India ..	—	—	9,078	37,183	11,565
Straits Settlements ..	—	—	3,645	12,458	4,026
Philippines	7,983	8,466	62,626	125,424	51,125
Dutch East Indies ..	—	—	—	33,969	8,492
Russia (Asia) ..	—	—	—	3,514	878
Siam	—	—	—	8	2
British America ..	—	—	—	122	31
Peru	—	—	—	18	4
Australia	—	—	—	1,911	477
Hawaii	—	—	—	5,972	1,493
Chile	—	—	—	—	—
Brazil..	—	—	—	—	—
United States ..	—	—	—	63	16
All other countries ..	1,451	2,432	2,473	11,729	4,522
Total	163,697	118,369	326,909	514,467	280,860
Average price per 100 pounds	.61	.61	.55	.52	.55

Source: Annual return of the foreign trade of empire of Japan.

EXPORTS OF PORTLAND CEMENT FROM JAPAN BY QUANTITY, 1919-1922

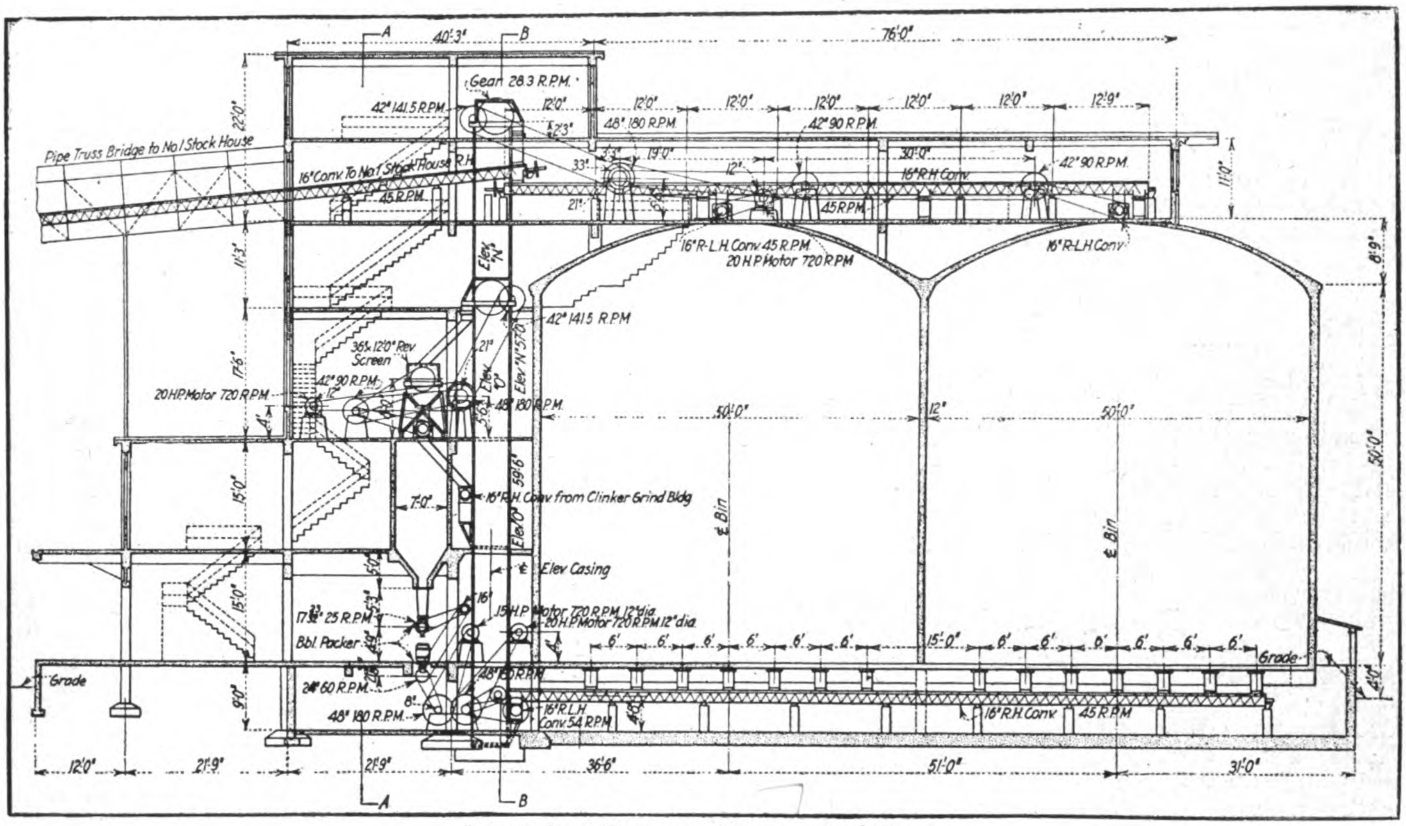
[Quantities in thousands of pounds]

Exported to—	Average, 1911-1914	1919	1920	1921	1922
China	5,698	24,876	30,489	63,865	58,343
Kwangtung province	27,257	157,140	61,337	67,986	60,547
Hongkong	1,034	249	—	—	—
British India ..	2,350	35,220	512	46,411	11,802
Straits Settlements ..	767	17,838	24,375	5,433	1
Philippines	10,905	49,738	146,893	60,646	62,753
Dutch East Indies ..	1,563	92,490	163,059	118,457	32,679
Russia (Asia) ..	174	717	—	—	—
British America ..	5	—	—	—	—
Peru	1	864	—	—	—
Australia	89	—	—	—	—
Hawaii	312	—	—	—	—
Chile	—	1,881	—	—	—
Brazil..	—	79	—	—	—
United States ..	12	—	—	—	—
All other countries ..	918	732	14,496	15,653	5,555
Total	51,085	381,824	441,161	378,451	231,680

Source: Annual return of the foreign trade of the empire of Japan. Frontier values are shown in this statement, which represent cost and charges of delivery on board the vessel at the port of exportation.

NOTE.—Detailed statistics are not yet available for 1923. The total exports of Portland cement for the five months period January to May amouuted to 45,870,000 pounds.

From the small beginning made by Mr. S. Asano in the Fukagawa Cement Works, he has gradually increased his investments in the industry until to-day the Asano Cement Company operates seven of the largest plants in Japan producing 9,000,000 barrels annually or nearly fifty per cent. of the total output of the country, which is roughly 20,000,000 barrels. These works are located, one at Fukagawa (Tokyo), one at Moji, two at Toshima in Hokkaido,

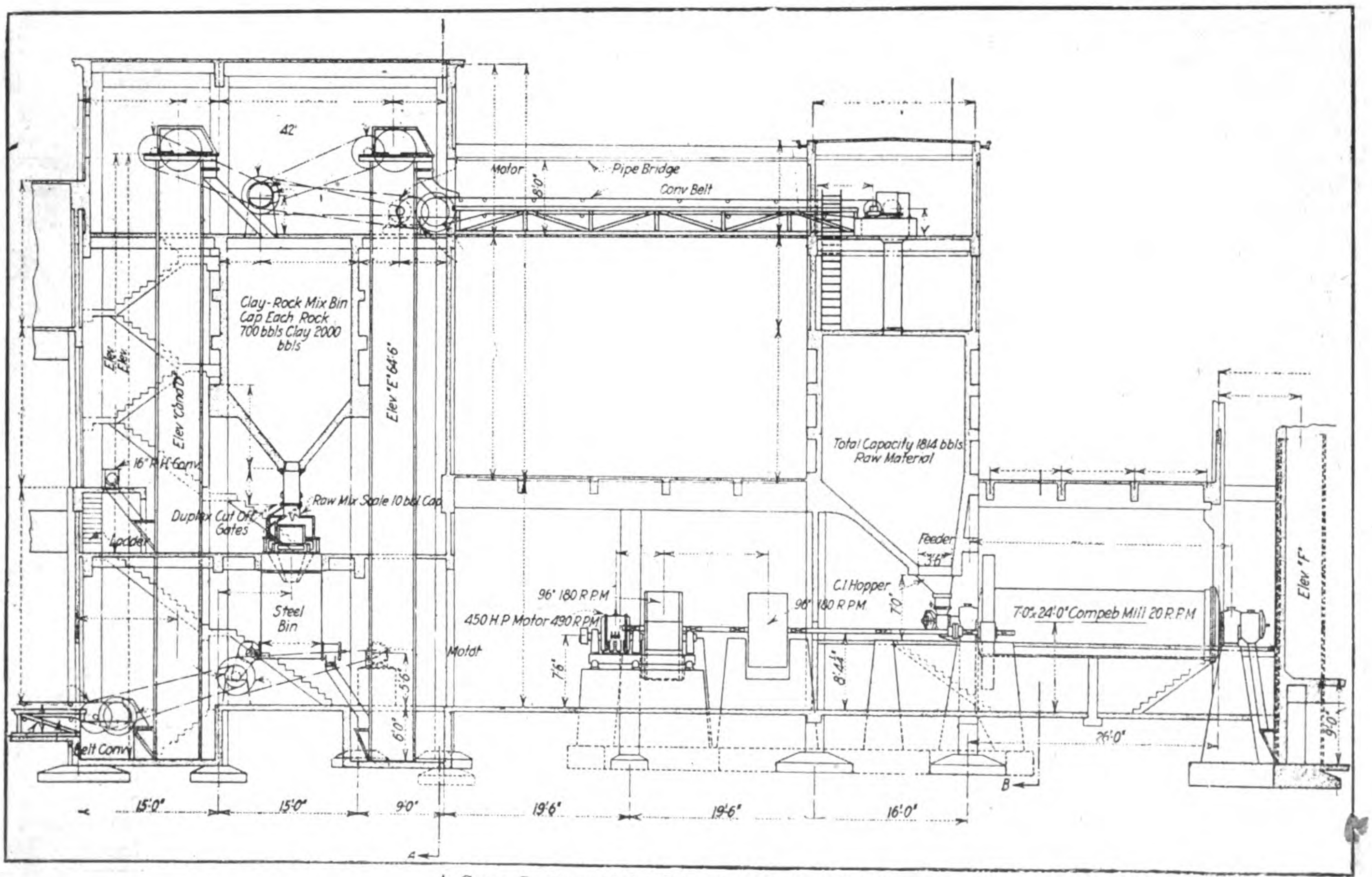


Longitudinal Elevation of Cement Stock House.

one at Takao, Formosa, and two at Kawasaki, near Tokyo. The Kawasaki plant, the most up-to-date, was built in 1914 on reclaimed land on the bay between Tokyo and Yokohama near the village of Kawasaki, in the prefecture of Kanagawa. When the plant was completed, a second unit was at once projected and Paul C. Van Zandt, at that time sales engineer for the Allis-Chalmers Mfg. Co., went to Japan to negotiate for the sale of the machinery for that company through their agents, the American Trading Co., of New York and Tokyo.

Mr. Van Zandt was placed in charge of the design and construction of the second Kawasaki unit as consulting engineer for the Asano Cement Company. Later Mr. Van Zandt became chief engineer of the Asano Cement Company, in general charge of the engineering operation and construction of all the plants of that company, which position he now holds.

The detailed and working drawings were all made under the supervision of John A. Roberts, cement plant designer of Allis-Chalmers Mfg. Co., who followed Mr. Van Zandt to Japan and



A Cross Section of the Clinker Grinding Building.

organized a competent drafting force from the engineering staffs of the cement company and the Tokyo office of the American Trading Co. Work on the new plant commenced in the fall of 1917 and completed the latter part of 1919. Every modern thought with reference to plans and equipment was embraced in the latest installation of the Asano Cement Co. The buildings and binwork are entirely of reinforced concrete and the machinery units are of the latest and most up-to-date manufacture. No American cement p.ant surpasses it in the " concrete-for-permanence " type of construction.

The new No. 2 plant at Kawasaki began operations in October, 1920. The Nos. 1 and 2 plants combined have a total capacity of 5,000 barrels of cement per day.

Raw Materials

The limestone quarries which supply the main ingredient in the manufacture of cement are located about 25 miles west of Tokyo and about the same distance from the plant. The rock on being received at the plant is unloaded in a rock storage, which is covered and has a capacity of about 30,000 tons. The limestone obtained from these quarries is very dense, containing only surface moisture and as a result of this drying of the rock is not necessary.

The clay which is obtained from a quarry near Yokohama supplies both silica and alumina. This is also brought in on cars and deposited in a covered storage having a capacity of 20,000 tons. From the storage the material is run through a set of slugger rolls which reduce the material to a suitable size for passage through the dryer. No. 1 plant originally had two 6 by 60-ft. indirect heat dryers for drying the clay, but these were found not to be sufficient, due to the high percentage of moisture. (The clay contains from 20 to 30 per cent. moisture). The clay after leaving the rolls is reclaimed by a bucket elevator which deposits the material in a feed bin at the head end of the dryers. In the dryer building for the No. 2 plant the material is then fed in to two 8 by 60-ft. single-shell, direct fired dryers by 18-in. reciprocating feeders. The extra large dryer here affords greater capacity. The two drying buildings are so arranged that the material from either one can be sent to either the No. 1 or the No. 2 plant.

Removal of Dust and Gases

An interesting feature in the operation of the dryers is the collection of dust and gases. In the drying of the clay considerable fine dust is created, which had a tendency to settle on a Buddhist temple that is located in close proximity to the cement plant. The high authorities of the temp.e raised considerable fuss over this. To obviate this nuisance and keep the temple clean it was necessary to install a system which would remove the dust created in the operation of the dryers.

At the head end of the dryers is a concrete dust chamber which connects to both of the dryers. The gases are exhausted from this chamber by means of a fan and discharged into a 12-ft. concrete cyclone collector. From the cyclone the gases pass into a Cottrell electric dust precipitator 10-ft. wide and 30-ft. long which removes all remaining dust.

The clay on leaving the dryers is conveyed either to a storage bin or the material is elevated to an overhead screw conveyor on a bridge spanning the railroad tracks, where it is conveyed to the mix bin in Plant No. 2. (The different storages are shown in an accompanying drawing showing a general layout of the plant).

Crushing Plant

There are four No. 5 gates gyratory crushers. The rock is dumped into any one of these gyratories from the cars and is reduced to about 1½-in. size. The top of the crushers is about on a level with the ground line. The material from the crushers is reclaimed by two No. 5 bucket elevators of 64-ft. centres, which discharge the material into two 40-in. by 16-ft. screens.

The material under 1-in. goes through the screens and onto a 24-in. belt conveyor located just a little above the grade line. The material over 1-in. drops from the screens into bin located over a set of 54 by 24-in. Anaconda rolls, which reduce the over-size for conveying to the raw mill. The 24-in. belt conveyor under the rolls delivers the material to an elevator which deposits it in a raw-mix bin having a capacity of 770 barrels of rock and 2,000 barrels of clay.

Raw Grinding

The clay is brought over direct from Plant No. 1 in a 16-in. screw conveyor which deposits the material into an elevator at a point 24-ft. above the belt conveyor. It is then elevated and deposited in the raw-mix bin.

Underneath the raw-mix bin are two scales of five and three tons capacity, respectively, which weigh out the correct proportions of the materials and discharge them into a steel hopper directly underneath. From this hopper the mixed material is fed by a reciprocating feeder into an elevator which elevates it to the feed tanks of the raw grinding machines. These feed tanks have a combined capacity of 1,814 barrels and serve two Allis-Chalmers No. 724 compeb mills. The material is fed from these bins into the compeb mills through an improved type Allis-Chalmers style " B " feeder. The compeb mills are belt-driven from 450-h.p. motors and run at 20 r.p.m.

Correction Bins

The finely ground raw material on being discharged from the compeb mills is reclaimed by an elevator which deposits it in a 16-in. screw conveyor located over the four correction tanks, which are 30-ft. in diameter and 40-ft. high, and which have a capacity of 21,042 barrels. Underneath each tank there are four feeders which discharge into a central 16-in. screw conveyor which takes it to an elevator, depositing it into two kiln feed bins ahead of the kilns. These bins have a capacity of 415 barrels each.

It is the practice here to draw about twice as much material as is required to keep the kiln full at all times, the overflow going into an elevator which returns it back to the bins. In this way there is a complete circuit of material, which enables the chemist to have proper control of his mix at all times.

Kilns and Coolers

Underneath each kiln feed tank is located a 7-in. half pitch screw conveyor, which, in turn, feeds a 9-in. water-jacketed screw conveyor running through the dust chamber at the head end of the kilns. The speed of both screw conveyors is controlled by means of a No. 2 Reeves speeder. The material through the water-jacketed screw conveyor is fed into two Allis-Chalmers kilns, which are 9-ft. in diameter and 200-ft. long. The dust from the dust chamber is reclaimed by means of a screw conveyor to an elevator which deposits it for re-mixing in the correction tanks.

The material discharging from the kilns drops into two 8-ft. by 60-ft. coolers through a cast-iron spout supported by a brick pier. As the clinker discharges from the coolers it is reclaimed by bucket elevators and deposited on a 24-in. drop pan conveyor, which distributes the clinker over the clinker storage.

The company is installing waste-heat boilers at the present time.

Coal Mill

The coal brought to the plant in boats from Yokohama and at present loaded by coolies, each carrying two small baskets supported by a yoke over his shoulder.

The coal in the baskets is set on a platform scale by the coolies, and the attendant at the scale either adds to or takes away enough coal to make the scale balance. He then records the amount and in this way records are kept of the exact amount of coal used. The coal is then dumped into the coal storage at Plant No. 1. Here again, the coal is loaded into wheelbarrows and taken by coolies to a hopper feeding a bucket elevator which deposits the coal to a coal bin situated at the head of the coal dryer.

The coal is fed to the dryer from the coal bin through an 18-in. reciprocating feeder. The coal drier is 6 by 60-ft. indirect heat type, stoker-fired. As the coal is discharged from the dryer it is reclaimed by a bucket elevator and distributed over three coal bins ahead of three 42-in. Fuller pulverizing mills. There are two dryers used and consequently six pulverizing mills. From the Fuller mills the pulverized coal is elevated and conveyed to the pulverized coal bin located on the burning platform. The pulverized coal is fed from each bin by two 6-in. screws, which discharge into an Allis-Chalmers coal injector, and it is then picked up by air furnished by a No. 10 American blower and discharged into the kilns.

Clinker Storage

The clinker storage, which is illustrated by accompanying photographs and drawings, is built entirely of reinforced concrete. The roof over the storage is of the three-hinged arch type, the arches being of special design. There is a total capacity of 68,400 barrels. The building is 48-ft. high and 90-ft. across centres.

Clinker Grinding

On reclaiming the clinker it is drawn through V-shaped openings in the roof of the tunnels underneath the clinker storage onto two 24-in. belt conveyors discharging into two elevators which deposit the clinker into two clinker bins ahead of two No. 724 Allis-Chalmers compeb mills. The clinker bins have a total capacity of 2,767 barrels.

The gypsum is conveyed over from a storage in Plant No. 1 and deposited in a gypsum bin of 18 tons capacity located in the clinker storage grinding room directly over the incoming belts from the clinker storage by a feeder, which is belt-driven from the head end of the belt conveyor. The amount of gypsum being fed is regulated by clinker scales.

The material from the clinker bins is fed into two Allis-Chalmers No. 724 compeb mills through style "B" feeders. As the pulverized clinker leaves the compeb mill it is reclaimed by an elevator which sends it to the stock house.

Storage and Packing

The cement conveyor from the compeb mills discharges into an elevator which in turn discharges into a 16-in. screw conveyor over the stockhouse. This conveyor distributes its material to any one of four reinforced concrete silos, 50-ft. in diameter and 50-ft. high, having a capacity of 25,000 barrels of cement each.

As the material is required for packing it is drawn from under the silos into screw conveyors, which deposit it in an elevator. This elevator then spouts the material to two revolving screens. The fines from this screen are conveyed to the packing bin located above barrel packers.

Until now nearly all the cement in Japan has been packed in wooden barrels and 10 barrel packers and one 4-tube Bates valve bag packer have been installed in this plant. The cement is fed to the barrels from the bin by means of a revolving feeder. The barrel is set on an iron disc or platform, which is vibrated from a line shaft underneath by means of cogs of different pitch. This causes the cement to settle so that the required quantity may be put in the barrel (380-lb.) When packed in bags, the bags weigh 95-lb. each From the packing room the barreled cement is loaded into cars.

Power Plant

The plant is electrically-driven throughout. The power is purchased from a hydro-electric company also owned by Mr. Asano and received at a sub-station on the company's property. All motors over 50 hp. are three-phase, 50-cycle, 3,300-v., alternating current. The small motors are three-phase, 50 cycle, 500-v.

The cement plant itself is located on reclaimed ground, for prior to the time of filling in the land the property at high tide was completely under water. The property on which the plant stands covers some 100,000 *tsubi* (about 80 acres) and it required approximately 30,000 *tsubi* (240,000 cu. yds.) for filling in.

In building this Plant No. 2, it is interesting to note that there was required 833 tons of steel, 14,400 yd. of concrete, and 22,600 barrels of cement. The machinery foundation alone required 3,500 yards of concrete.

Statistics of Japanese Cement

In 1917 the total production of cement in Japan was 4,000,000 barrels, and of this the Asano Cement Co. produced 1,944,000 barrels or approximately half of the entire output of Japan. The Asano Cement Co. has seven plants in Japan, two at Hokkaido, one at Tokyo, two at Kawasaki, one at Moji, and one at Formosa. These plants are the most modern in the Far East. Mr. Asano has installed modern grinding units in all of his plants and has thereby increased the capacity and cut the costs at his plants considerably. The new No. 2 plant at Hokkaido is also of reinforced concrete, of 1,800 barrels capacity, and was built along the same lines and at the same time as the Kawasaki plant.

Another recent and very important change is the installation of a crushing plant at the quarry. The rock is crushed in a No. 8 gyratory crusher. The cars are brought underneath a bin and loaded by gravity instead of hand.

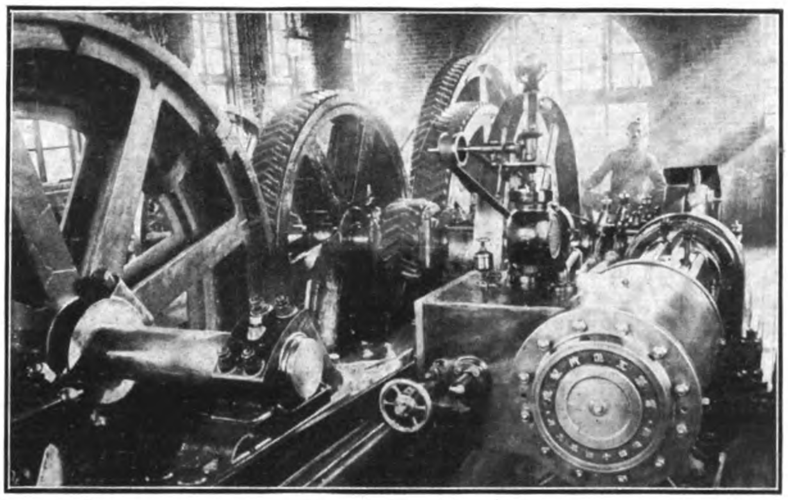
PENCHIHU

(*Continued from page 63*)

cubic meters of air at a pressure of six pounds to the square inch, taking 840 horse-power for blowing each furnace blast. The plant is also equipped with dust collection apparatus that screens the furnace gases before they pass into the flues of the stoves for heating the air blast on their way to be burned under the boilers of the power house.

Iron Supply

The iron for the Penchihu furnaces comes largely from the Miaoehrkau deposits estimated to contain about 80,000,000 tons,



Hoisting Engine of No. 1 Pit, Made in Japan

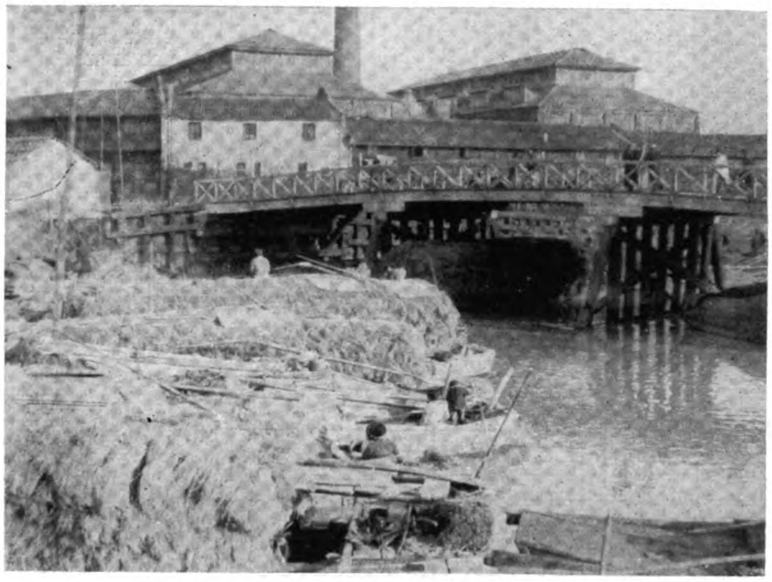
of which a fair proportion is a variety of magnetite containing 70 per cent. of iron, the rest being a low grade ore averaging between 30 and 40 per cent. of iron. The daily output from these workings has been about 200 tons but with the new improvements that have been installed this tonnage will be doubled. The cost of mining this ore and delivering it to the furnace is said to be about Y.2.50 per ton. In addition to the Miaoekrkau deposits there are upwards of 120,000,000 tons of low-grade ore in the immediate vicinity of Penchihu which will form a cheap and almost inexhaustible supply if the new process of roasting and concentration now being tried out at Anzan proves a success. The richer vein at Miaoehrkau has already been worked to a depth of nearly 500-ft. and although there is sufficient of this ore to keep going with for some years, the supply is limited and cannot be depended upon as the mainstay of the industry.

From the working shafts at Miaoehrkau an endless cable railway transports the ore to a loading bin or station from whence it is loaded into the cars of a light railway operated by the company and delivered to the S.M.R. cars at Nanfen or to the concentration plant near this station. This plant operated on the Grondahl system has a capacity of 125 tons per day.

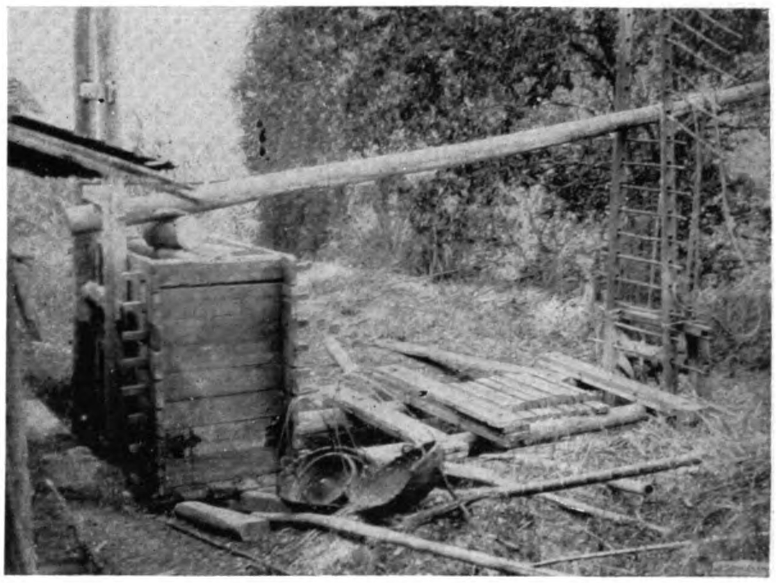
In addition to the Miaoehrkau mines the company was conceded permission in 1915 to develop and operate twelve other iron mines in the same district. Development work is proceeding on two of these properties located at Tungyuanpao and Paiboonling both located in the Fenchi district of Fengtien province.

Buffers for Indian Railways

Another contract has just been placed by the India office, with Messrs. George Turton, Platts & Co., of Sheffield, for 4,500 large steel buffers for Indian railways. These buffers are duplicates of the 6,500 already reported in The Far Eastern Review, ordered from the same firm for the East Indian railway.



Boatloads of Straw Carried to the Paper Mill



An Ancient Process for Making Bamboo Paper

Paper Making in China

PAPER manufacturing, which China discovered in the first century, continues to be one of the most important industries in the country, according to *The Chinese Economic Bulletin.* Instead of wood or rags, Chinese paper manufacturers use rice straw, bamboo and the bark of several species of trees. Paper manufacturing centres in China are found all over the southern provinces from the Yangtze regions southward. Wherever rice is cultivated and bamboo groves grow, the industry thrives. Numerous varieties of paper are produced in these provinces, each having some particular use. They may be divided into two main groups: (1) those made from rice straw and tree bark and (2) those made from bamboo. Of the first group, Hsuan paper may be taken as representative. Hsuan paper is produced chiefly in Anhwei province. Hsuan-cheng, a *hsien* district in the province, being the best known manufacturing centre, hence Hsuan paper.

Hsuan paper is made from a mixture of straw and tree bark pulp, which for ordinary quality purposes, contains about 70 per cent. straw pulp and 30 per cent. bark pulp. The percentage varies with the quality of the paper to be made, the presence of a higher percentage of bark pulp improving the quality. The bark is obtained from a kind of brushwood of the Ulmaceae family known in Chinese as Tan tree. It grows in a wild state on the hillsides in the Yangtze valley regions, and is sometimes specially cultivated by paper manufacturers for its bark. When full-grown it reaches a height of over ten feet, and has numerous branches. The bark is obtained chiefly from the branches which are cut in winter time. The bark is peeled and reduced to pulp by boiling.

The process of boiling the raw materials is done by means of a basin-like iron boiler about five feet in diameter. The bottom is lined with pieces of board so as to prevent contact of the raw material with the bottom of the boiler, which would otherwise be spoiled by over-heating. In the case of straw the raw material is done up into neat bundles and placed in the boiler, into which lime and water are added until the straw bundles are entirely immersed. Firewood is usually used as fuel in the boiling, which lasts for a certain period of time, determined by the experience of the workmen. After boiling the contents are allowed to remain in the boiler to cool. A piece of cloth is often used to cover the boiler to prevent its contents from coming in contact with the air too suddenly. After cooling the straw bundles are taken out and washed clean of any lime solution. The same process of boiling is repeated once more before the straw is ready for bleaching Tan bark is treated in the same manner; but instead of twice as in the case of straw, bark is boiled three times before it is bleached.

Bleaching forms the slowest and most tedious part of the process of paper manufacturing. Instead of using chemicals, Chinese paper manufacturers depend entirely upon sunlight as the bleaching agent. After the raw material is boiled and washed clean of lime, it is placed in a sunny place, generally on the sunny slope of a hillside. Water is sprinkled on the raw material as soon as it becomes dry. This goes on for several months—seven months for straw and five months for tan bark—until the sun completes its work. The bleached material is then reduced to pulp in a wooden mortar by pestling, which is done by means of a traddle, worked by one man in the case of straw. Tan bark, however, requires further pounding on a stone slab after it has been brayed in the mortar. In this case, two men are required; one working the pestle and the other moving and shifting the partly-converted pulp to insure a thorough pounding.

Each kind of pulp is then stored in an earthenware jar. For making the common Hsuan paper, 30 per cent. of tan bark pulp and 70 per cent. of straw pulp are mixed in a wooden tank containing water. Generally, about 50 catties of the mixture is put into each tank, but the proportion of the pulp to the water in each tank is determined entirely by the judgment and experience of the workmen. A liquid rich in starch and made by boiling yam is poured into the tank to add cohesion to the pulpy mass. The thickness of each sheet of paper to be made depends entirely on the percentage of the liquid present in the material. When thus prepared, the pulp is taken out of the tank, strained in a wickerwork basket and spread in a thin layer on a piece of board or a bamboo screen. The layer of pulp thus spread is partly dried by the operation of a rolling-pin passing over the surface. This squeezes out the free water. The drying chamber consists of two rooms partitioned by a thick brick wall hollowed inside. A fire is built inside the wall so as to give a heating effect on both sides, which are made glossily smooth by spreading a thin layer of starch over their stucco surface. The partly dried sheets are removed from the bamboo screen and laid on either side of the wall to complete the drying process. The dried sheets are ready for the market after trimming and cutting into the desired size and shape. The drying chamber is generally a tile-roofed hut, well-ventilated, with numerous holes all over the roof to facilitate the escape of moisture from the drying sheets.

There are two varieties of Hsuan paper: one four feet by two feet known as Sze Chi Liao Pan and the other six feet by two feet eight inches known as Chia Kung. The latter differs from the former not only in size but also in quality. It is thicker and commands a higher price. Hsuan paper is one of the best varieties of Chinese paper. Its chief use is for art work. The scrolls and paintings that adorn the walls of Chinese households are done on Hsuan paper.

Paper made from bamboo pulp is usually of inferior quality. There are quite a number of varieties, the most common being Pai

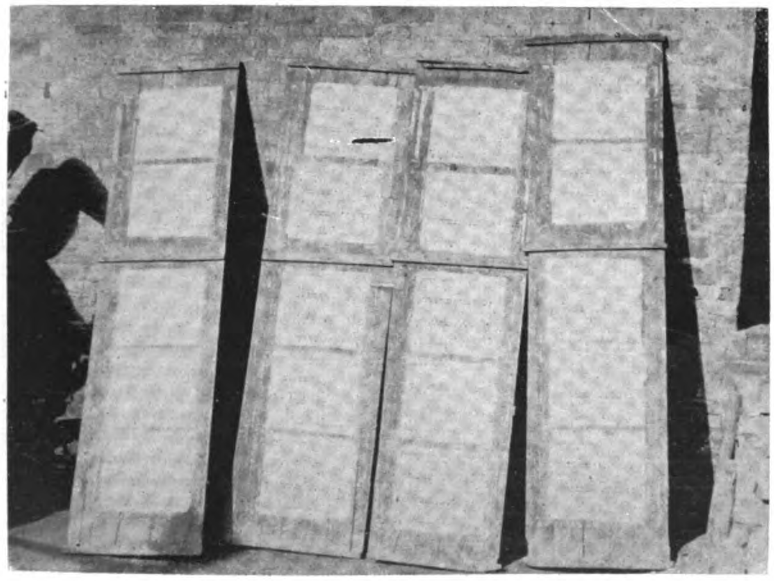
Kwan and Piao Sin. Pai Kwan paper is used for ordinary stationery and for book printing and Piao Sin for wrappers, fire brands and other uses. In making paper the bamboo must be cut before it grows too old. Bamboo shoots start to grow in April, and the young bamboo must be cut at the beginning of June. Bamboo after a year's growth is useless for making paper because its fibres are no longer tender enough to be reduced to paper-making-pulp. When young bamboo is cut and pruned of its branches, it is tied in a bundle and placed in a pond to be steeped in water for about two weeks until the bark or the green covering is removed by maceration. The macerated bamboo stalks are then taken out of the pond and cut into chips, each about the length of its natural joints. The chips are carefully sorted and graded. From a single stalk the chips are divided into five classes. The part nearest the root and that at the top are not suitable for making any sort of paper but the lowest grade because the "fibres" are either too coarse or too flimsy. The chips obtained from the middle of the stalk are the best, being used for making high-grade paper. When the chips are sorted and graded, they are treated with lime and water for five or six days in a pond. They are then boiled in an iron boiler for two to seven days. The water in the boiler is then drained off and by further beating and pounding the contents are reduced to fibres, which are then washed several times until they become perfectly clean. By the action of soda and wood ash placed in the boiler together with the cleaned fibres for about 20 hours, the fibres are softened. Boiling is renewed for several days and further washing of the fibres follows. In summer time the washing takes about ten days; in winter forty days are required to clean the fibres of soda or wood ash. The fibres, now sufficiently softened, are placed in a well-ventilated room to dry. The process of reducing the fibres to pulp and making and drying the paper is practically the same as that described above with regard to the treatment of bark or straw in making Hsuan paper. When the sheets come out of the drying chamber, they are bleached with sulphur and rolled with a stone roller to make their surface smooth and glossy. They are then ready for the market.

The coloring of the paper does not belong to the province of the manufacturer; it is done by the paper dealers. By custom colored paper is more in demand then plain paper in China, each kind of colored paper having a particular use. Red paper, for instance, is taken to signify "happiness" and is therefore used on all occasions except in mourning when blue or green paper is used instead. Yellow paper signifies authority and was formerly used for writing official proclamations and also in connection with religious observances. Colored paper is generally of very inferior grade. The coloring is done by the dealer after it has arrived on the market.

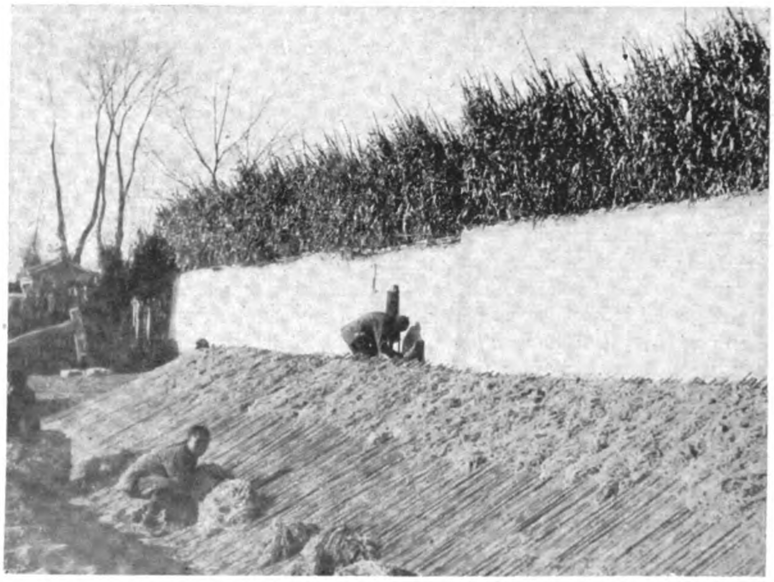
Numerous varieties of paper are produced by the different provinces. In Kiakiang, the best-known paper manufacturing centre in Szechuan province, no fewer than 17 varieties are produced, each having certain uses. All of them are made from bamboo fibre. The following table shows the name, market price and other particulars of each variety of paper produced at Kiakiang:

Name	Market Price	Place of Consumption	Remarks
Kung Chwan	$0.40-$0.90 per "Ma" of 360 sheets	Chungking, Chengtu, Kiating and Yunnan province.	
Teh Fang	$16-$43 per 10,000 sheets	Chungking, Chengtu, Neikiang and Fushun	Used chiefly for book printing and also as wrappers
Fang Tze	$30-$36 per 10,000 sheets	Chungking, Chengtu and Neikiang	For making books, etc.
Kwan Tze	$35-$36 per 10,000 sheets	Chungking	About 1,000,000 sheets are consumed yearly in Chungking
Chang Kung Chwan	$18-$22 per tao of 80 catties	Chengtu and Chungking	Total yearly production is about several hundred tao.
Kao Yang	$10-$20 per 10,000 sheets	Chengtu, Chungking, Luchow, etc.	Known locally at Kiakiang as Shui Tze and at Luchow, Pi Tze. Its principal use is for fans and books.
Lien Sze	$1-$1.50 per tao of 95 sheets	Chengtu, Neikiang and Fushun	This is a bleached sort, large quantities being consumed yearly
Imitation Hsuan Paper	$3 per tao of 95 sheets	Chungking and Chengtu	Made from fine bamboo fibres bleached. Twice as thick as the Teh Fang paper.
Hsu Pai Tsein	$50-$120 per tao of 95 sheets	Chengtu	Used exclusively for art works such as paintings and scrolls. There are three varieties. The 5-feet variety is sold at $50 per tao, the 6-feet variety, $70 and the 8-feet variety, $120.
Pao Tze	$20-$30 per 10,000 sheets	Chengtu	Used chiefly as news print for the vernacular papers. The bleached variety commands a higher price.
Kiung Tze	$4 per tao	Luhsien	Very coarse but extensively used at religious and funeral services.
Pai Er Lien	$10-$12 per 10,000 sheets	Chengtu	Used chiefly as wrappers.
Lao Lien	$14-$15 per 10,000 sheets	Chengtu and Luhsien	Used chiefly as wrappers.
Chwan Lien	$17-$18 per 10,000 sheets	Chengtu, Luhsien, Kiating and Yunnan province	Finer variety is used as writing paper and coarser variety burned at funeral and religious services.
Chang Lien	$10-$15 per 10,000 sheets	Chengtu	For book printing.
Tu Lien	$5-$7 per 10,000 sheets	Chengtu and Luhsien	Used chiefly as wrappers and also for making books.
Ching Chang	$10-$16 per 10,000 sheets	Chengtu, Kienwei and Suchow	For book printing.

The prices in the foregoing table are given according to the market quotations prevailing in Szechuan in July, 1924. Paper making in Szechuan is by no means standardised. The same sort of paper made at different places or at different times may differ greatly in quality or size, hence its price varies accordingly. The



Drying Paper Scrolls



Pulp Soaked and Dried Above the Finished Product Spread on Prepared Mud Walls

names given above are local names. They may be known under other names in another province.

The cost of different kinds of raw materials for paper manufacturing may be shown as follows :

Raw Material		Cost	Remarks
Bamboo Fibre	Pai Kia Tso Ma (Fresh)	$7-$9 per picul	
	Chin Tso Ma (Fresh)	$5-$6 per picul	This together with Pai Kia Tso Ma is bamboo fibre of the best kind. Used in making such paper as Chwan Kung, Chwan Lien and Teh Fang.
	Shui Tso Ma (Dried)	$11 per picul	Inferior grade.
	Chai Tso Ma (Dried)	$9 per picul	Used chiefly in making paper of the coarser variety.
	Pan Tso Ma (Fresh)	$3 per picul	
	Lun Tso Ma (Dried)	$1-$1.50 per picul	This is the lowest grade of fibre, used only for making paper of the coarsest variety.
Soda	Imported Soda	$13 per bag of 160 catties	
	Native Soda	$10 per picul	Produced by certain Chinese soda factories at Pengshan and Loshan, Szechuan province.
	"Tsao" Soda	$7 per picul	A kind of native soda produced at Tienchuan and Omei, Szechuan province. This is of inferior grade. Requires 300 catties to treat 10,000 catties of bamboo fibres.
	"Tsai" Soda	$15-$16 per picul	Produced at Paohsien, Szechuan province. Requies 180 catties of this sort of soda to treat 10,000 catties of bamboo fibres.
	Lime	$0.60-$0.70 per picul	Produced at Loshan and Omei, 3,000 catties are required to treat 10,000 catties of bamboo fibres.
	Fuel	No fixed price	About 2,000 catties are required to boil 10,000 catties of bamboo fibres.
	Bleaching Powder	$40 per chest of 80 catties	Imported from Japan. About two catties are used for every 100 catties of paper pulp.
	Soap Tree Leaves	10 cash (less than half a cent) per catty.	The juice is used to add cohesion to the pulp

The following table shows the main equipment of a Chinese paper mill in Szechuan :—

Article	Use	Value
Two Stone-lined ponds	For washing and steeping bamboo fibres	$30 each
One iron boiler	For boiling bamboo fibres	$20
One stone mortar or a specially prepared stone slab	For pounding bamboo fibres	$7
One stone tank	For storing raw materials	$10
Bamboo screens	For straining and drying the pulpy mass	...
Earthenware jars	For storing the chemicals used in paper making	$1 each

There are numerous accessories not included in the foregoing list. What forms the important part of a Chinese paper manufacturing plant is the drying chamber with its thick, hollowed wall to which reference has already been made.

The wages of Szechuan paper mill hands vary from $1.20 to $3 a month with food, which consists of hardly anything more than maize flour cakes. In the paper mills women are also employed. The paper mill owners are by no means capitalists. Their financial condition is only a little better than the hands they employ. In the paper mills master and men often work side by side and the occupation is by no means a pleasant diversion. In washing the bamboo fibres, their hands are swollen and sometimes seriously hurt by the action of the soda and lime water.

The profits from paper manufacturing may be handsome, but it is not the paper manufacturer but the paper dealer or exporter who gets the lion's share. The manufacturer is always too poor to raise capital in any other way than to obtain loans from the paper exporter, who comes to a paper mill with an offer of an advance payment for so much paper to be delivered on a certain date at a low price. The manufacturer is always eager to accept the advance payment, which he at once utilizes as capital to start operations. When the paper is ready, the exporter pays the balance and ships the cargo to other places to be sold either by wholesale or in retail at a high profit. The working capacity of each paper mill is estimated by the size or number of boilers it possesses. A big mill can boil 10,000 catties of bamboo fibre at one time, a smaller mill, 3,000 catties. Paper manufacturers and their employees in Szechuan are raised in the mountainous districts, and can stand hard work and are able to subsist on very coarse food.

With the exception of Szechuan paper, which has been described, the best-known varieties produced in each of the other paper-producing provinces are as follows :—Kiangsi : Mao Pien, Lien Shih, Pai Kwan and Piao Sin ; Anhwei : Hsuan paper ; Fukien : Lao Kia ; Kwangtung : Lu Ti ; Chekiang : Liu Tsien Yuan.

Russo-Japanese Corporation to Exploit Siberian Forests

JAPAN is losing no time in taking advantage of the business opportunities created by the new treaty with Russia. Hardly had the ink dried on the signatures when a corporation, backed by the most powerful interests in Japan, was organized to exploit the lumber resources of Siberia. Registered under the name of The Russian Territory Forestry Society the new enterprise headed by Mr. C. Kadono, vice-president of Okura & Company, has as its principal incorporators, the Mitsui Bussan Kaisha, Mitsubishi Trading Company, Okura & Company, Suzuki & Company, the Fuji and the Oji Paper Mills, the Akita Lumber Company, Karafuto Industrial Corporation, Maritime Province Lumber Company, Russian Forestry Union, Far East Forestry Lumber Development Company and the Toyo Development Company. The new combination will enter Siberia with a capital and organization that will enable it to take its place as the strongest factor in the Far Eastern lumber trade and furnish sufficient wood pulp and lumber for Japanese paper mills and reconstruction purposes to free Japan from the major part of her importations from America and Canada.

The far-reaching effect of the new agreement on the economic future of Japan may be guaged in part by the liberty of action it gives to Japanese interests in promoting new enterprises in Mongolia, in which territory Russia has hitherto enjoyed a monopoly of exploitation. One important outcome will be the establishment of sheep raising on a large scale in Eastern Mongolia under the direction of Okura & Company in an attempt to free China and Japan from dependence on foreign importations of wool. Needless to say that the same industry will also include the supply of mutton and beef for Far Eastern consumption.

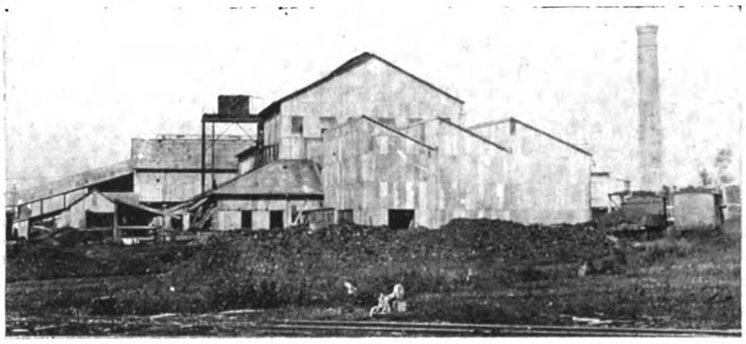
Reconstruction of Nizam's Guaranteed State Railways

The reconstruction of, and considerable additions and extensions, to, the Nizam's guaranteed state railways is to be put in hand almost at once. Sir Seymour Tritton, the well-known Westminster consulting engineer, is proceeding to India shortly, and will report on a general scheme. The erection and equipment of the new loco and wagon shops, erecting shops, and repair works will mean the placing of very valuable contracts with engineering firms.

New Automatic Coaling and Sanding Plant

An innovation is now being tested out on the London and North Eastern Railway Company, in the shape of an electrically operated automatic coaling and sanding plant for their locomotives at Doncaster at a cost of £30,000. The installation of the new plant is being watched with considerable interest by various Far Eastern concerns. The adoption of the plant will enable coaling and sanding of engines to be performed much more rapidly and at a considerably reduced cost, and will increase the time during which the locomotives will be available for traffic purposes. Coal and sand will be supplied simultaneously.

Hambledon Mill of Colonial Sugar Company near Cairns, Queensland



Babinda Mill, Built by Government, now Operated by Growers

The Sugar Industry of Queensland

Italian Labor Solves Problem of Growers

RANKING next to wool, wheat, and dairying, the rich and prosperous sugar industry of the state of Queensland, is one of the most important commercial assets, a basic primary interest of the commonwealth of Australia, and more than that, it is the main fundamental supporting the ideal of a "White Australia." The sugar lands of Queensland are capable of producing all the sugar needed by British empire countries. This fact, with its tremendous possibilities has recently been brought home to Australians, that England last year paid America no less than £40,000,000, sterling for sugar and strenuous efforts are now being made for a preference within the empire for Queensland sugar.

Queensland with the forest soils of the south country, and those of the jungle lands of the north, combined with the perfect, all-year-round climatic conditions, assures complete and seasonable cultivation with regular, abundant, and profitable annual harvests.

In the year 1849, sugar was first grown in a small plantation on the bank of the Brisbane river, now "New Farm," one of the most picturesque suburban areas of the fine city of Brisbane, the capital of the state of Queensland. Twenty-five years later, the particularly rich lands of North Queensland were discovered, and quickly settled. This area has since come to be known as one of the richest and most extensive sugar centers of the world. With the begining of the sugar industry in the north and the remarkable rush of settlers that followed, the first substantial effort was begun for the assurance of the national ideal of a "White Australia." This did not definitely nature until the year 1904, when black labor, recruited from the South Pacific Islands, was forbidden by popular demand, and the deportation ordered of all colored workers.

Hot as is the summer of North Queensland, it has been completely proved white labor is capable of all classes of work, even that of the heaviest field operations. To promote, attract, assure and encourage white labor, Australian law demands the highest wages, not less than 20 shillings a day of eight hours, and the most comfortable living and housing conditions. The history of the change from black to white labor conditions is interesting. Having proved the fitness of white labor, and after fighting strenuously for the realization of the ideal of a "White Austraia," white labor by its Unionilsm has for years, consistently and constantly, ruthlessly hampered the progress and prosperity of this wonderful industry. Obsessed with the idea of the "nationalization" of the industry, and in the face of the terrible failures of all Australian national industries in all states, unionism obstinately set itself against private ownership and enterprise, with an unexpected and extraordinary result.

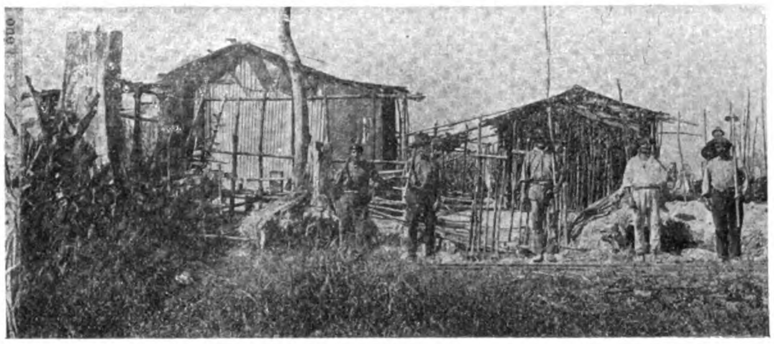
Townsville, Chief Shipping Port for Queensland Sugar

The industry has been flooded with Italian labor, little interested in Australian union ideals, and by hard work, coupled with consistent and reliable conduct, is steadily supplanting not only Australian labor but Australian ownership to a considerable extent. An agitation has now begun questioning the presence of the Italians, who are beginning to be regarded as an intrusion upon the ideal of a "White Australia," which, it is asserted, means solely "British" Australia. The difficulty is not easily surmounted, the dismissal of the Italians cannot be considered owing to the danger of international complications, as well as in the very pronounced fact, that the continuance of the Queensland sugar industry in a great measure relies upon the efforts of the Italians. Forming great companies or communities they have come to be possessed of large areas of the richest sugar lands, and Italian labor is popular with Australian growers. It is not given to strikes, nor to unreasonable demands wages for above award rates or for superior living conditions, demands which, on the part of Australian labor, incessant and irritating, have no finality and have endangered the prosperity of the sugar industry.

The Australian government to help the sugar growers, and, if possible, to satisfy Australian labor, adequately protected the industry, and until this year liberally subsidized every ton of raw sugar produced. This was to assure high wages, and comfortable living conditions, and stabilize on the soundest the industry on sound foundations. Australian labor still strikes, while the Italian hold becomes firmer. In a few years it is possible that Australian labor will be forced out of the sugar industry of the North, unable, as it is even now to take any concerted action to hold up the industry or any considerable period. Three years ago for every Italian cane cutting gang, there was at least three Australian ones---the numbers are reversed to-day.

Hope for better and saner conditions in the future are at the moment apparent in a section of Australian labor. The "Moderates," as they are called are beginning to recognize the loss of strength to unionism the continued increase of the Italians, the unemployment of Australian labor, the reduction of Australian settlement, and therefore the probable failure of the "White Australia" ideal. There are some 7,000 sugar growers in Queensland and while the Italian aspect is objectionable to many people, it is undoubtedly a factor guaranteeing the prosperity of the industry without interruption. At the same time Australian growers are a particularly sturdy lot and by their numbers seek to control the industry, and keep it Australian.

The value of the Queensland sugar industry is estimated at about £25,000,000 sterling, with a working capital of many



Rude Huts of Laborers who Buy Plantations from their Savings

Gang of Italian Cane Cutters in Queensland Sugar Field

millions, and producing wealth equal to £2,000,000 a month. The industry employs directly 50,000 men and the annual wage is near £10,000,000. The national revenues benefit to a considerable extent by the wealth of the industry, more so of late that it can carry on without the government subsidy, which by general agreement has been removed. The Queensland sugar industry has materially assisted the settlement of the state, especially the tropic North. It is responsible for some of the busiest and most progressive cities of the state, Townsville, Cairns, Mackay and Bundaberg, for many large towns, Innisfail, known as the "Million pound" town, Ingham, Babinda, Ayr, Childers, and Nambour, Forest and jungle lands are being cleared annually to the extent of tens of thousands of acres. Railways are spreading out to top several thousands of miles, a notable enterprise of recent date being the linking up of the railways from Cairns in the extreme North of Queensland, to Perth the capital of West Australia, a journey of 4,000 miles, one of the longest in the world.

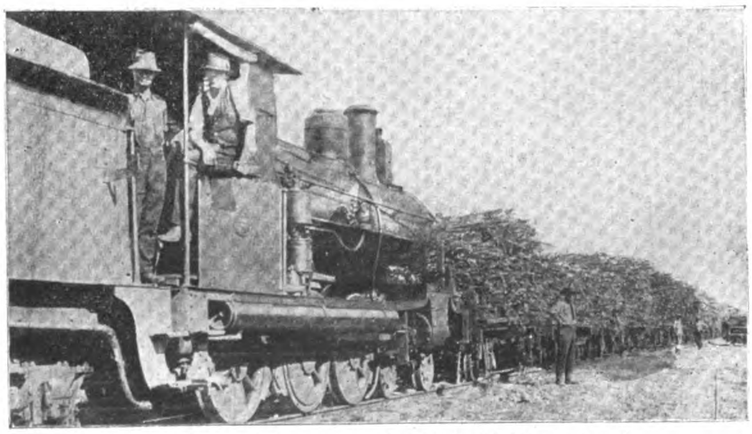
In every sugar district there are several hundreds of miles of tramways, permanent and portable, and the quantity of rolling stock, locomotives, trucks and passenger coaches must be numbered by the thousands. Engaged in the sugar trade is a fleet of vessels from steamers of 10,000 tons to small motor launches, with an immense number of barges, and molasses, tank punts, doing service from up river mills to the loading anchorages at sea. Millions of pounds have been, and are being, spent in wharves and storing sheds in all the bigger ports such as Cairns, Townsville, and Brisbane. Great engineering works have been opened in all the Australian capitals, the sugar industry keeping these fully engaged. Refineries of most modern equipment famed for size and completeness are also operated in the eastern districts. At least 200,000 people are directly and indirectly concerned in this great sugar industry of Australia. The first ton of sugar was produced in Queensland in the year 1862, and with the aid of the simple domestic wash-boiler. In 1867 the tonnage was 168 tons, in 1880 it jumped to 15,681 tons. This season (1924) it will amount to 300,000 tons.

Trucking Cane to the Main Railway Line

In 1901 there were 60 mills in Queensland, all of the most primitive type. To-day there are exactly the same number of mills all of which cost from half to three-quarters of a million sterling. Generally the capacity is over 500,000 tons.

Mills are both government and private owned. Government ownership is naturally not popular, it has to be admitted it has served a very useful and convenient purpose. The government is ever ready to erect mills in new and promising districts, at once relieving the growers of the burden of cost, and giving them a splendid chance of utilizing their earliest crops, thus bringing in returns to encourage and to help them to carry on. Every supplier in the district of a mill pays a fixed amount for the crushing and milling of his cane, at the same time a certain sum is held back to refund with interest the cost of the mill. When the money advanced by the government is refunded and if the growers are willing to take over the management of the mill, the government hands it over, maintaining only a slight supervision to see that the enterprise is carried on wisely and to the satisfaction of the growers, who might be termed a co-operative concern.

The Queensland sugar industry is admitted by experts to be as complete and perfect as any industry in the world. Every department, scientific, commercial, management and cultivation is as up-to-date as well paid brains and energy can make it. Both the federal or commonwealth and state or Queensland governments are keenly alive to its importance, and especially interested in its general progress. The governments maintain departments devoted to the interests of the industry. In experimental stations scattered over Queensland, experts are constantly engaged in investigating every phase likely to lead to its general advancement. Remarkably free from pests and diseases, the result of constant and vigilant inspection, cultivation is most successful. The classing of soils and canes suitable for various types of soil, the experimenting in canes for profitable density, frost resisting, and fullness of suger qualities are matters continually employing large and experienced staffs. Badila, or New Guinea cane, is the kind in general use but every year some new variety is found suitable for certain areas, having certain qualities assuring its cultivation on a profitable basis. Sugar seasons in Queensland vary from very good to fair, never indifferent to bad, and this has assured numerous subsidiary industries, such as jam and fruit preserving, confectionary and biscuit making for which Australia is now a leader. Australians pay 5 pence to 6 pence a pound for sugar, the highest rate in the commercial world, but they do so gladly, believing that high wages and high standards of living conditions for all concerned in the industry, is necessary for the growth of the commonwealth.



Tramload of Cane near Innisfail, N. Queensland

Distribution of Petroleum in Burma

By George P. Chaplin, M.Inst.M.M.

HAVING spent some time recently studying the subject of petroleum occurrences in Burma and the possible extension of the oil industry there, I offer the following few notes, hoping that they may be of some general interest to the non-technical readers of the *Magazine*.

The accompanying map, based on that in the "Oilfields of Burma" by Dr. E. H. Pascoe (Vol. XI, Part 1, Memoirs of the Geological Survey of India), shows the majority of the localities where petroleum indications were known in 1910, and it may be said that few further surface indications of importance have been reported since that date. It will be seen that, with the exception of those occurrences on the Arrakan coast, west of the Arrakan-Yoma Range, practically all the others are along a line extending up the Irrawaddy valley from Prome to slightly north of Pakokku, and thence, with a distinct break, along the valley of the Chindwin to Kalewa, with further isolated indications at Kindat (Upper Chindwin), which is the most northerly of the petroleum occurrences officially reported.

The distribution of the producing districts is also indicated in the analysis in the table where for easier reference the different producing oilfields have been divided geographically into four groups, the Central Upper Chindwin, Arrakan, and Thayetmayo. These figures show that the central group has produced, for the three years referred to, 99.3 per cent. of the total yield, and that of this large amount the Yenangyaung field with 63 per cent. and the Singu field with 34 per cent. have between them produced 97 per cent. When the statistics for 1923 are published it is probable that rather less production from Yenangyaung, with a corresponding increase from the Singu field, will be shown; only small differences are to be expected from the other fields and groups.

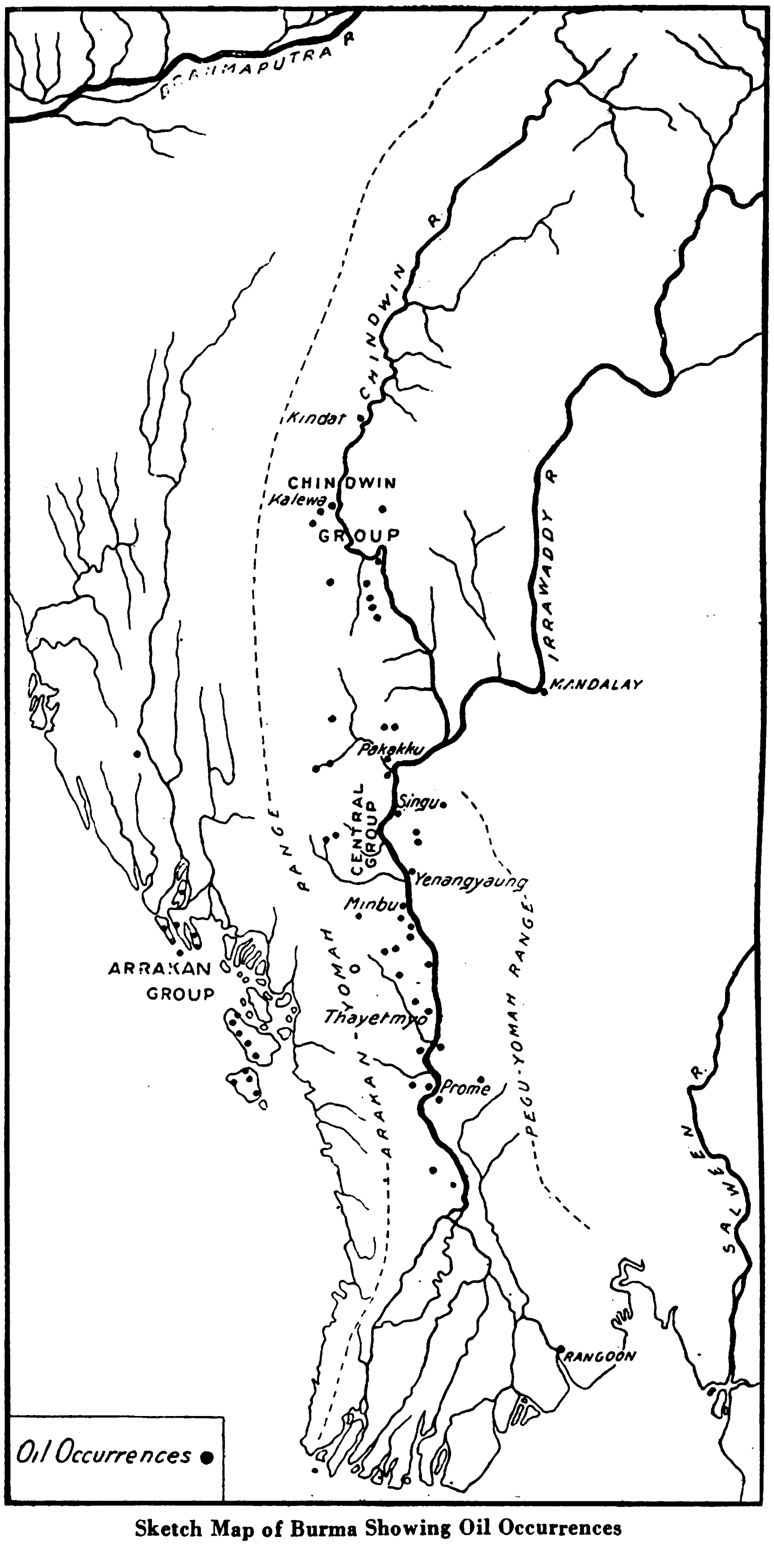
I do not want to go too deeply into the geology, but it is instructive to inspect the sketch map showing the probable approximate distribution of land and sea after the first main phase of the Himalayan uplift, that is, during early Miocene times, during which period the geological series in which petroleum is found in Burma was laid down.

All petroleum produced in Burma is admittedly found in rocks of the Pegu system, which are of Oligocene or lower Miocene age. Formerly it was thought by some geologists that the oil occurred only in the Kama clays of this system, but it is now recognized that though the different groups have not been definitely traced over the whole extent of their exposures, oil may occur at any horizon in the system.

The extent of the Pegu system in Burma roughly corresponds to the area embraced by the Gulf of Pegu on the sketch map, which shows the distribution of land and water during Oligocene and early Miocene times, though the southern portion is entirely overlain by the later Irrawaddian series, and also in part of the northern portion of this old gulf the Pegu rocks have been eroded, leaving Eocene and older systems exposed.

With regard to the fields of the Upper Chindwin and the central groups, it is believed that these occupied areas in which lakes, lagoons, or deeper portions were still in existence when the rest of the gulf was either more or less dry land, or else covered by shallow water only, earth movements subsequent to burial and consolidation of the strata having formed the anticlinal structure in which the oil is found. Axes of anticlines throughout the Pegu system have a general north and south strike, which is mostly slightly west of north and east of south. It has been pointed out by Cunningham Craig that there are evidences of other earlier-formed flexures approximately at right angles to those mentioned above, but it does not seem that the earlier movements had any recognizable effect on the oil concentration.

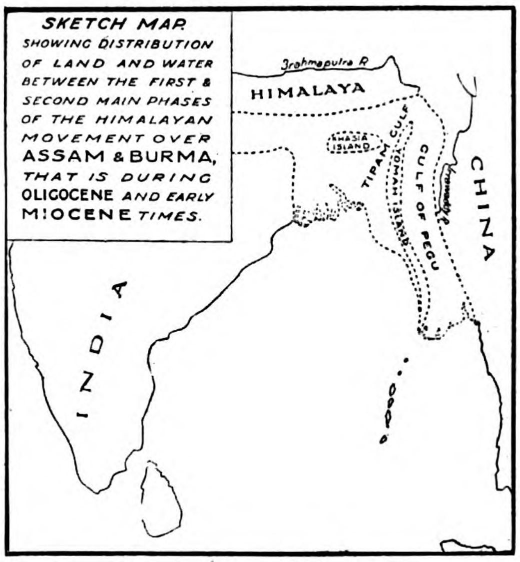
Much has been written about the Yenangyaung field which, to date, has supplied well over 75 per cent. of the recorded total of Burma's production. It is not known definitely when oil was first extracted there, but it is known that prior to 1800 there was an annual yield of more than 500,000 barrels produced by the Burmese from over 500 wells, and that by far the greater number of these were at Yenangyuang. It is probable that the number of hand-dug wells then existing was considerably in excess of 500, as a settled average of 1.5 barrels per day per hand-dug well may be considered as being on the high side. After the British occupation and annexation, the rights of the Burmese owners of hand-dug wells and potential oil-bearing ground were naturally respected, but the native owners (called Twinzas) among themselves only held small



Sketch Map of Burma Showing Oil Occurrences

patches in certain areas reserved for them. When it became necessary to legislate for the opening up of these areas by modern methods, the unit decided upon was that of a circle with 30-ft. radius. This possibly appeared to be a compromise, which would meet most of the conditions existing as far as local conditions and knowledge then went. The result has been that Yenangyaung has been a very expensive field to work, and the different companies were obliged, in self-protection, to drill competitively against their neighbors. Probably, in the Twingon and Beme reserves 60 per cent. of the total drilling was economically unnecessary, and its cost was as completely wasted from a national point of view as if it had been thrown into the Irrawaddy. The Twinza or Burmese owner has, however, benefited greatly, as owing to competition high prices have been realized by them for their site areas, which are only equal to 0.065 acres each.

It will readily be recognized under the conditions imposed by the close siting of wells that the production from the Yenangyuang field has been intensive; also that a larger percentage of the oil present in the various sands has been extracted than is the case with other fields where wells are economically spaced; and, further, that though its total yield has been larger its life will be shorter than if normal drilling programs could have been carried out by the various companies concerned.



Burma in Oligocene and Early Miocene

The Yenangyaung field is now regarded as passing its prime, and production from the Singu field will probably be increased so that the combined production from these two will be maintained, the latter being capable of a considerably greater sustained output.

Most of the drilling in the past has been done with standard (American) rigs, the derricks being usually 82-ft. high. Some drilling has been done, in the shallower fields, with portable drilling machines, and in a few cases rotary drilling has been carried out. Drilling is generally not easy, as the ground seldom stands up well. Also in the lower productive series concretions of cemented calcareous sandstone are not altogether infrequent, these being often responsible for a crooked hole.

Conditions and customs are also against speed in drilling, as it is the exception for wells to be drilled on "tour." Generally one nine-hour shift only per 24 hours is worked, and work is stopped at one o'clock on Saturday and is resumed again on the following Monday morning. A drilling crew consists of the driller and nine natives, exclusive of the boiler fireman. This seems, and is, a large crew compared to other countries, but physically the Burmese are a small race, and the average weight of the adult male will be under 9 stone.

The average rate of drilling throughout Burma for wells drilled with standard tools, excepting shallow wells of 1,000-ft. and under, and not taking into consideration stoppages for Sundays, cementing, etc., is not more than 250-ft. per month, and is probably below this amount.

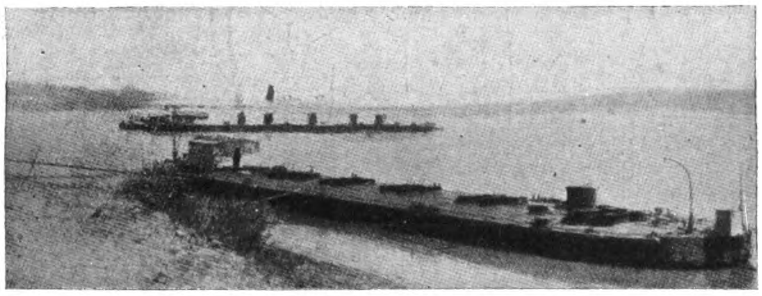
Labor is nominally cheap, but in the long run costs more than the dearer but more efficient labor of other fields where the climate is more temperate.

The Thayetmyo district has been regarded rather as the Cinderella of the oil-bearing areas, and probably less geological work has been done in it than elsewhere; it contains evidences of the presence of oil, and favorable structures are known to exits, but the question as to whether lithological conditions in these structures are also favorable has not yet been determined.

In the Arrakan area the extent of the oil-bearing rocks is not large, and it is interesting more from a geological point of view than from a commercial one. The oil seems to be contained in rocks of Eocene age. It is possible that Pegu beds of small extent only were formed at the mouths of swiftly running streams of small length, descending from the heights of the Yomah Island, but under these circumstances, unless other factors where also in operation, it is unlikely that extensive oil deposits would result.

Except for a certain amount of "topping," which is carried out on the fields themselves, all oil except that from the Arrakan group is conveyed to refineries belonging to the different companies, all of which are situated on the left-hand bank of the Rangoon estuary, opposite to and some four to ten miles below Rangoon.

All the oil produced by the Burma Oil Company from their Yenangyaung and Singu fields is passed through their pipe-line, which, from Yenangyaung to Syriam (some 275 miles) is a single line of 10-in. diameter. Most of the other companies transport their product by oilflats, which are towed down the Irrawaddy, when necessary the oil being brought to storage tanks on the banks of the river by pipe-lines, which in the case of fields other than Yenangyaung and Singu are generally of 4-in. diameter. The average oilflat used has a capacity of 600 tons, and can take this quantity when the river is in flood; in the dry season, however, when the river may be 40-ft. or more lower, 450 tons only is carried.



Transport of Oil Down the Irrawaddy

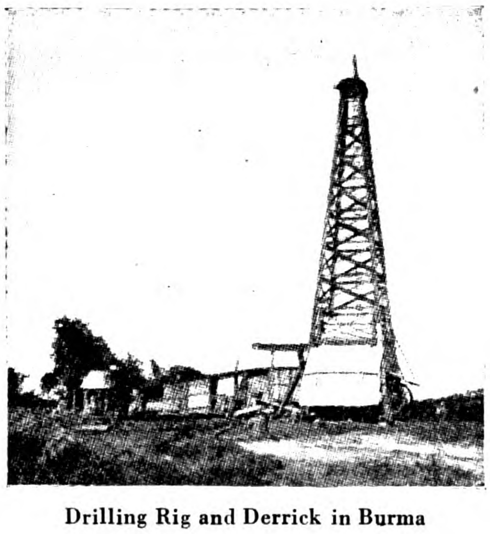
Petroleum produced in Burma has a paraffin base, and generally is a comparatively light oil. In isolated cases small veins and seams of manjak have been found, proving that mixed or asphaltic base oils have existed; these occurrences of manjak, are, however, uncommon.

The following approximate particulars of an oil produced by one field are indicative of the general characteristic contents of Burma petroleum for refinery purposes—

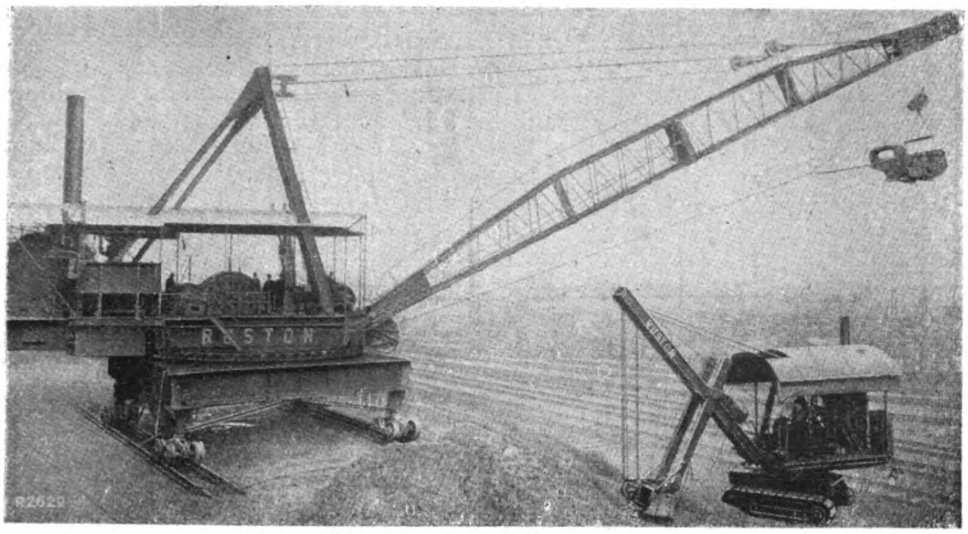
Specific gravity		0.870
Petrol	per cent.	18
White kerosene	,,	20
Yellow kerosene	,,	32
Wax	,,	6
Blue oil ..	,,	15
Residue and losses	,,	9

The blue oil contains the lubricating fractions and part of it, according to requirements, is treated for fuel oil, batching oil (for jute), or for further kerosene, or is used for refinery fuel purposes. It will be noted that the crude oil carries a large percentage of kerosene and wax, a satisfactory petrol content, and only a small quantity, relatively, of lubricating oil fractions. In fact, it is an oil specially suitable for profitable local treatment, as all the kerosene (even the worst grades) has a ready sale in the country and in India. The petrol can mostly be disposed of

(Continued on page 98).



Drilling Rig and Derrick in Burma



Ruston and Hornsby Dragline Excavator: Bucket Capacity 8 cubic yards: Jib 120 feet : Weight 280 tons. Supplied to the India Office for the Sutlej Valley Irrigation Project.

British Engineering Trade in India

Increasing Use of Excavating Machinery

MR AINSCOUGH, Senior Trade Commissioner in India and Cey.on, has just issued a report "Some Aspects of British Trade in India," in which he calls attention to many items of interest particularly as regards irrigation and other public works.

A few items culled from his report are of considerable general interest, since they tend to very clearly show the changed and changing conditions of affairs pertaining in India.

With regard to the Sutley Valley project, which is intended to irrigate 5,108,000 acres, he says, that one great problem has been the supply of cheap labor. This was plentiful when the Punjab Triple Project which it extends and supplements was under construction, but much of it was absorbed by the new canal colonies thereby brought into being. It was realized at the outset of the Sutlej project that mechanical appliances would be necessary, not only to make good the shortage of labor but also to carry out the project in the shortest possible time.

The scheme is the first important irrigation project in India to replace coolie hand labor by the dragline excavator. Six of these machines have been at work, including a large Ruston and Hornsby dragline weighing 280 tons and shifting ten tons of soil per cut. One feature of them is that they are fitted with electric light and can work day and night. It is estimated that the large machines each replace 2,000 to 2,500 coolies, working 16 hours or more per day, wet or fine, including those seasons of the year, when manual labor usually leaves construction work to attend to agricultural pursuits.

British makers took up the manufacture of draglines only of late years. At first mistakes were made, but the performance of the new large machines on the Sutlej project and also on the Gezira Plain scheme in the Sudan, Mr. Ainscough remarks, give ground for hope that British draglines will find a large market in India. Of eight large and three smaller machines recently purchased for the Sukkur (Lloyd Barrage) scheme, no fewer than eight large British draglines were selected.

Dealing next with the Lloyd Barrage and canal project, Mr. Ainscough says that it will affect the British manufacturer in two ways. For the next few years there will be a very large demand for plant, machinery, and stores to be employed on construction work. Thereafter the increase in sind, as a result of three million acres of good land being placed under cultivation, will bring in its train a greatly increased demand for imported articles of all kinds. Important purchases of dragline excavators, sheet piling, structural steel of all kinds, rock-drills oil engines, air compressors, light railway material, etc., have already been made. In addition, such items as electrical generating plant, workshop machinery and machine tools, pumps, pile drivers, suction dredgers, concrete mixers, mortar mills, etc., will be required.

Mr Ainscough suggests that British manufacturers should instruct their branches or agents in India to pay special attention to these demands. The engineers on the work appreciate information with regard to and demonstrations of special plant suited to their requirements.

Intimately associated with this development of agricultural production in sind and the great irrigational extensions in the Punjab, is the future of the port of Karachi. It has ranked for a good number of years now as one of the five great Indian ports. The trade has multiplied sevenfold since the middle eighties. Owing to the lower port charges and facilities for rapid clearance of goods, there has been a distinct tendency during the past year for the Delhi market to import its 'piece goods and other imports through Karachi rather than via Bombay—a tendency which will be encouraged when the harbor works, now in progress, are completed.

The west wharf scheme will ultimately provide an addition of thirteen berths on the west side of the harbor at a cost of some two millions sterling. The construction of three berths, each 550-ft. long, to accommodate vessels up to 34 feet in draught, is now in progress, and when these are completed the remaining ten berths will be taken in hand. The wharves will be equipped with hydraulic cranes able to deliver goods either into wagons or transit sheds. Subsequently the port commissioners will take in hand the reconstruction of the present berths on the east side of the harbor, the extension of the oil pier and the construction of a new boat basin. Mr. Ainscough points out that this work must be supplemented by improved railway communications and marshalling yards if the port is to keep ahead of future requirements.

The project of constructing a steel cantilever bridge over the Hoogly between Calcutta and Howrah is an ambitious one, for the cost will be some four millions sterling. The Bill introduced into the Bengal Legislature by government to obtain powersf or the construction of a new bridge met with some opposition from the Swarajist section, and instead of being referred to a select committee was ordered to be circulated for public opinion. Since the existing pontoon bridge is unsafe, the Bengal government has sanctioned its partial reconstruction. This work will occupy about two years, and it is expected to prolong the life of the bridge till 1932, if not longer.

According to Mr. Ainscough's generally expressed ideas the prospects of trade with India are growing daily.

New Fire Float for the London Fire Brigade

The London fire brigade has just ordered a new fire float which will be built by Merryweathers of Greenwich, the famous fire engineers. The new vessel, which will be 70 feet in length, will be fitted with internal combustion engines of 220 b.h.p., and Merryweather turbine pumps, having a combined capacity of 2,000 gallons per minute at high pressure.

Merryweathers were the first firm in the world to introduce a fire boat in which internal combustion engines were employed, and as the number of fire floats they have designed and built far exceeds the output of any other firm (it is believed that it considerably exceeds the total of all other firms combined) they may claim without exaggeration to occupy a unique position in this department of engineering activities. The London fire brigade is probably the premier fire brigade of the world, and the action of the London county council in placing with Merryweathers the order for the new float is a gratifying recognition of the standing of that firm.

Piping Contract for India

An Indian contract has recently been awarded to Messrs. T. W. Ward, Ltd., of Sheffield, for five miles of 6-inch steel lap-welded, screwed and socketted piping, which is to be despatched forthwith, and is believed to be the forerunner of still larger orders on the same lines.

Distribution of Petroleum in Burma

(Continued from page 96.)

locally, that is, by the larger companies who have efficient distributing and selling organizations. The lubricating fractions are also mostly absorbed locally, leaving practically only part of the wax which has to be shipped to distant countries.

Regarding the future of Burma as an oil-producing country, there are two schools of ideas. The older established countries leave it to be inferred that their geological departments have inspected the known potential oil-bearing areas and that they do not except extensive new fields capable of large production to be found. The newer companies and syndicates, however, believe that, though the more obvious fields are known, commercial possibilities exist, and that this can be proved with time.

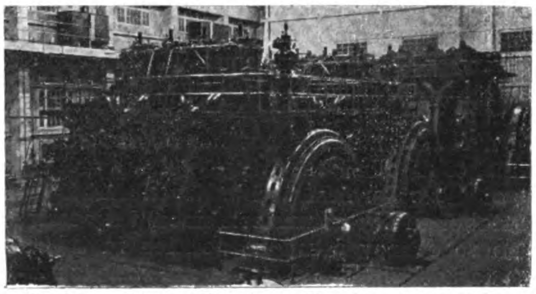
It certainly would appear probable, as with other countries which, as far as the oil industry is concerned, are older than Burma, that fresh pools will be found in regions that were passed over in early days. The most promising localities would at present seem to be the Upper Chindwin and along the eastern flanks of the Arrakan -Yomah range. Though the geology of Burma has been broadly worked out, much detail work still remains to be done, and it is certain that, failing discoveries of large fields, isolated formations which have trapped economic deposits of oil will be found even if such deposits are not of the magnitude of the Yenangyaung and Singu fields.

There is also the possibility that payable oil may be found in the Eocene rocks; no accumulation worth mentioning has as yet been found in this system; but in some localities indications of oil occur in it.—*The Mining Magazine.*

TABLE SHOWING QUANTITY OF PETROLEUM PRODUCED IN BURMA DURING THE YEARS 1920, 1921, AND 1922

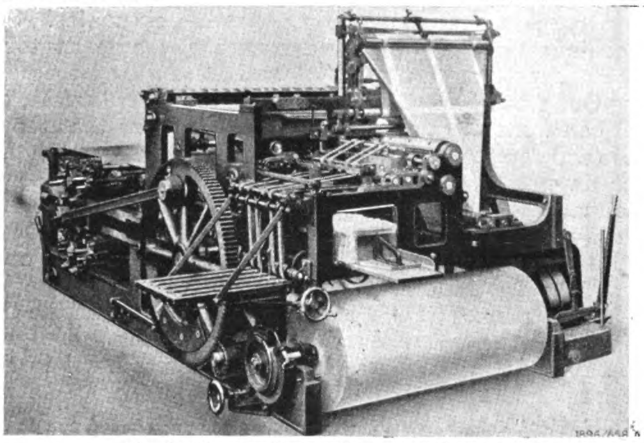
Groups	1920 Field Production. Imp. Galls.	1920 Group Total. Imp. Galls.	1921 Field Production. Imp. Galls.	1921 Group Total. Imp. Galls.	1922 Field Production. Imp. Galls.	1922 Group Total. Imp. Galls.
ARRAKAN GROUP.						
Akyab	9,770		9,780		8,886	
Kyaukpyu	30,075		27,869		16,211	
		39,845		37,649		25,097
UPPER CHINDWIN GROUP.						
Upper Chindwin	1,022,766	1,022,766	1,182,782	1,182,782	1,210,914	1,210,914
CENTRAL GROUP.						
Yenangyat	3,176,231		2,510,533		2,413,416	
Singu	95,256,752		104,167,749		92,107,998	
Yenangyaung	176,285,048		184,420,147		179,741,493	
Minbu	3,835,198		3,706,831		3,940,416	
		278,553,230		294,805,254		278,203,323
THAYETMYO GROUP.						
Thayetmyo District	91,329	91,329	66,372	66,372	2,319,835	2,319,835
		279,707,170		296,092,051		281,759,169

SULZER BROTHERS
SHANGHAI ENGINEERING OFFICE
No. 4 AVE. EDWARD VII
蘇爾壽工程事務所
上海愛多亞路四號
本公司常備目錄供給各界
垂詢工程事務亦竭誠酬答
Power Station, French Concession, Shanghai
2 by 1,500 bhp. 2-cycle Sulzer Diesel Engines
1 by 3,600 bhp. ,, ,, ,, Engine



Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, STATIONARY AND MARINE DIESEL ENGINES, Airless Injection Diesel Engines, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.
WINTERTHUR. SWITZERLAND.

BUHLER BROTHERS
Engineering Works and Foundries
UZWIL (SWITZERLAND)
Established 1860 Employees abt. 2,000



Duplex Press with one Paper Roll, Delivery Side

SPECIALITIES:
Portland Cement Works
Brick and Tile Making Plants
Chocolate and Cocoa-Factories
Breweries and Malteries
Powder and Celluloid-Presses
Crushing and Breaking Machinery
Silico-Calcareous Brick Works
Paste-Goods Factories
Briquetting Plants
Rice-Mills
Roller Mills for Soap and Paint Manufacture
"Duplex" Newspaper Printing Presses
Conveying Plants of every kind
Saw-Mill and Woodworking Machinery
For particulars apply to the
Far Eastern Office: BUHLER BROTHERS
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

APR 27 1925

THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

上海仁記路拾六號

遠東時報

SUN YAT-SEN

First President of the Republic of China, Revolutionist and Patriot, the Leader of the Movement to Modernize an Ancient Nation

BACK TO PORTSMOUTH

THE RECRUDESCENCE OF JINGOISM

CHINA PROTESTS IN VAIN

DEVELOPMENTS IN THE FAR EASTERN IRON AND STEEL INDUSTRY

CHINA'S RAILWAYS

DESCRIPTION OF A SHALE OIL DISTILLATION PLANT

EARTHQUAKE DAMAGES TO THE TELEGRAPH AND TELEPHONES

PULVERIZED COAL PLANTS

CENTRAL WORKSHOPS OF THE F.M.S.

Vol. XXI March, 1925 No. 3

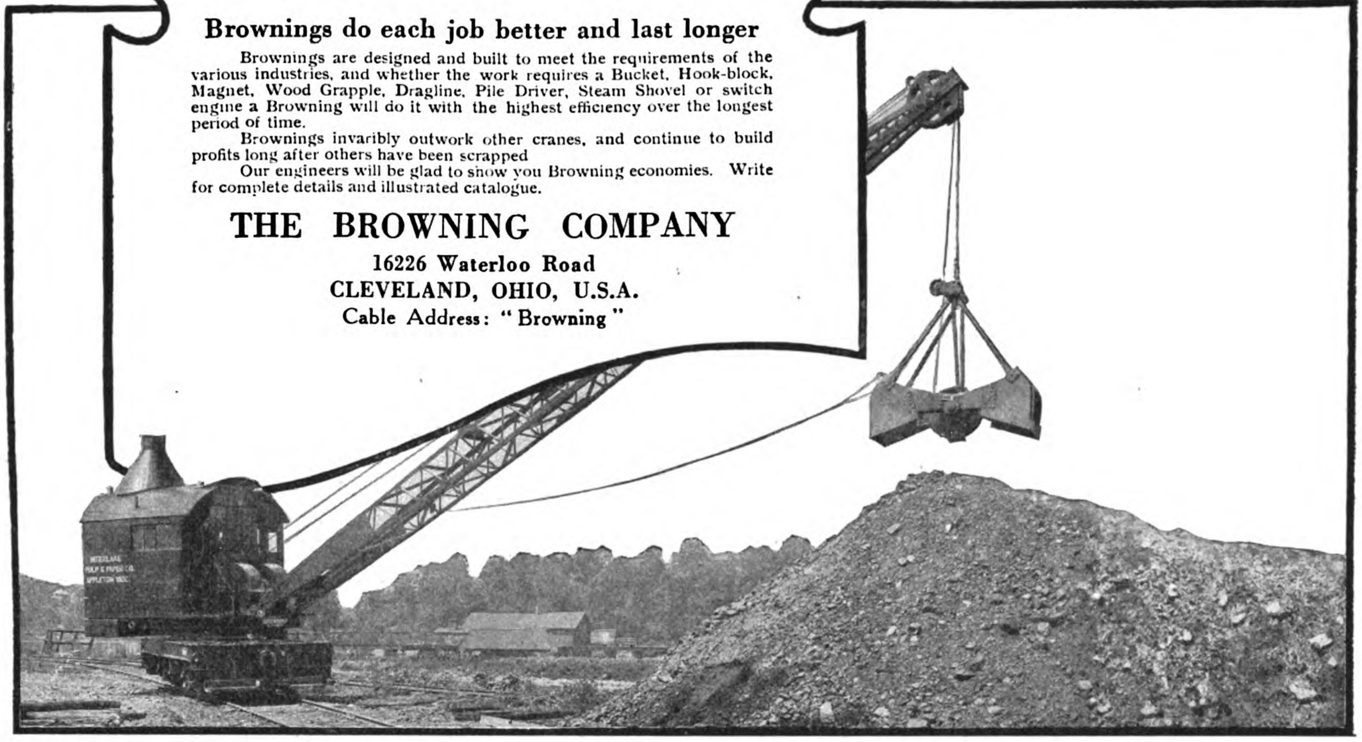
Brownings do each job better and last longer

Brownings are designed and built to meet the requirements of the various industries, and whether the work requires a Bucket, Hook-block, Magnet, Wood Grapple, Dragline, Pile Driver, Steam Shovel or switch engine a Browning will do it with the highest efficiency over the longest period of time.

Brownings invaribly outwork other cranes, and continue to build profits long after others have been scrapped

Our engineers will be glad to show you Browning economies. Write for complete details and illustrated catalogue.

THE BROWNING COMPANY
16226 Waterloo Road
CLEVELAND, OHIO, U.S.A.
Cable Address: "Browning"



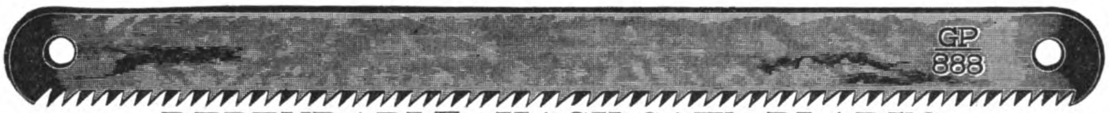
BROWNING LOCOMOTIVE CRANES

GOODELL-PRATT

1500 GOOD TOOLS

GP 888

This mark identifies the Goodell-Pratt *all hard* Hack Saw Blades.



DEPENDABLE HACK-SAW BLADES

Goodell-Pratt offers a variety of dependable Hack-Saw Blades, the two most popular styles being illustrated here.

GP-777 is a flexible blade with a soft center, and hardened back and teeth. Desirable for work which subjects the blade to severe twists and side strains.

GP-888 is an all hard blade, made from a special high grade of hot-rolled sheet steel, .025 inch thick, cut so that the length of the blade runs with the grain. For speed and endurance GP-888 is in a class by itself.

Export Orders are given especial attention, shipments being carefully packed in new and strongly re-enforced wooden cases.

Free catalogues may be obtained direct or from importers of American tools, most of whom carry the Goodell-Pratt line of tools.

Representatives:

Muller, Phipps & Sellers, Ltd. Room No. 758 Marunouchi Building Tokyo (Central P. O. Box No. 98)	Muller & Phipps (China), Ltd. N.K.K. Building 2 Canton Road, Shanghai, China	Muller, Phipps & Sellers, Ltd. Dojima Building Osaka (Central P. O. Box 63)

GOODELL-PRATT COMPANY, TOOLSMITHS, GREENFIELD, MASS., U.S.A.

GP 777

Goodell-Pratt *flexible* Hack-Saw Blades carry this mark

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative,
50 Church Street

GREAT BRITAIN: Walter Judd, Ltd.,
81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth,
Roxas Building, Escolta.

BERLIN: Rudolf Mosse,
46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum

VOL. XXI MARCH, 1925 NO. 3

CONTENTS:

	PAGE
FRONTISPIECE	
SUN YAT-SEN	*99
BACK TO PORTSMOUTH	103
THE RECRUDESCENCE OF JINGOISM	106
CHINA PROTESTS IN VAIN	108
DEVELOPMENTS IN THE FAR EASTERN IRON AND STEEL INDUSTRY	109
CHINA'S RAILWAYS	*112
DESCRIPTION OF A SHALE OIL DISTILLATION PLANT	*113
EARTHQUAKE DAMAGES TELEGRAPH AND TELEPHONE INSTALLATIONS OF JAPAN	*115
COTTON MILLS AND RAW COTTON SUPPLY IN TIENTSIN	*123
PULVERIZED COAL PLANTS IN THE FAR EAST	*125
NOTE ON THE HANSHIN EXPRESS ELECTRIC RAILWAY.—KOBE-OSAKA	*128
A YEAR IN TIENTSIN	*130
CENTRAL WORKSHOPS OF THE F. M. S. RAILWAYS	*131
MANUFACTURE OF LIME IN CHINA	*134
THE MANUFACTURES OF THE PHILIPPINES	*135
ELECTRICAL STARTER FOR SEMI-DIESEL CRUDE-OIL MOTORS	142
THE TRADE OUTLOOK IN CHINA	142
ELECTRICAL GOODS IN JAVA	143
BRITISH CONTRACTS FOR THE FAR EAST	145

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The ... 41
Allen & Co., Ltd., Edgar ... 11
American La France Fire Engine Co., Inc. ... 35
American Locomotive Sales Corp. ... 25
American Tool Works Co. ... 1
Associated British Locomotive Manufacturers for China ... 49
Attwater & Sons ... 48
Avery, Ltd., W. & T. ... 11

Babcock & Wilcox, Ltd. ... 36
Baldwin Locomotive Works ... 65
Bank of Chosen ... 54
Banque de l'Indo-Chine ... 56
Bank of Taiwan, Ltd. ... 61
Berger Manufacturing Co. ... 5
Bethlehem Steel Export Corp. ... 31
Bliss Co., E. W. ... 19
Brill Co., J. G. ... 39
British-American Tobacco Company (China), Ltd. ... 9
Browning Co., The ... Cover
Bucyrus Company ... 7
Buhler Brothers ... 146
Butterfield & Swire ... 44

Canada Carbide Co., Ltd. ... 70
Chambers Scott & Co., Ltd. ... 14
Chartered Bank of India, Australia & China ... 48
Chinese Eastern Railway ... 36
Columbia Ribbon & Carbon Mfg. Co. 70

Daido Electric Power Co., Ltd. ... 28
Dai-Ichi Ginko ... 62
Dai Nippon Brewery Co. ... 34
Diamond State Fibre Co. ... 15
Dixon Crucible Co., Joseph ... 70
Dodge Brothers ... 3

Drewry Car Co., Ltd. ... 13

Electricity Department, S. M. C. ... 4
Escher Wyss & Cie ... 16
Etchells Congdon & Muir, Ltd. ... 63
Evans & Sons (Wolverhampton), Ld., Joseph ... 2

Fairbanks Co. ... 35
Fairbanks Morse & Co. ... 15
Fuji Gassed Spinning Co. ... 10

Gas & Fuel Plants, Ltd. ... 14
General Fireproofing Co. ... 41
Gleniffer Motors, Ltd. ... 13
Goodell-Pratt Co. ... Cover
Goulds Manufacturing Co. ... 14
Green Island Cement Co., Ltd., The ... 20
Greene, Tweed & Co. ... 71
Greenfield Tap & Die Corp. ... 21

Heinemann, A. G., Gebr. ... 19
Hongkong Rope Manufacturing Co. ... 20
Hongkong & Shanghai Banking Corporation ... 59
Hongkong & Whampoa Dock Co., Ld. 30
Horsfall & Bickham, Ltd. ... 13
Hotel Statler Co. ... 53

Imperial Japanese Government Railways ... 66, 67
Industrial Bank of Japan, Ltd. ... 58
International Banking Corporation ... 55
International General Electric Co., Inc. ... 51

Japan Sugar Co., Ltd. ... 6
Jardine Engineering Corporation, Ltd., The ... 12
Jugo Ginko ... 56

Kanegafuchi Spinning Co., Ltd. ... 10
Kawasaki Dockyard Co., Ltd. ... 33
Kelvin Bottomley & Baird, Ltd. ... 27
Kitchen & Wade ... 62
Kokusai Kisen Kaisha ... 45

Link-Belt Co. ... 63
London Directory Co., Ltd. ... 61
Louisiana Planter & Sugar Manufacturer, The ... 62

Manning, Maxwell & Moore, Inc. ... 14
Mather and Platt, Ltd. ... 2
McConway and Torley Co. ... 72
Mills & Manning, Inc. ... 52
Mitsubishi Bank, Ltd. ... 57
Mitsubishi Iron & Steel Co., Ltd. ... 38
Mitsubishi Marine & Fire Ins. Co., Ld. 38
Mitsubishi Shoji Kaisha ... 18
Mitsubishi Warehouse Co. ... 38
Mitsubishi Zosen Kaisha, Ltd. ... 39
Mitsui Bank, Ltd. ... 57
Mitsui Mining Co. ... 18
Mitsui Bussan Kaisha ... 26
Motor Rail & Tram Car Co. ... 5
Mustard & Co. ... 72

Nippon Menkwa Kabushiki Kaisha ... 50
Nippon Yusen Kaisha ... 46, 47
Nipponophone Co., Ltd. ... 34
Nobel Industries, Ltd. ... 22

Okura & Co. (Trading), Ltd. ... 24
One Hundredth Bank, Ltd., The ... 59
Osaka Shosen Kaisha ... 42

Pooley & Son, Ltd., Henry ... 4

Redpath Brown & Co., Ltd. ... 15
Reyrolle & Co., Ltd., A. ... 27

Ridgway Dynamo & Engine Co. ... 17
Royal Bank of Canada ... 61
Ruston & Hornsby, Ltd. ... 5

Sale & Frazar, Ltd. ... 8
Shanghai Dock & Eng. Co., Ltd. ... 32
Shanghai Municipal Council ... 4
Siemens China Co. ... 6
Smidth & Co., F. L. ... Under Index
Smooth On Mfg. Co. ... 71
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. ... 75
Standard Oil Co. of N. Y. ... 29
Standard Underground Cable Co. ... 14
Stewarts & Lloyds, Ltd. ... 16
Sturtevant Co., B. F. ... 63
Sulzer Bros. ... 146
Sumitomo Goshi-Kaisha ... 60
Sumitomo Bank, Ltd. ... 60
Superheater Co., The ... 27

Thornycroft & Co., Ltd., John I. ... 1
Toshin Soko ... 40
Toyo Kisen Kaisha ... 43
Trimont Manufacturing Co. ... 7

United States Steel Products Company ... 23, 37, Back Cover

Wallace & Tiernan Co., Inc. ... 63
Walworth International Co. ... 72
Westinghouse Electric International Co. ... 76
Williams & Co., J. H. ... 7
Worthington Pump & Machinery Corporation ... 73

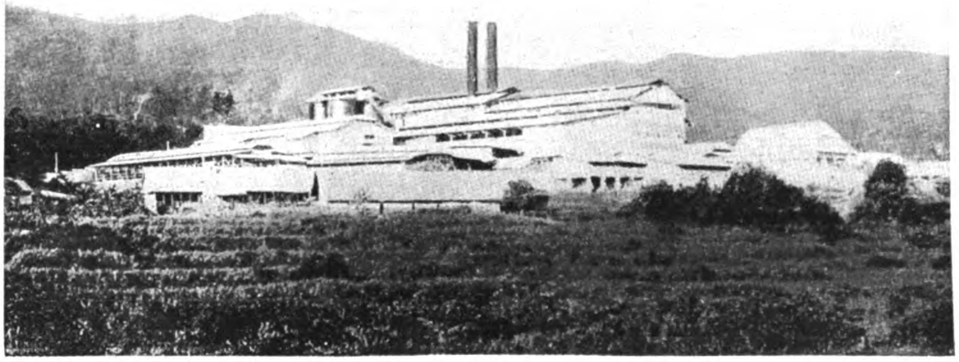
Yarrow & Co., Ltd. ... 21
Yokohama Dock Co. Ltd. ... 34
Yokohama Specie Bank, Ltd. ... Cover

F. L. SMIDTH & Co.

PEKING—CHINA

Telegraphic Address: "FOLASMIDTH," PEKING

LONDON
SYDNEY
PARIS
RIO de JANEIRO
TURIN



NEW YORK
COPENHAGEN
33 VESTER-GADE
BIELSKO
JAPAN

The Nederlandsch-Indische Portland Cement Works at Indaroeng, West Coast of Sumatra, equipped with F. L. Smidth & Company's Cement Machinery

MACHINERY FOR CEMENT WORKS

LIME WORKS, BRICK WORKS, NODULISING PLANTS FOR IRON ORE AND VARIOUS MINING INDUSTRIES

More than 300 Rotary kilns, with a total yearly output of 60,000,000 Barrels, have been supplied and 5,000 grinding plants equipped with our Machinery

UNIV. OF MICH.

Dr. SUN YAT-SEN

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

Vol. XXI SHANGHAI, MARCH, 1925 No. 3

SUN YAT-SEN

First President of the Republic of China, Revolutionist and Patriot, the Leader of the Movement to Modernize an Ancient Nation

THE death of Sun Yat-sen takes from China a personality whose presence has made itself pre-eminent in China's affairs during the past thirty years and who since the founding of the republic, has been the outstanding figure in the struggle to keep the country a republic and a democracy. Fighting against terrible odds, forced to spend the greater part of his life in exile or on the battle front, misunderstood by Chinese and foreigners alike, prevented by all the forces of selfishness from carrying his program for the regeneration of the country into effect, Dr. Sun continued to his dying day his struggle for his country's regeneration. For it must be borne in mind that notwithstanding the fact that circumstances forced Dr. Sun to be the destructive force of republican China, the puller down of worn out and useless institutions, in his own mind, in his serious writings, in his conversations, he had a clear constructive program for the reorganization of the government, for the modernization of the social and economic life, for the vitalizing of the means of comunications of the land.

The personality of Dr. Sun was startlingly magnetic. Although physically a small, thin man, he impressed his visitor as a person of inherent force. Like Roosevelt, he won confidence by personal magnetism, by sincerity of purpose, by the certainty of his own convictions. Himself the product of western influences, he found the inspiration for his ideas in the west, particularly in the democracies of Great Britain and the United States. Japan gave him refuge when the Manchus were seeking his head and it was in Japan in 1904 that he finally formulated his plans for the overthrow of the Manchus and organized the political party of the revolution, the *Tung Men Hui*. Dr. Sun was never anti-foreign in the sense that he took a violent dislike to one nation or another; he was rather pro-Chinese, seeking support for his own country and his own people wherever such support offered itself and resenting injustice at the hands of foreign powers. Thus, in his plans for the reorganization of China's railroads and the building of a huge railroad system which would bring the whole country together, thus strengthen the government, developing trade and bringing the force of the printed word to all the people of the land, he was not so concerned as to where the finances came from as that the contracts written should not be harmful to China. He was a man of vision rather than a visionary. He saw ahead of his age and therefore found it difficult to convince men who live only for the day.

Sun Yat-Sen in 1912

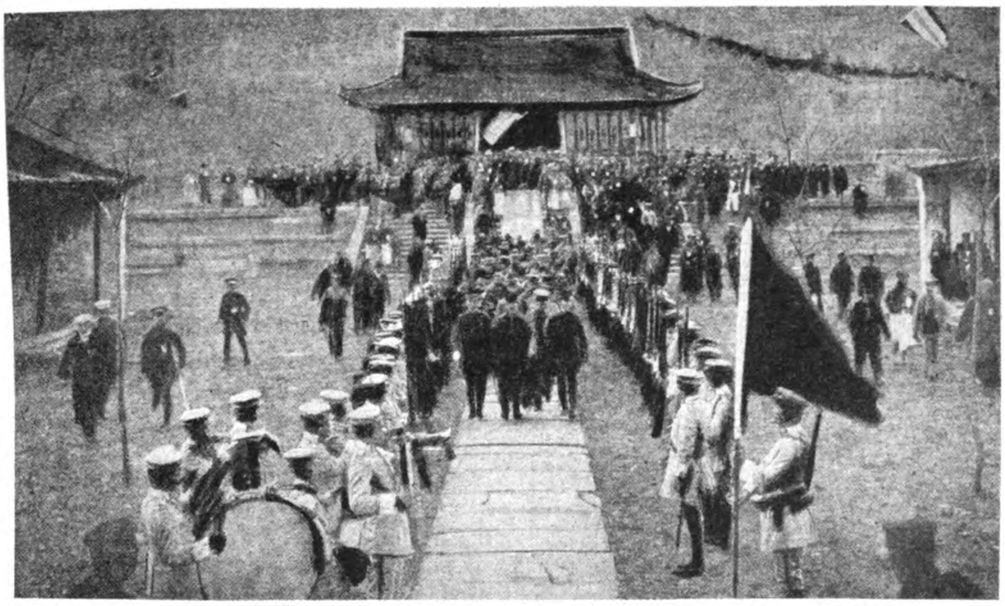
Sun Yat-sen was a native of Kuangtung province and was born the son of a farmer in the Heungshan district in 1866.

After learning English at a very early age, he studied further under Dr. John Kerr, an American Presbyterian missionary, after whom hospitals and benevolent institutions in Kuangtung are named. Going later to Hongkong, Sun enrolled as a student of the Alice Memorial Hospital in 1887, from which institution he graduated five years later as a Licentiate of Medicine and Surgery, Hongkong, one of his teachers being Sir James Cantlie, M.D., LL.D. Doctor Sun, as he was thereafter known because of the title conferred upon him, became a Christian, and a member of the London Missionary Society.

After his graduation, he settled to practise medicine in Macao and Canton. He made two trips to Tientsin at this time. His first trip was to be appointed to a medical position in the north bringing Tls. 100 a month. He failed to get the job, although he was highly recommended by influential Cantonese in Tientsin. On the second trip, he brought with him the resolutions of a progressive group of young men in Hongkong who sought to influence Viceroy Li Hung-chang to reform the government after China's failure in the Sino-Japanese war (1895). He never even saw Li Hung-chang. Thoroughly disgusted with Manchuism and officialdom, he now devoted himself to revolution.

After the failure of a conspiracy in Canton in 1895, Dr. Sun was forced to flee to Hongkong, Japan, Honolulu and America, spending short periods of time at each place. From America he went to England, arriving in 1896. On October 11, the same year, he was kidnapped outside the Chinese legation by the agents of the imperial government (who had offered a reward of half a million taels for Sun, dead or alive) and detained at the order of the Chinese minister. Sun managed to make his plight known to Dr. Cantlie, who was instrumental in effecting his release after a dezen days' imprisonment. After

THE FIRST NATIONAL ASSEMBLY AT NANKING



Dr. Sun Yat-sen and party proceeding through the Ming Mausoleum Grounds, Nanking, during the impressive ceremony of notifying the Mings that China had again returned to the Chinese

Capital of the Republican Provisional Government at Nanking (the Provincial Assembly Hall)

President Sun and his son, Sun Fo, in 1912

his release, Dr. Sun stayed for a short time in England, subsequently visiting Europe, America and the Far East as a revolutionary propagandist.

Going to Japan, Dr. Sun, in conjunction with Generals Huang Hsing, Hu Han-ming and Chen Chi-mei, and Messrs. Wang Ching-wei, Hsu Chien, C. T. Wang and others, established the *Tung Meng Hui*, a revolutionary organization for driving from China an alien dynasty.

Dr. Sun was abroad when the revolution started at Wuchang. He immediately returned to China and established the provisional government at Nanking.

To Dr. Sun the honor belongs of being China's first president, to which post he was elected at the end of 1911 and which he assumed on January 1, 1912. Immediately upon his assumption of the provisional presidency Dr. Sun visited the famous Ming Tombs at Nanking and there solemnly announced to the spirits of his ancestors that the Manchus and their despotism had been driven out and that China was under Chinese rule—this time as a republic.

As a result of a condition that the Manchus would abdicate if Yuan Shih-kai were given the presidency, Dr. Sun resigned and toured the various provinces, advocating a democratic policy for China. Yuan Shih-kai was elected president, and Li Yuan-hung became vice-president, an arrangement which was acceptable to Dr. Sun.

Marshal Tuan Chi-Jui

At the request of President Yuan, Dr. Sun visited Peking in August, 1912, and was given a royal reception. At this time he advocated an extensive railway construction program, which included lines which would cover the whole country and which would link China up with the Trans-Siberian railroad. He was appointed by Yuan Shih-kai, National Director of Railways.

After his return to Shanghai, Dr. Sun strongly advocated the transfer of the Chinese capital from Peking to Nanking or Wuchang. This aroused the ire of President Yuan, who alleged that Dr. Sun with plotting against him and using the money intended for the railway scheme, and the authority given him as director of the National Railway Corporation was cancelled. The 1913 revolution which followed was short-lived, and Dr. Sun was compelled to seek refuge in Japan. Yuan and his party then held the supremacy until 1915, when he attempted to proclaim himself emperor, on the ground that a republic was unsuitable for China. This movement failed and paved the way for Li Yuan-hung to become the president, but in the following year, forced by Gen. Chang Hsun's monarchical army, he dissolved parliament. Dr. Sun again opposed him and the Anfu party which had by this time come into power under the leadership of Marshal Tuan Chi-jui..

Attempts to bring about internal peace failed, and Dr. Sun went to Canton where with Dr. Wu Ting-fang (who had refused to countersign President Li's mandate dissolving parliament) Mr. Tong Shao-yi (the former premier), Gen. Chen Chuan-hsuan (the tiger mandarin, who was formerly viceroy of the two Kuang provinces), Gen. Chen Chiung-ming, Gen. Tang Chi-yao (*tuchun* of Yunnan) and others, he established a constitutional government under an administrative council. As a result of the machinations of the Kuangsi party, Dr. Sun and his followers were ejected in 1920, leaving Gen. Chen and others supreme. In the following year, after Gen. Chen Chiung-ming had forced the Kuangsi party out of Kuangtung, Dr. Sun again returned to Canton, being elected President by the small remnant of Parliament in April that year.

A year later, he was forced to flee from Canton, amidst a shower of bullets from Gen. Chen Chiung-ming's men. Two attempts had been made in the meantime to carry out northern punitive expeditions, both of which failed, one from Kuangsi and the other from northern Kuangtung.

Again expelled, he came to Shanghai, and here remained for a year, returning to Canton on February 15, two years ago after Gen. Chen Chiung-ming had been compelled to leave Canton by Yunnanese, Kuangsi, Hunanese and Kuangtung troops, whom Dr. Sun claimed to be his supporters. However, the Kuangsi troops turned traitors and attempted to force him once more to flee, but this *coup* failed and the Yunnanese troops won the field for Dr. Sun.

On October 10, 1924, trouble arose between Dr. Sun's government in Canton and the merchants' volunteers of that city through a consignment of arms and ammunition intended for the latter, which Dr. Sun seized. A fight occurred which resulted in the routing of the volunteers and the burning of a section of Canton city. This, together with the fact that he had brought " visiting " troops to Canton, and imposed crushing taxation resulted in a situation which made it advisable for Dr. Sun to leave Canton. Events in the north opened such an opportunity to him.

Dr. Sun left Canton on November 14, after hearing of the General Feng Yu-hsiang *coup* in Peking and in response to a request from Marshal Tuan. He arrived in Shanghai, where he delivered a strong pronouncement against foreigners. From here he went to Kobe, leaving again on November 30 for Tientsin. When he reached that port he was ill and had to go to Peking for treatment. He went to the Hotel de Pekin, remaining there some days before he was admitted to the Peking Union Medical College Hospital.

Dr. Sun's more mature ideas are undoubtedly best stated in his books, among which " Industrial Plans," " Elementary Treatise on People's Rights," " Sun Wen Hseuh Hsoh " (" Principles of Sun Yat-sen ") and the " International Development of China," are the most important.

Dr. Sun leaves a wife, a son, Mr. Sun Fo, formerly mayor of Canton, and a daughter, Mrs. Tai En-tsai, the wife of the former mayor of Wuchow, a city on the borders of Kuangtung and Kuangsi.

Dr. Sun's part in the making of the Chinese republic cannot be limited to the mere outline in a biographical article. He conceived the idea of overthrowing the Manchus after a visit to Tientsin where he waited almost half a year to see Li Hung-chang, then Viceroy of Chihli, to whom he desired to present a memorial composed by a society of young men in Hongkong who were impressed with the seriousness of their country's condition after China's failure in the Sino-Japanese war. Li Hung-chang refused to see Dr. Sun, whose visit to the north opened his eyes to the futility of the Manchu officials and the Chinese servants of the Manchu Court. He gave up his medical practice in Macao and Canton and thenceforth devoted himself to revolutionary activities. He visited Japan, the Straits, Annam, the United States, Great Britain, everywhere stirring up his fellow-countrymen to a realization of the situation. When the revolution finally came, Sun Yat-sen had organized a great power among the over-seas Chinese who supported the revolution, financed the republican movement, kept the *Kuomintang* alive and always made it impossible for his enemies and the enemies of his party to continue in power. This force was so great that no matter what was done by such leaders as Yuan Shih-kai to destroy Dr. Sun's influence, he always remained a power. Of him, it can be said that he welded all the Chinese people, whether within China or in other countries, into a nation with a national outlook, a national aspiration, a national hope.

His nationalism was paramount. He could not understand China in terms of a loosely connected conglomeration of different peoples. To him China was homogeneous and he demanded of all his followers, a faithfulness not to a city or province, but to China as a whole. If perhaps at times he sacrifices Kuangtung for what he felt was the good of the whole nation, he did so because he was a Cantonese and could more easily sacrifice what was dearest to him, what was his own. He died a poor man in spite of all his opportunities to enrich himself. He sacrificed others in his struggle for democracy, but he also sacrificed himself. The greatness of

President Li Yuan-Hung

Sun Yat-sen perhaps lay in his complete unselfishness, his complete ability to do any task, to fight any battle, without regard for himself.

The character of the man, his national sense, his impressive personality was perhaps nowhere better expressed than at the Ming tombs in Nanking in 1912 when he announced to the last Chinese dynasty, the Mings, that China was again returned to the Chinese. The following description which is taken from THE FAR EASTERN REVIEW of April 1912 is here given as a reminder of what was perhaps the greatest event in the life of this wonderful man. It was written by an eye-witness of the ceremony:

The whole ceremony was strikingly picturesque and impressive. Early in the dull morning soldiers to the number of fifteen thousand marched out of the city, passed the decaying palaces of the Mings, whose time-worn walls now grim and desolate reverberated to the strains of martial music and the thunder of tramping feet, and went on between gigantic stone monoliths standing silent guard on the way to the tomb. Along the whole route soldiers were formed up with glistening bayonets to await the coming of the retired president. The rainbow flags of the republic flew on the hills and in the dales, bugles blared and bands played, and the pomp and circumstances were such as should have made the great stone elephants and the giant men stir with interest or compel the palace of Hung Wu, now buried by a hill of earth, to burst asunder its mammoth covering and open its subterraneon portals to the new time.

To the ranging eye the scene from the tomb was magnificent. Over the battlefield of two months ago and stretching like a dragon over the hills and hollows to the huge embattled walls of Nanking the troops in multi-colored uniforms stood in splendid array whilst the light played strangely tremulous upon the heaving lines of bayonets. The passing of Dr. Sun and his staff through the city gate, which was shelled so heartily and effectively by the revolutionary gunners from Purple Mountain on December 1, was the sign for a great stir among the military, and a wealth of strange, weird music from the bands and bugles. On horseback, accompanied by General Hwang-hsin, and General Hsu, Sun Yat-sen rode on his strange mission. Young officers on either side, with Mauser pistols drawn, scrutinized the crowds behind the soldiery for an overt move. Had anyone been unfortunate to lift a hand in a sinister manner his life would not have been worth a moment's purchase. But there was no call for action. The ex-president, pale, and bearing himself with brave show, rode in through the portals of the tomb enclosure to the boom of cannon and the strains of music. The sun had by this time broken through the clouds, and the scene was never to be forgotten when the historic ground and surroundings and the peculiar nature of the ceremony is realized. None could view the activities of the modern dressed Chinese before the tomb of the ancient without being strangely affected. Where were the spirits of the dead ? What could they think if they could see ? A dozen such questions were asked by a dozen different provincials. Dismounting near the first temple the president wandered round inspecting the ancient scrolls and inscriptions on massive tablets. The great tablets of the huge turtles' backs attracted his close attention. He spent minutes deciphering the engraving that time had almost obliterated. In each temple were altars spread with luxuries for the spirits ; tea and sweetmeats, luscious pork and other substantial fare that the unbeliever cannot associate with a spiritland menu. Dr. Sun noted it all, and then went through the gates leading to the tunnel through which the coffin had to be borne hundreds of years ago in order that the spirits could find peace and rest. To form the tunnel a huge brick pile had been built and on top of this had been erected a temple for worship by royalty. It was now roofless, and rank weeds overgrew the floor. The red walls were falling, and decay had set its hand irrevocably to work. At the end furthest from the entrance where the old altar stood was now placed a table, above it flags of the republic were crossed, and between these was suspended an ancient and valuable life-sized painting of the emperor, Hung Wu. On the table a sumptuous array of food, tasty and satiating, was spread for the spirits, and two huge red candles blazed in the daylight and poured streams of red wax to the boards as they guttered in the breeze. The wind soughed in the trees covering the hill forming the grave mound of the emperor, and high above the white fog shrouded the top of Purple Mountain ; there was not a sound but that of the moaning wind, as the president and his party stood with bare heads and profoundly bowed before the altar and the picture of the long-dead monarch. Three times they bent their heads, and whilst the master of ceremonies, in frock coat, read out to the spirits the reason for the gathering, the spectators could not but marvel at the significance of the ceremony and the strangeness of the group, dressed as they were in European military uniform, paying this homage to the spirits of an emperor who was laid to rest some five hundred years ago.

Nor could Dr. Sung Yat-sen, the central figure, fail to impress. Pale and filled with emotion, he now faced the gathering to tell them briefly of the revolution and to announce, without attaching any significance to his self-effacing act, that he had resigned the presidency and that Yuan Shih-kai would be elected in his stead on his recommendation. Standing before the world, with his feet within the mausoleum of the first of an illustrious line of Chinese emperors, with his hands voluntarily releasing the topmost rung of the ladder of power in his land in order that his enemy, of greater experience, might guide the newfledged Republic of China, Sun Yat-sen was a veritable modern Cincinnatus, and perhaps he has more claim to admiration than the old Roman hero when it is remembered how he has been chased about

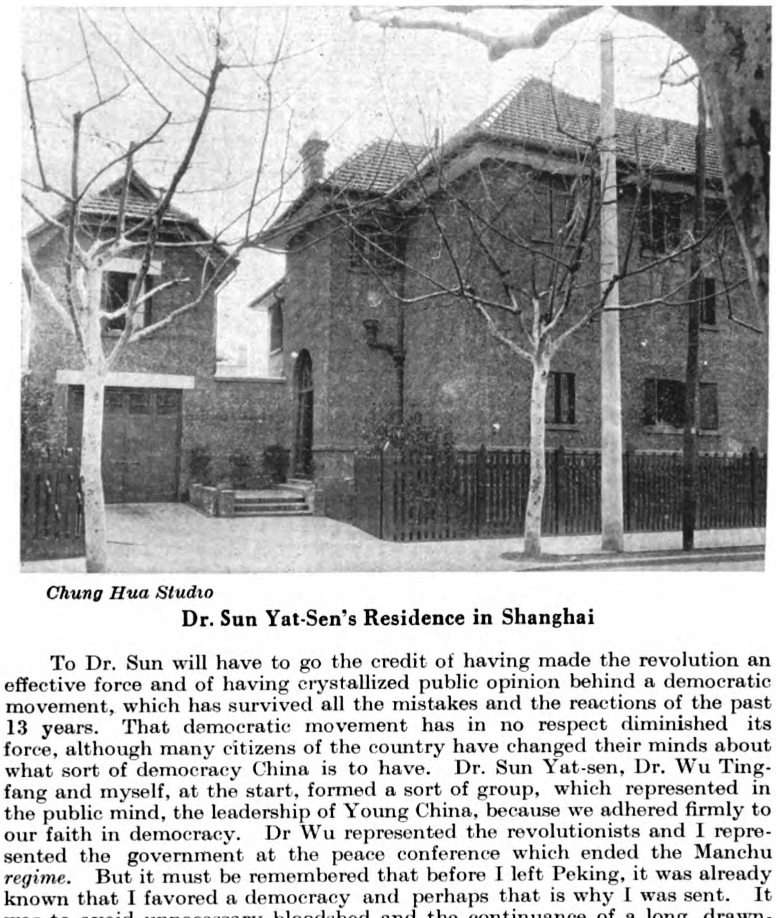
THE PEACE COMMISSIONERS, 1912
Premier Tang Shao-Yi, the Imperial Delegate, standing, and Dr. Wu Ting-Fang, Republican Delegate, seated

the world by a relentless foe, and how his return to his native land has been of less than two months' duration. Dr. Sun Yat-sen, as he delivered his inspiring address, was the personification of patriotism, and what he may lack in administrative experience, he more than makes up by the magnificent qualities that he possesses and which impelled him to sacrifice at his own volition such a high national position as he so quickly attained.

The men about him could not refrain from bursting into long and stirring cheers as he bespoke loyalty to Yuan Shih-kai, and pleaded for unity in the provinces and among the numerous branches of official life. And as the cheers rose in moving volume from the little crowd within the roofless temple near the tomb they were taken up by the concourse below and went sweeping away along the ranks of the soldiers, swelling as they swept up the hills, diminishing as they ran down the hollows, until the very walls of the city were reached, and there they mingled with the booming of the cannon saluting away along the Yangtze. It was a wonderful sight, and magnificent in effect. Bugles sent paeans across the recent battlefields, and amid the strains of band music Dr. Sun Yat-sen, self-stripped of presidential honours, left the spirits to marvel among themselves, and taking horse rode slowly back into the city through the long lines of still cheering troops.

The value of Dr. Sun to the Republic of China, his position in the history of the country and the effect of his death has nowhere been better described than by his associate and friend, Mr. Tong Shao-yi, first premier of the republic, in an interview for the *North-China Daily News*:

"The whole country will mourn Dr. Sun Yat-sen, whose life has been a courageous devotion to the ideal of democratic government in China. We were not only fellow-provincial but natives of the same district, our homes being but eight miles apart in Heungshan. For some 40 years we have known of one another and since the founding of the republic, we have often been associated in public service.



Chung Hua Studio

Dr. Sun Yat-Sen's Residence in Shanghai

To Dr. Sun will have to go the credit of having made the revolution an effective force and of having crystallized public opinion behind a democratic movement, which has survived all the mistakes and the reactions of the past 13 years. That democratic movement has in no respect diminished its force, although many citizens of the country have changed their minds about what sort of democracy China is to have. Dr. Sun Yat-sen, Dr. Wu Ting-fang and myself, at the start, formed a sort of group, which represented in the public mind, the leadership of Young China, because we adhered firmly to our faith in democracy. Dr Wu represented the revolutionists and I represented the government at the peace conference which ended the Manchu *regime*. But it must be remembered that before I left Peking, it was already known that I favored a democracy and perhaps that is why I was sent. It was to avoid unnecessary bloodshed and the continuance of a long, drawn-out strife. Dr. Sun was made President and I became Premier of the republic. Dr. Wu Ting-fang was the Minister of Foreign Affairs.

Democracy is in itself a very great ideal and its leader in China must remain in our history a notable figure. But there are many forms of democracy and we have experimented with some of them and have not been very successful. The experiments which fail bring a certain opprobrium upon those who try them, but such judgments are usually hasty and without serious importance. The fact that the failure of these experiments has in no way impaired the popular support of democracy proves conclusively that to the Chinese people the present period is recognized as an experimental stage in their development and that they realize that only through trial and error can they find a system of government which will be democratic in spirit and practice and at the same time, in full accord with their history and traditions.

"Dr. Sun realized this and sought in several ways to find a method which would work. That he did not always succeed was only natural, since no one man will succeed, can succeed, in solving this problem. But underlying all his experiments, as underlying all our ideals, is the sense, inherent in every Chinese, of local self-government. At times, this sense is dulled by the course of events, but at present it is particularly keen, particularly active. Throughout China, men are thinking of reconstructing not only their provincial governments, but even limiting their activities to their districts and villages. We have to begin our work of reconstruction with the smaller units, if ever we are to get anywhere.

"The Kuomintang party, of which Dr. Sun was the leader, will survive his death. It is the only political party in China which is organized and which contains the necessary leadership for united action. It is the only national political party. It is the only political group in the country which includes large numbers of men who will sacrifice themselves for their country, even as they have, in the past, sacrificed themselves. During the lifetime of Dr. Sun, the party naturally orientated itself about his personality and there were occasional internal dissensions, which is only natural and usual, in a large body of men. Now that he is gone, certain elements will drift away because their relationship to the party was largely a personal relationship with Dr. Sun and perhaps they will find it difficult to work with those who will come to the helm. But these are matters of detail. As long as the democratic ideal survives in China, the Kuomintang will survive as its historical guardian.

"Again, I must repeat that throughout the country that ideal is now expressing itself most effectively in a provincial autonomy movement, a political tendency in China which through its mechanism will end the sway of the militarist and of secret political activities, as with it, secrecy disappears. You cannot have a secret when 22 provincial assemblies have to know about it. Secret politics, secret financial operations, secret opium and arms operations, secret international relations, are the principal enemies of democracy in China. Dr. Sun disliked all this secrecy. He tried to play in the open and therefore often offended people he really liked. But he preferred to risk offending them rather than to tell them what was untrue. And how much better is that than the sort of thing his opponents, the various governments in Peking, have given us ?

"You ask what will be the political effect of Dr. Sun's passing away. I reply : We shall mourn his loss. And in the moment of mourning we shall forget everything about him but one outstanding fact and that is that he was the champion of democracy in China. Everything else will be forgotten. Every personal whim, every personal dissension, every difference of opinion will be forgotten. Only the large fact of his life will remain, his struggle against despotism, his struggle against corruption, his struggle for the right of the governed to a say in the government. And throughout the country as this thought sweeps the minds of the people, as this thought becomes the cry of the suffering millions, as men speak it and write it and read it, a spirit will be abroad in the land which will make itself felt and which in the end will shake Peking to its very foundations. For Peking is built on the sands of a Mongolian desert.

Who can succeed to the position of Dr. Sun Yat-sen in China? How difficult it is to think of a leader who can merge in his own personality all the characteristics which made Dr. Sun what he was and which gave him so honored a place in Chinese history! The battle in China now is for unification, for the re-establishment of governmental authority, for the revision of China's international relations, for the development of trade and commerce and the vitalization of communications. Where is there a man who can bring the country out of chaos, who can lead China to a position where she will command the respect due her ? Whoever that man is, he will have to be guided by the principles laid down by Dr. Sun, he will have to have the sterling qualities of Dr. Sun, he will have to live up to the tradition of honesty and sincerity established by Dr. Sun.

Together with the millions of China, we mourn the loss not so much of a great Chinese as a pre-eminent citizen of the world!

Back to Portsmouth

The United States Court for China Reverses Decision Which Prepared the Way for a Revision of the Treaties

JUDGE Milton D. Purdy of the United States Court for China on March 2, handed a decision in which he reversed the Commissioner of that court, who a year ago decided that the American government assumed extraterritorial jurisdiction over American citizens in Dairen in spite of the fact that the State Department had recognized Japanese jurisdiction in the Kwantung leased territory as it had recognized British jurisdiction in Hongkong. When Commissioner Lurton rendered his decision, a movement was afoot in China among a certain element of the Chinese to force Japan to forego her rights in Kwantung as she forewent them

in Shantung. The decision synchronized with this anti-Japanese movement in China and gave to radical Chinese the impression that the American government was supporting every anti-Japanese movement in the country. The decision was particularly objectionable because a minor official of a court exercising consular jurisdiction took it upon himself to disregard the agreements, understanding, usages between the United States and Japan, upsetting in a single decision the work of the President of the United States and the Secretary of State in building a structure of friendship and amity between the United States and Japan.

At that time, THE FAR EASTERN REVIEW protested against this decision in an article entitled, "Back to Portsmouth." Almost alone in championing the cause of justice, this paper risked incurring the disfavor of the court, by criticizing a judicial decision. We felt that it was even a greater service to the United States than it was to Japan, to call attention to the fact that the court was misreading the treaties and the practice of the State Department and was establishing a dangerous precedent which was bound ultimately to lead to very serious difficulties not only with Japan in Kwantung leased territory but with Great Britain in Hongkong. The decision was a direct attack on all leased territories, a questioning of the conduct of friendly nations. It was a judgement against these friendly nations rather than against the sea-captain directly involved in the proceedings.

The decision of Commissioner Lurton which has just been reversed by Judge Milton D. Purdy, read as follows:

"The defendant in this cause questions the jurisdiction of the United States Court for China to act on the ground that the crime herein charged was committed in the city of Dairen, which is situated in that portion of China known as the Liaotung peninsula and known as the leased territory, claiming it to be under the sovereign power of Japan.

"In determining the questions herein involved, it is deemed necessary to construe the various treaties entered into by the United States with China, as they are the governing law.

"In the year 1844, the United States entered into a treaty with China which gave to the former certain extraterritorial rights within the territory of the latter. In article No. 21 of said treaty, the United States was given jurisdiction to try and punish its citizens who were charged with the commission of a crime within the territorial limits of China,and it reads as follows:

'Subjects of China who may be guilty of any criminal acts towards any citizens of the United States, shall be arrested and punished by the Chinese authorities according to the laws of China, and citizens of the United States who may commit any crimes in China shall be subject to be tried and punished only by the consul or other public functionary of the United States. And in further prevention of all controversy and disaffection, justice shall be equally and impartially administered on both sides.'

"The same jurisdiction was also embodied in the treaty of 1858 in article No. 11 thereof.

"On March 27, 1898, the Russian government concluded a lease with China regarding the Liaotung peninsula. In article No. 1 of the terms of this lease, and in the last paragraph of said article, it reads as follows"

'This act of lease, however, in no way violates the sovereign rights of his majesty the Emperor of China to the above mentioned territory:'

The territory described in this lease included the city of Dalny which has since been renamed Dairen.

"In the treaty of peace between Russia and Japan, dated September 5, 1905, Russia transferred the lease she had made with China relative to the Liaotung peninsula to Japan, but subject, however, to the consent of China who ratified it on January 23, 1906, under a separate treaty with Japan.

An Analysis

"In analysing the intentions of the parties to these treaties, it appears that China in the original lease made with Russia reserved to herself her sovereign powers over this territory as it was explicitly so stated in the body of the lease. It further appears that in the treaty of peace between Russia and Japan, these same rights were transferred to the latter subject, however, to the acquiescence of China which appears to have been given a few months later. The period of this lease as acquired by Japan extended only until March 27, 1923. In the beginning of the year 1915, Japan sought to renew the Liaotung lease with China, and exchanged notes respecting same under the title of The Treaty Respecting South Manchuria and Eastern Inner Mongolia. This treaty among other things extended the term of the lease of Port Arthur and Dalny for a period of ninety-nine years. It also contained an article which can be said bears strongly on the question that is being considered here.

This article known as article No. 5 of said treaty in the second paragraph thereof, reads as follows:

'Civil and criminal cases in which the defendants are Japanese, shall be tried and adjudicated by the Japanese consul; those in which the defendants are Chinese, shall be tried and adjudicated by Chinese authorities. In either case, an officer may be deputed to the court to attend the proceeding; but amongst civil cases between Chinese and Japanese relating to land, shall be tried and adjudicated by delegates of both nations conjointly in accordance with Chinese laws and local usage.'

"In construing this particular part of the treaty, it shows conclusively that Japan recognized the sovereignty of China, and reiterated in specific terms her extraterritorial rights for her subjects and does not claim supreme powers to herself to the exclusion of Chinese sovereignty in this particular territory.

"During the negotiations between Japan and China respecting this treaty, the famous Twenty-One Demands presented to China by Japan came into existence, one of which, bore directly on the extension of the lease of Port Arthur and Dalny. On May 8, 1915, an ultimatum was handed to China by Japan requiring her to agree to these demands which the former claims was accepted under duress. However, before China's formal acceptance was given, the United States government communicated the reservation of rights of the American government under date of May 13, 1915, as follows:

'In view of the circumstances of the negotiations which have taken place, and which are now pending between the government of China and the government of Japan, and of the agreements which have been reached as a result thereof, the government of the United States has the honor to notify the government of the Chinese republic that it cannot recognize any agreement or undertaking which has been entered into or may be entered into between the governments of China and Japan impairing the treaty rights of the United States and its citizens in China; the political or territorial integrity of the republic of China or the international policy relative to China, commonly known as the 'open door' policy.'

"It is here very apparent that the United States has not been a party to or has in any way waived her extraterritorial rights given to her by the various treaties with China, and took the occasion to so notify both China and Japan before this treaty was actually signed.

At Washington

"The same question subsequently occupied a very important part in the sixth plenary session of the conference on the limitation of armaments held in Washington on February 4, 1922 (page 324).

"The chairman, the Honorable Charles Evans Hughes, secretary of state of the United States, read into the record of that session the following statements which were declared to be a part of the record, and agreed to by the representative of the powers present. It reads in part as follows:

'By the chairman:

'I am directed by the committee on Pacific and Far Eastern questions to read for the purpose of having the statements formally placed upon the records of the conference, the following declarations with respect to the so-called twenty-one demands of the Sino-Japanese treaties of 1915.

'The first statement that I shall read is the statement made to the committee by Baron Shidehara on behalf of the Japanese government. . . . .

'(2) Japan has no intention of insisting on her preferential rights in the Sino-Japanese arrangement in question concerning the engagement in China of Japanese advisors or instructors on political, financial, military or police matters in South Manchuria.'

"And in article No. 3 of the last text is found:

'In coming to this decision which I have had the honor to announce, Japan has been guided by a spirit of fairness and moderation, having always in view China's sovereign rights and the principle of equal opportunity.'

"The chairman, then on behalf of the government of the United States, read in part as follows:

'With respect to this grant, the government of the United States will, of course, regard it as not intended to be exclusive, and, as in the past, will claim from the Chinese government for American citizens, the benefits accruing to them by virtue of the most favored nation clause in the treaties between the United States and China.'

"In these utterances which have been made a permanent record, and adopted by the United States government, it shows conclusively that it never has relinquished its extraterritorial rights in this particular territory in question.

"It further appears that Mr. Hay, Secretary of State in 1900, instructed the consuls in China that they had no authority to exercise extraterritorial jurisdiction or to perform non-judicial consular acts within the leased territory under their present Chinese exequators, and that his instructions were complied with: that the reason for so acting was due to the fact that the other powers with the exception of Japan were under the opinion at that time that the leasing of Weihaiwei, Shantung and the Liaotung peninsula transferred the sovereignty to the lessees.

"In the memorandum of Mr. Van Dyne, assistant solicitor for the United States (For Rel. 1900, 387, 388, 389, Moore's International Law Digest) he seems to take a different view of this situation than did Mr. Hay, and says:

'As it is expressly stipulated in the lease that China retains sovereignty over the territory leased, it could doubtless be asserted that such territory is still Chinese territory and that the provisions of our treaties with China granting consular jurisdiction are still applicable therein. But in view of the express relinquishment of jurisdiction by China, I infer that the territory is permanently (?) is merely intended to cut off possible future claims of the lessees that the sovereignty of the territory is permanently vested in them. The intention and effects of these leases appear to me to have been the relinquishment by China, during the term of the leases, and the conferring upon the foreign power in each case of all jurisdiction over the territory. Such relinquishment would seem, also, to involve the loss by the United States of its right to exercise consular jurisdiction in the territories leased. And, as Mr. Conger suggests, as these territories have practically passed from the control of an uncivilized people to civilized, there would seem to be no substantial reason for continuing to exercise such jurisdiction.'

"Furthermore, the United States was given certain rights within the integral territory of China by a treaty, and these rights can be abrogated in no other way than that in which they were given. In other words, before the United States relinquished extraterritoriality in any portion of China as existed in 1844, there must be definite action taken by congress.

"Judge Moore in his International Law Digest (Vol. 5, page 321) says:

'That the contracting power can annul the treaty cannot, I presume, be questioned, the same authority precisely, being exercised in annulling as in making a treaty.'

"He further ennunciates a principle (Vol. 5, page 337) which strongly bears on this case, and which reads as follows:

'An alliance between two nations cannot absolve either of them from the obligations of previous treaties with third powers.'

" And again (Vol. 5, page 369) :

' It is the duty of the courts not to construe an act of congress as modifying and annulling a treaty made with another nation, unless its words clearly and strongly point to such a construction.'

Citing in support of this, principly, the cases of Lem Moon Sing vs. U. S. 158 U. S. 538, and U. S. vs. Mrs. Gue Lin, 176 U. S. 459.

" This last principle of Judge Moore's seems to cover the situation herein involved. The defendant in this case is the one that is attacking the jurisdiction of the United States in exercising its authority over him in an action brought in its federal court. There is no positive assertion on the part of the United States that it has abrogated its treaties with China in respect to the issue involved in this case.

" It might be said that this situation would become more complex should this same objection be made by a friendly power, as the disposition of the matter would then be adjudicated by a totally different tribunal.

" Having taken into consideration the various phases of this novel case, I fail to find that the United States court for China has lost its jurisdiction over this defendant who is charged with committing a crime within the leased territory of China, and more particularly described as being in the city of Dairen. The defendant's demurrer is therefore, accordingly overruled, and as there appears to be sufficient evidence adduced to make out a *prima facie* case of assault against him, he is required to answer the information filed herein."

This decision is now declared null and void. Judge Purdy did not uphold it on a single point. He wiped it out out lock, stock and barrel.

It is interesting to note that when the first decision was rendered, certain Americans in China who delight in what appears to them the discomfiture of Japan, were overjoyed. They thought that here was an opportunity of undoing by a judicial decision, the excellent work of the State Department in lessening the diplomatic value of the jingoistic attacks on Japan both in the United States and among Americans in China. *The China Press*, commenting on our criticisms of Commissioner Lurton's decision, said :

" A monthly magazine has taken upon itself to criticise the decision, not because it may be legally wrong, but because it might lead to unfortunate developments in the diplomatic history of the Far East, involving the reopening of a large number of questions which had been regarded as effectively settled. *But we are of the opinion that the decision of the court deserves no such criticism, but rather praise as a ruling calculated to reaffirm the constitutional rights of American citizens as defined by treaties embodied in our law. The treaties of 1844 and 1858 having been ratified by congress became part of the law of the United States and no agreement between other countries can modify the privileges of our citizens without the consent of our legislature. It is consequently a matter of relatively small importance what interpretation the state department cares to put on the documents involved in this case.* Indeed, we have always understood that in various rulings secretaries of state have refused to pass on any question the answer to which might bring it into conflict with any tribunal, and the inference to be drawn from this is, that the state department itself desires the courts of the United States to be absolutely untrammeled by any political or diplomatic consideration.

" What the writer of the article in question apparently fails to perceive is that the duty of any court of justice is to administer the laws applicable within its jurisdiction and to suggest that such application should be subject to diplomatic expediency is to advance a proposition foreign to the spirit of any judicial process."

To this we replied :

Quite right. The legal aspects of the decision are beyond our criticism. Our comment takes the form that it is manifestly injurious to the prestige of the American government for an official of a bureau under the direction of the State Department to precipitate a delicate international issue without consulting beforehand with his superiors, especially when the decision reverses the established policy of the government, renders possible a readjustment of our foreign relations and says in effect, that the state department is incompetent to interpret the treaties. Rushing through such a decision and giving it out immediately for publication in the local press without reference to the position of the state department would seem to be the height of discourtesy, one that would not be tolerated in any other government or private business enterprise.

If it is a matter of relatively small importance what interpretation the State Department cares to put on the documents involved in the Lurton decision, then its stand on other equally delicate international questions is also a matter of relatively small importance and opens the way for further impairments of its constitutional powers by other federal departments operating in China under treaty provisions which, in the last analysis, the state department is called upon to interpret and enforce. A bill is now before congress to have the U.. S. Court for China transferred from the jurisdiction of the state department to the department of justice. The bill has received the endorsement of the Associated American Chambers of Commerce of China. The " American " newspapers reflecting the policies of this organization are very strong in support of the measure. Any scheme which undermines the authority of the state department by the independent operation of other American governmental departments in China tends to strengthen the authority of the invisible government in this country, and would naturally receive the approval of the editorial writer for *The China Press*.

Now, there would seem to have been no urgent judicial issue involved in raising the question of the court's jurisdiction over American citizens in the Kwantung leased territory, for, after rendering the decision, the accused was permitted to depart from the jurisdiction of the court without hindrance. It would seem that after setting aside the established policy of the government and precipitating the issue with Japan, the court should have as energetically enforced its decision and remanded the accused for trial. As it stands, an international issue has been created without in any way advancing the ends of justice. When viewed from this angle, the decision can properly be interpreted as a wholly gratuitous slap at the state department—part of the campaign to have the court freed from its supervision.

The question of lessening the authority over American institutions in China has apparently ceased to agitate the American community in China. Since Judge Purdy became the presiding officer of the United States Court for China, all talk of transferring the court from the jurisdiction of the Department of State to the Department of Justice has ceased. There is no longer any agitation with regard to the court. It has become what it always should have been, a judicial agency for protection of the life and property of Americans in China in accordance with the treaties between the United States and China at the same time respecting the rights of other nationals in China and the arrangements made between the United States and other nations concerning China and Americans in China. That is the business of the court. All else is extraneous.

The press report of the discussion in court on this matter, leading to Judge Purdy's decision reversing that of Commissioner Lurton makes interesting reading :

Attorney Holcomb argued that in-as-much as the American consul at Dairen was assigned to Japan by the State Department it showed a tacit relinquishment of extraterritoriality. He pointed out that under the treaty with China the American court can sit wherever there is an American consul.

United States District Attorney Leonard G. Husar, prosecuting the case, pointed out that the consul was assigned to Japan merely as a matter of diplomacy and in no way affected the rights granted American citizens under the extraterritorial treaty.

Judge Purdy advanced an argument along a different line, contending that the real basic reason for extraterritoriality was to prevent American citizens appearing before Chinese tribunals. Hence with the withdrawal of China from the Dairen area the need of extraterritoriality automatically ceased.

" But that does not affect the treaties," countered the United States Attorney. " Despite Japanese leaseholding Manchuria is still part of China and as such, the provisions of the treaty remain applicable to all parts of it."

The court argued that as no claims to special rights had been made by the United States Congress during that last twenty years it was evident that they were not interested in such a claim.

" If Congress does not assert such rights why should you," Judge Purdy asked.

" We are interested in a lot of things that Congress is not because we live out here," was Mr. Husar's rejoinder. " Congress has not been called on to claim any rights."

" Suppose China should cede or lose Mongolia to Soviet Russia. Then after twenty years some American should get in trouble there. Do you think that we could apply extraterritoriality ? " questioned the court.

The District Attorney replied that Kwantung was not lost to the Chinese republic but was merely leased to Japan for a period of 100 years. He strongly insisted that the treaty was the final authority and did apply to that area. He maintained that the United States could not stop China from giving up her own rights in certain areas but that China could not give up the rights of American citizens.

The court refused to alter its stand and granted the motion to quash, authorizing the return of the $500 bail put up for the accused.

The case hinges upon a circular letter sent to all consular officers in China by Secretary Hay in 1900 in which he notified them not to accept consular jurisdiction in cases in any of the leased territories in which China had withdrawn her officials and judicial tribunals.

The memorandum, after citing the provisions in the treaties between the United States and China in relation to extraterritorial jurisdiction, said : " By the leases made by the Chinese government of Weihaiwei, Kiaochow, and Port Arthur, to Great Britain, Germany, and Russia respectively, the *jurisdiction* of China over the territories leased is relinquished during the terms of the leases. In the case of Weihaiwei, leased to Great Britain, it is expressly provided that ' within the territory leased Great Britain shall have *sole* jurisdiction.' In the lease of Kiaochow to Germany, it is provided that China shall have no voice in the government or administration of the leased territory, but that *it shall be governed and administered during the whole term of the lease by Germany* ; that Germany is at liberty to enact any regulation she desires for the government of the territory. Chinese subjects are allowed to live in the territory leased, under the protection of the German authorities, and there carry on their business as long as they conduct themselves as law-abiding citizens. Provision is made for the surrender to the Chinese authorities of fugitive Chinese criminals taking refuge in the leased territory. The Chinese authorities are not at liberty to send agents into the leased territory to make arrests. The lease declares that China ' *retains her sovereignty over this territory*.' In the lease of Port Arthur to Russia it is provided that the control of all military forces, as well as of the *civil officials* in the territory, shall be vested in one high Russian official ; that all Chinese military forces shall be

withdrawn ; that the Chinese inhabitants may remain or go, as they choose ; that if they remain, any Chinese charged with a criminal offense shall be handed over to the nearest Chinese official to be dealt with. (Mr. Conger says that the Russian legation informs him that this last provision is not correctly translated, and that, construing it in connection with article 8 of the treaty of 1860, the Russian government has the right and does try Chinese for crimes committed against Russians.) This lease is expressly declared on the understanding that it '*shall not* prejudice China's sovereignty over this territory." As it is expressly stipulated in the leases that China retains *sovereignty* over the territory leased, it could doubtless be asserted that such territory is still *Chinese territory* and that the provisions of our treaties with China granting consular jurisdiction are still applicable therein. But in view of the express relinquishment of jurisdiction by China, I infer that the reservation of sovereignty is merely intended to cut off possible future claims of the lessees that the sovereignty of the territory is *permanently* vested in them. The intention and effect of these leases appear to me to have been the relinquishment by China, *during the term of the leases*, and the conferring upon the foreign power in each case *of all jurisdiction over the territory*. Such relinquishment would seem, also, to involve the loss by the United States of its right to exercise consular jurisdiction in the territories leased. And, as Mr. Conger suggests, as these territories have practically passed from the control of an uncivilized people to civilized, there would seem to be no substantial reason for continuing to exercise such jurisdiction."

These instructions have been followed for 25 years. They have never been counter-manded by other instructions. Americans in leased territories, such as Hongkong and Dairen, have appeared before British and Japanese tribunals in those territories. A practice has grown up based upon these instructions. To have amicable relations between the United States without consulting the State Department, to overrule a decision and practice of 25 years, to ignore every question of policy, is foolsome.

Judge Purdy is to be congratulated on a perfectly just and honorable decision !

The Recrudescence of Jingoism

The Supporters of Militarism in the United States Are Hitting at Japan in the Hope of Forcing Through Congress a Larger Naval and Aerial Program

Constant Nagging Bound to Lead to Unfortunate Results

Saner Influences at Work under Leadership of President Coolidge to Prevent Stupid Stampede

THROUGHOUT the United States, a part of the press has taken upon itself the task of nagging at Japan, of annoying Japan, of worrying Japan. This movement is fomented by large, well-financed, well-organized associations which subsist upon popular fear and excitement. The purport of the present argument is that Japan will build or is about to build, or is building, a huge aviation corps, which will be used in the next war, the Japanese-American war. These airships and aeroplanes will fly from Japan straight to the western coast of the United States and there will be nothing there to stop them from thus conquering the whole country !

What can more lead to suspicion, loss of confidence, loss of friendship than such fatuous discussions ? What can do more mischief that these wild statements, unsubstantiated by fact, unsound in theory ? If this section of the American press seeks to force the United States into a war with Japan, they are altogether overlooking the character of the Japanese. Proud, stubborn, fearless, the Japanese will endure much for friendship. And there is no nation whose friendship, whose sympathy and co-operation Japan seeks as much as that of the United States. Such movements as the one which is at present making itself heard in the United States will fail to result in a war between the United States and Japan, *because Japan wants no war. Japan wants peace. Japan seeks peace. Japan seeks only the opportunity to develop in Asia the resources, the man-power, the natural wealth of those places she occupies and those countries which seek her co-operation. And in these development operation Japan seeks American assistance and from giving such assistance, the United States shares in the fruits of the ventures.* Why disturb such a favorable situation by hideous and fulsome war talk.

The same sort of talk brought on the curse of the European war from which victor and vanquished have alike suffered. The same sort of talk in Europe prior to 1913, stirred up national antagonisms, which could find gratification only in the slaughtering of countless millions and the destruction of the monuments of centuries. Do the men who thrive on such dangerous and uncontrolled doctrines realize the mischief they do ? Do they understand what havoc they do to their own country ?

The *New York American* perhaps leads the way in this light discussion of serious problems :

> " Where, then, is the guarantee ? Where is America's bulwark—the bulwark that must assure her safety and protect her welfare if her safety and welfare are to be protected and perpetuated ? In America's navy, in America's adequate navy.
>
> " Without that adequate navy, America's ready wealth and colossal resources are but invitations to attack her. Only by an impregnable line of defense at sea can America's wealth and America's sovereignty over it be maintained in peace and advance without conflict. The men who would weaken the nation's first line defense, expose it to defeat by a naval enemy, risk its ruin and the desolation of American homes with it, are assuming the greatest responsibility that any American rulers have assumed in sixty years.
>
> " The gentlemen in Washington have been warned. They have been warned more frankly, more brutally, than any others have been warned in modern times. The warning has been written before their eyes, shouted in their ears. None of us wished to see it or hear it. But it has been forced upon us.
>
> " All the world knows this. In Europe it is reckoned with as a certainty of the future. The only way to falsify the reckoning and defeat the certainty is by doing what we have not done, what we hesitate to do, what some gentlemen in Washington even shrink from doing, and that is so to fortify ourselves at sea, in accordance with our treaty rights, that, safe from attack and assured in our welfare, we may say to all peoples, well intentioned or evil intentioned :
>
> " We Americans ought to fear God, but nothing else in all the world."

Read-Admiral Bradley A. Fiske, retired, is all a-tremble as to what might happen to the United States. He says in one place :

> " Certain other nations are becoming stronger militarily, while we are becoming effeminized. We can see, for instance, that in Japan the people are sternly repressing all tendency to luxury, and that a nation-wide movement, almost feverish in intensity, is acting to aggrandize its air force, even working women and little boys and girls contributing their mites. We, on the contrary, are becoming more and more addicted to luxury and pleasure, while gaudy fashion shops almost monopolize our grandest avenue.
>
> " At the present day the nation which exemplifies the most clearly and the most spiritually the intimate relation between patriotism and religion is the nation of Japan. To the Japanese, patriotism and religion are inseparably entwined, and both are embodied in the person of the Mikado.'
>
> " The three nations which represent this state the most are Germany, Russia and Japan. There are many thousands

of extremely good people in this country, who live in comfort and enjoy the material benefits which the almost boundless wealth of our country confers upon them, but who fail to realize that the people of Germany, Russia and Japan do not live in such luxurious surroundings and that they cannot be justly blamed if they envy us. They realize that we have obtained it largely by means of war, and they can lardly be blamed if they say to themselves that they can get from us what we have because they are more skilled in war.'

"To accentuate their quite natural ambition is the profound conviction that they have been treated unjustly by the United States. We do not think so, but they do. Especially do the Japanese feel this, for our action toward them has not only been of a kind harmful to their national interests, but couched in terms they believe to have been made intentionally insulting. Whether they are right or worng in this matter, there is no recognized standard in this poor world of ours by which we can decide. The important point is that they think themselves right, and that the paramount cause of wars has been just that combination of a conflict of interest with a conviction on each side that it is right, which now exists between our country and Japan."

The answer of the *New York City Post* is perhaps a better one than we could think out. It is headed, "Cold Statistics," and gives them :

"Amid the loose talk about naval rivalry between Japan and the United States the two governments are preparing their naval budgets for the mext fiscal year. The United States will spend, in round numbers, $300,000,000 ; Japan a little over $100,000,000.

"Contemplation of these figures by the loose-talkers should reassure them that the United States is rather more than holding its own. The comparison scarcely supports the argument that the American navy is being allowed to suffer from lack of funds while that of Japan is continually forging ahead. But the jingoes in neither country will permit plain facts to come between them and their reckless propaganda.

"It is granted that statistics may be adduced to prove almost anything. It is probably true that the Japanese navy benefits to a greater extent by the expenditure of a given amount than does the American navy. There is no unit by which an exact calculation can be made.

"Those who prefer, to take their statistics cold might consider the naval budgets of the two powers over a period of five years. A comparative table might roughly be drawn as follows :

Years	United States	Japan
1920-21	$787,000,000	$187,000,000
1921-22	425,000,000	248,000,000
1922-23	298,000,000	138,000,000
1923-24	297,000,000	198,000,000
1924-25	300,000,000	112,000,000

"A fair-minded American would have difficulty finding a Japanese menace in these figures."

One can quote the jingoes *ad infinitum* and with an equal amount of disgust. In every time, in every country, there is the single-tracked mind, the unlearning, unthinking, megalomaniac, the fighter of dragons and pink elephants, whose creed may be summed up in the single phrase, "Carthage must be destroyed!" For a day, they have their say. They furnish sensational newspapers with sensational copy. They appeal to the fear psychology of the mob. They play upon the patriotic instincts of a people with wild yet plausible accounts of what might happen.

Again such, the *New York World*, maintains the calm, enlightened, liberty-loving policy of its great publisher, Joseph Pulitzer. During a long career, there was never a time when Joseph Pulitzer failed to attack injustice or curried to popular favor by the fomenting of mean prejudice. The *New York World*, continues this broad-minded, big-hearted attitude. In a number of editorials, the *World* has attacked the constant nagging of the jingoist. Opposing the Pacific manœuvres in an editorial entitled, "A Matter of Tact," the *Evening World* said :

"There is nothing remarkable in the hostile attitude of a large element of the Japanese toward our plans for naval manœuvres in Pacific waters. These manœuvres were certainly not planned as a defiant gesture to the Japanese, but, however harmless our motives, we are under suspicion in Japan, and this suspicion is being fed by the demagogues and touble-makers. These manœuvres give the jingoes the opportunity they seek. Much can be said against the timeliness of the naval demonstration.

"Under existing conditions it would have seemed the part of wisdom for the naval authorities to have taken the diplomatic situation into consideration. The contention of the navy department that we have 'a right' to have the manœuvres in the waters of our own island possession is not impressive, albeit true. It is not a question of right, but of tact.

"With the best intention in the world we have made a number of successive blunders in our relations with the Japanese, and this one might well have been prevented through a better co-operation between the state and navy departments."

The morning edition of the paper uses no fine phrases in speaking of the jingoes :

"American jingoes who have sought to spread suspicion against Japan may not be silenced by any reassuring words from Secretary Hughes. Their minds are mostly proof against arguments and proof against facts. But the American people cannot fail to listen when the secretary of state says that 'there are no issues whatsoever between the two countries endangering the existing cordial relations.'

"Nor will they fail to take note of it when Mr. Matsudaira, the newly appointed Japanese ambassador to the United States, and Baron Hayashi, the Japanese ambassador in London, speak in the same vein. To those still in a reasonable state of mind such official declarations from both sides must be conclusive. More than that, they indicate the purpose that the existing cordial relations shall be preserved.

"Baron Hayashi makes it clear that there are 'jingo elements in various countries of the world, my own included,' who practice the same methods of misrepresentation. He is no less right in saying that they are 'disregarded by the bulk of their nationals.'

"For jingoism is an industry fostered by a certain class of politicians everywhere. They play into one another's hands at long range by inciting trouble. What a Britten may say in Washington carries no weight in this country. The Chicago man's antics are old stage play. But in Japan, where he is not known, there is danger that they will be misunderstood. So a Japanese politician in Tokio may discharge frothy talk and his words, disregarded there, acquire undue importance in the United States through ignorance of his standing. It might help if Representative Britten could be sent to Japan for exhibition and some of the Japanese jingoes of whom Baron Hayashi complains were brought here for inspection."

The *Columbus Ind. Ledger* continues in the same vein :

"We are suffering here in America from the presence of individuals or interests that seem to take general delight in nagging and ragging Japan. There is no apparent reason why this should be done. The two countries are wide apart and do not come into close neighborhood relationship. The number of Japanese in this country is not so large that they threaten our business or industries ; and this number will not increase under the present immigration law. We do not covet any territory possessed by Japan ; and that country is making no hostile move toward any part of our own territory. Japan is a good customer of the United States, and we have and still continue to enjoy excellent commercial relations through Japanese connections.

"But in spite of these friendly and pleasant conditions, the raggers, and jingoists and naggers keep up their gadfly tactics with a persistency that is little short of amazing."

President Coolidge, Secretary Hughes and now even Secretary of Navy Wilbur are calling a halt to this vicious and insidious propaganda against a friendly nation. In a statement issued in Washington on February 1, Secretary Wilbur said :

"A good deal is being said just now concerning the terrors of the next war. It is stated that in the next war whole cities and whole populations will be obliterated by the awful means of warfare devised by science, that poison gas and disease germs and high explosives will do their dreadful work in destroying not only troops but civilians—men, women and children as well.

"These statements are not true and are not justified by past history or present conditions. The fact is that we have the 'next war' going on right now in China and there have been 'next wars' since the world war. The writers who seek to terrorize the people by the statement of the awful calamities of the 'next war' overlook the one fundamental principle of war, that to have a war one must have a defense and that the means of defense should be commensurate with the offense.

"If poison gas can be used on one side it can be used on the other, as Germany found out to her sorrow. If disease germs can be used on one side they can be used on the other. Moreover, the nation using disease germs as a means of offense cannot confine the effects of disease to one side of the fighting line. You can't keep small-pox or any other disease on one side of a given line, and what will render the soldiers on one side of the line immune to disease will render the soldiers on the other side of the line likewise immune.

"There is no need of scaring ourselves or allowing our women and children to be frightened by such stories. There is no doubt that modern warfare is a serious and frightful thing as we have so lately been reminded, and that unpreparedness for such war and its possibilities is inexcusable in any nation that has the means of preparing to avoid its hideous possibilities."

The sound men, the responsible men of the country are fighting this war propaganda as one fights a plague. They are attacking it from every angle. They are appealing to the good sense and decency of the American people. But who is behind all this war talk ? What interests are served in stirring up one nation against the other ? Who is doing it ?

Some American living in China, at one time, were interested in such a movement. They are not interested in it now. They once proposed that the United States go to war with Japan in the interest of China. No one would favor such a project now. They once conducted a propaganda to show how badly China had been treated by Japan and how worthy China was of universal sympathy. No one would argue like than now. China has her own problems and in due course will solve them in her own way. But such a solution can be achieved more easily through the active co-operation between Japan and the United States sooner than by a war, which could bring only misery to millions of Chinese.

Let us stop talking war ! Let us build in peace !

China Protests in Vain

Objection to Japanese-Soviet Agreement Untenable

CHINA'S protest against the Japanese-Russian Treaty as violating the sovereign rights of China because of the recognition of the treaty of Portsmouth of 1905, has impressed neither Soviet Russia nor Japan. The Russian view is that China has had many opportunities to come to an understanding with Russia, but was unable to make up her mind. Influence by the legations in Peking, hampered by petty jealousies among her own officials, disunited, uncertain chaotic, China has lost every opportunity of taking advantage of the Soviet offers. First, Mr. Yourin came along with proposals which fitted perfectly with China's aspirations. They were rejected. Then Mr. Joffe tried and he failed. Mr. Karakhan succeeded in signing a preliminary agreement but the intervening civil war, made further efforts in this direction difficult, if not impossible. Now, Dr. C. T. Wang has again been appointed to write a treaty with Russia, but it is uncertain whether he will accept the appointment, without some guarantees that when he shall have achieved success, some official will not interfere for internal political reasons, as Wellington Koo did the last time, and that any treaty signed will be recognized nationally.

The heart of China's present international difficulties arises from the disorderly provincial autonomy now actually the political system of China. Were provincial autonomy constitutional and orderly, there can be no doubt but that it would be the most satisfactory form of government for China. As it is, there is no system, no definite organization. Each province, or each group of provinces under a particular militarist does more or less as it likes. Before the Sino-Soviet preliminary treaty could become operative, a separate treaty had to be written with Marshal Chang Tso-lin, who controls the territory, North Manchuria, in which Russia is principally interested in China.

The Chinese Eastern Railway and its control was the problem which faced the central government in Peking, Soviet Russia and Marshal Chang Tso-lin. The railway was being managed by so-called "white" Russians on the basis of the original agreement between China and Russia, the Russo-Asiatic Bank, acting for Russia. When the preliminary agreement was signed between Soviet Russia and China, the Ministry of Communications believed that the management of the railway would revert to it. Dr. C. C. Wang, an experienced railway official, one of the most competent in China, was actually president of the Chinese Eastern Railway at the time. Marshal Chang Tso-lin, on the other hand, was at that time not on speaking terms with the central government. He was, as a matter of fact, independent of the central government and anticipated that he might at any time be called upon to defend his territory against an onslaughter by Marshal Wu Pei-fu, who then controlled and managed the central government. Marshal Chang soon dispossessed Dr. C. C. Wang from his position on the Chinese Eastern Railway, took possession of it himself and appointed his own man as president. The "white" Russian general manager, Mr. Ostrounoff, was clapped into prison, where he still is and a Soviet régime ensued.

The Soviet agreement required that an equal number of Chinese and Russians shall be employed on the road, but by all accounts, the road is constantly becoming more Russified, China losing her control altogether.

In view of China's complete mishandling of her relations with Soviet Russia, it is not at all surprising that Mr. Karakhan sent a rather sharp reply to China's protest against the Russo-Japanese agreement of January 20, 1925. Mr. Karakhan said :

"Now, I feel bound to state that the said note of your excellency, dealing with that stipulation of the convention signed between the Union Soviet Socialist Republics and Japan which refers to the Treaty of Portsmouth, caused me a great surprise, and I am constrained to lay down that your excellency's protest against the recognition of the validity of the Treaty of Portsmouth is so much in contradiction with the true significance of this act that it could at the best be explained by an inadequate examination of all the international acts pertaining thereto and—which is more regrettable—by fully ignoring those acts which the Chinese government has itself concluded with Japan.

(1) "Being mindful, to a degree which is well known to the Chinese people, of the sovereign rights and interests of China, the government of the Union of Soviet Socialist Republics, in its negotiations with Japan, did not agree to recognize the validity of the Treaty of Portsmouth until, after a thorough and most careful study of the eventual consequences of such recognition, it was clear beyond any possible doubt that the recognition in 1925 formally of the validity of the Treaty of Portsmouth, which was concluded and put into effect in 1905, could not in any measure effect the rights or interests of China whatsoever.

"Your excellency's protest would have been quite timely and have had perfectly reasonable grounds twenty years ago, when the treaty of Portsmouth was being signed and when the Tsarist government—with the *sans-gene* peculiar to an imperialistic power —felt itself in China like a master in his own home and, without the knowledge of the Chinese government, ceded to another country the territories and rights which the Tsarist government had itself seized in Manchuria. However, the Chinese government not only failed to offer any opposition to the Tsarist government, but by two acts which were signed between China and Japan in Peking on December 22, 1905, the Chinese government itself recognized all the rights of Japan that had been ceded to the latter by the Tsarist government on the strength of the Treaty of Portsmouth. Consequently, as early as on and from December 22, 1905, the Treaty of Portsmouth lost all its significance as an international act in any way affecting the interests of China. Moreover, in 1915, on the strength of an agreement concluded between China and Japan directly and without any reference to the Treaty of Portsmouth, the rights which, twenty years ago, have been ceded to Japan by the Tsarist government, were established on a new formal basis. I may be permitted here to invite your excellency's kind attention to the fact that those rights which have now apparently caused the protest on your excellency's part were fixed in 1915 for terms many times longer than those which were granted by China to the former Russian imperial government.

(2) "However, notwithstanding the fact that the recognition in 1925 of the formal validity of the Treaty of Portsmouth could not in any way prejudice the interests of China, the government of the Union of Soviet Socialist Republics nevertheless deemed it necessary, in a special declaration signed on the same day as the convention of January 20 of this year, to exonerate itself of all political responsibility for the contents of the Treaty of Portsmouth."

Developments in the Far Eastern Iron and Steel Industry

WITH the announcement of another loan of Yen 8,500,000 from the Yokohama Specie Bank to the Han-Yeh-Ping Coal and Iron Company, the reports of a strenuous campaign being carried forward in Japan for the merger of governmental and private steel mills, the prospect that the Anzan Iron Works of the South Manchuria Railway Company will be placed on a profitable working basis and the erection of a new steel plant in East Borneo, interesting developments are taking place in the Far Eastern iron and steel industry which may have a far-reaching effect on present trade conditions.

Han-Yeh-Ping Loan

It is no secret that the affairs of the premier Chinese industrial enterprise are in a bad way or that prolonged negotiations have been taking place in order to obtain further financial assistance from Japan.

It is not always possible for outsiders to guage correctly the real nature of the difficulties which operate to keep Chinese directed enterprises from making a profit, but it seems to be generally accepted in commercial circles that unless a revolution is effected in the management of the Han-Yeh-Ping Company, the great works and mines at Tayeh, Hanyang and Pinghsiang will pass under the control of these Japanese interests who have already advanced about Yen 45,000,000 to the company since 1913—two and a half times its paid-up capital of $18,000,000. In any comment on the affairs of this company, it is only fair to state that internal conditions in China have been largely responsibility for its present unfortunate condition. The operations of the military war-lords have cut the railway to the north and south of Hankow and stopped the coal supply. Faced with a shortage of coke, the Han-Yeh-Ping Company has been importing it from Japan at an excessively high cost. As a consequence, one furnace at Hanyang and one at Tayeh belonging to the company as well as those owned by the Yangtsze Engineering Works at Hankow have been to close down. Only 200 tons of pig iron a day are being turned out at Tayeh and none at Hanyang, where the normal output was 400 tons per day before the coke shortage.

Finding itself in futher financial straits and failing to obtain relief in China, the company was compelled to turn once more to its Japanese creditors for an additional loan to carry it over. At the last annual meeting held in December, the shareholders approved the negotiations for a new loan from the Yokohama Specie Bank, the accommodation being in the nature of an extension of the original agreement of 1913 under whose terms it represents an advance payment for iron to be delivered to Japanese interests. The proceeds of the loan are to be applied in large part for the purchase of new plant and machinery, which will enable the company to produce 400,000 tons of iron annually and to redeem several short-term foreign and native loans concluded at higher rates of interest. It is understood that the rate of interest is $6\frac{1}{2}$ per cent. and that amortization is to commence in 1928, in order to enable the company to reorganize its administration and expand its selling organization in China and foreign countries. Following the lines of the original loan agreement of 1913, the new conditions give to the Japanese lenders preference in purchasing the products of the company at prices to be mutually agreed upon.

Japanese Steel Merger

The new lease of life given to the Han-Yeh-Ping by this last loan has given rise in Japanese steel circles to the fear that if the Hanyang steel works are improved and brought up to full producing capacity its surplus products will be dumped on the Japanese market at prices ruinous to the domestic industry. To provide against this contingency, Mr. K. Takahashi, Minister of Agriculture and Commerce, has proposed a merger of the principal Japanese private and government steel mills in a single corporation with a capital of Yen 200,000,000.

The general plan of the proposed scheme is as follows:

1. The proposed ironworks shall be composed of the following concerns: the Government Steelworks at Yawata, the Rinsei Steelworks, the Fusan Iron Foundry, the Japan Steel Company, the Mitsubishi Iron and Steelworks, and the Oriental Steelworks.
2. The new concern shall be a semi-official organization with a capital of Yen 200,000,000.
3. The government shall be the holder of Yen 900,000 of shares, in exchange for the property of the Government Steelworks at Yawata
4. Shares amounting to Yen 110,000,000 shall be distributed among the owners of the private steelworks to be amalgamated, in exchange for the property.
5. The government shall assist the new concern in securing Yen 50,000,000 one year after its establishment, either in the form of loans or shares. Of this amount, Yen 40,000,000 shall be used by the concern as its operating expenses, and the remainder for establishing various facilities and improving them. The concern shall secure another Yen 10,000,000 in a similar way two years after its establishment.
6. The government shall give subsidies to the concern for 15 years after its establishment, unless the concern is able to pay a six per cent. dividend on shares other than those held by the government. Where the profits do not allow of a six per cent. dividend, no dividend shall be paid on the shares h:ld by the government. When the dividend on the government's shares reaches 3.5 per cent., a special dividend shall be paid to civilian shareholders. Such special dividend shall not exceed four per cent.
7. The following shall be carried out in the first year:—
   - (a) Different works shall co-operate in supplying raw materrials like iron ore, coal, etc.
   - (b) Unified purchase and distribution of raw materials.
   - (c) Readjustment of supply with demand and efficient distribution of different tasks to different works.
   - (d) Unified in selling and distributing of products.
   - (e) Readjustment in employment of operatives.

The plan also includes the building of ships and the establishment of other facilities.

Mr. Takahashi's plan received the approval of the Ministry of Finance and the Cabinet then appointed an expert commission to study and report on it. It was accepted that from the standpoint of both the industrial development and the national defense, some semi-official combination is essential, but the Cabinet reserved its final approval pending a full investigation with detailed accounts of the loans and subsidies upon which its success is premised. Explaining the object of the commission, Mr. Takahashi says it is to decide whether the steel industry in Japan can be made a unified national industry, and become the major industry of the country. He believes that the prosperity or failure of the steel industry will have a decided bearing upon Japan's future and that if the merger fail a change must be made in the industrial policy of the country.

Considerable opposition to Mr. Takahashi's plan has been raised by some of the independent steel concerns who claim that there is nothing new in the proposed merger. A similar plan was drafted at the close of the great war, when many of the new steel concerns found it difficult to carry on during the depression which followed. In fact, several bills having the same general object in view were drafted and submitted to the Diet by interested parties for the purpose it is claimed of manipulating the stock market. It is, however, admitted by everybody interested in the industry that some unification of the national iron and steel industry is absolutely necessary, but any plan that makes the government works at Yawata the nucleus of the Combination and hands the industry over to government control with the power to appoint directors and other officials, is bound to bring disaster.

New Iron Extracting Process

The campaign for unifying and nationalizing Japan's iron and steel industry had hardly started when the announcement was made that a new method of extracting pure iron from iron sand and iron ore had been perfected by Dr. Masatoshi Okochi, chief of the research institute which bears his name and a member of the House of Peers. His method is based on electrical dissolution and, it is claimed, that it will revolutionize the industry in Japan where enormous deposits of iron sand are found in several localities. Considerable stir was created in the Japanese industrial world over this development followed by the announcement that Dr. Okochi intends to resign his seat in the House of Peers to devote all his time to his discovery.

Enormous Iron Sand Deposit

Two weeks later, equally startling announcement was made that another new process had been invented, and that deposits in northern Japan had been located containing billions of tons of iron sand that would supply the national requirements of Japan for centuries.

The location of the deposit has lomg been known, but it was only recently that the process for extracting the iron was reported to have been perfected by Mr. Goro Matsukata, a son of the late Prince Seigi Matsukata, who has been experimenting since 1917. A smelting plant operated in secret by Mr. Matsukata in Kuji Bay is reported to have obtained 30 tons of iron from 1,500 tons of iron sand on December 8. The plant is to be enlarged to such an extent by next October that it will yield between five and six hundred thousand tons of iron a year.

It is said that the quality of the iron sand is excellent, and the field in Kuji contains at least 1,500,000,000 tons of iron. The deposits far excel the Tayeh mine of China, whose resources are estimated at 20,000,000 tons.

Mr. Matsukata is planning to increase the capital of the plant to Yen 20,000,000 and develop the mine to an extent that there will be no more need to import iron.

The "Ferrocoke" Process

The invention of Mr. Goro Matsukata is known as the "Ferrocoke" process of smelting.

A writer in *The Japanese Times* says the process is comparatively simple. After the ore is mined it is washed or "milled," the gravel being washed away and the concentrates remaining. When coal is made into coke a certain percentage of concentrates are added to the coal of the coke ovens and instead of the ordinary coke a substance called "Ferrocoke" is produced. The Ferrocoke, which is a combination of fuel and ore, is then the only substance fed to the blast furnace with pig iron and slag as the ultimate result.

The process at the same time can eliminate or reduce the quantity of titanium contained in the original ore and the pig pig iron manufactured is of the highest quality.

One blast furnace is already operating on the shores of Kuji Bay and the following percentages have been established as a safe average. From ore to concentrates forty per cent. and from concentrates to iron fifty five per cent.

In other words, 2,500 tons of iron sand will yield 1,000 tons of concentrates, which again will produce 150 tons of iron.

The iron can be produced at a figure easily competitive against prices on imported products. The greatest expense in the production is the item of coal.

While some coal mines may be found in northern Honchu. the coal mined there is too inferior for coking purposes, and it has been necessary to import coal from Hokkaido.

If good coal can be found in the vicinity of Kuji it will still further reduce the cost of iron production and in this connection it is of interest to note that fishermen have found seaweed in Kuji Bay with a first-class quality of coal hanging on the roots. It is therefore quite possible that suitable coal may be found on the small peninsula to the north of Kuji Bay.

The fact that the blast furnace is located on the shore of Kuji Bay will greatly facilitate and cheapen the shipping of the iron. In the course of time piers and wharfs will undoubtedly be erected in order to expedite the discharging and loading of steamers which is now being done by lighters running through the surf.

Anzan Program

In addition to the above developments in Japan's steel industry are the improvements now being carried out at the Anzan Iron and Steel Works, operated by the South Manchuria Railway Company in Manchuria. These works have been operated at an immense loss to the railway company owing to the low grade character of the iron ore deposits. After many experiments, however, the engineer of the works has perfected a concentration system which has proved such an unqualified success that the company has adopted it as the basis of a new extension program. The first stage of this program is being carried out this year by the erection of reduction furnaces and concentration plant which if successful is to be supplemented by a steel plant and rolling mill.

Protective Measures

The new steel program being pushed forward by Mr. Takahashi in Japan includes raising the duty on imported iron and a revision of the law for the encouragement of the domestic pig iron industry.

The prevailing tariff on imported pig iron is 10 sen per 100 *kin*, but this is offset by a conventional tariff of 8.3 sen per 100 *kin*. Mr. Takahashi proposes a 15 per cent. *ad valorem* duty on inported steel materials and 10 per cent. *ad valorem* on pig iron, and as this will include all imports from China, it materially affects the position of the Anzan works of the S.M.R. and the Penchihu works operated by the Okura Company and the Chinese government authorities in Manchuria. Both of these enterprises, created in order to assist in supplying the national requirements of Japan will be hard hit, unless some special protection is extended to them.

Effect on Chinese Industry

If the "Ferrocoke" process invented by Mr. Matsukata or the electric dissolution process of Dr. Okichi is successful in profitably utilizing the large iron sand deposits of Japan and the nation can be made independent of foreign supplies, Japan will probably follow the lead of America in raising a tariff wall high enough to protect the home industry from foreign competition. The development of the new process will be followed with keen interest as its success means that the huge Japanese investments in Chinese iron mines and blast furnaces (including the Yen 50,000,000 loan to the Han-Yeh-Ping) will become almost a dead loss unless the Chinese market is developed to the point where it will consume its own output.

Borneo Steel Mill

While these developments are taking place in Japan the Dutch project for establishing a steel plant in East Borneo in being pushed through.

In answer to a French statement that the soul of this enterprise was German, the Gazette d'Hollande recently gave out the following information :—

"The truth is that the initiative of the enterprise was purely Dutch, supplemented by foreign capital for its realization, but with the express reserve that the company should retain definitely its Dutch character, and that the Dutch government should be represented on the board of the company by a commissary furnished with special powers. All this is found explicitly set forth in documents which have been submitted to the Volksraad (Netherlands-Indies National Council), which include also the regulations of the "Société Anonyme des Fers et Aciers de Borneo." When the project was being discussed openly in the Volksraad in November, 1923, the question of the international character of the enterprise was brought up, and it was authoritatively stated that the company was representative of twelve important Dutch business interests. The capital was authorized at fl.70,000,000, the colony of the Netherlands Indies receiving fl.20,000,000 in shares in return for special concessions made by them to the company. The government further received half of the founders' shares, which carry with them special rights. If, in addition, one takes note of the founders' shares received by Dutch participants themselves, it is evident that the majority of shares of this sort pass into and remain in Dutch hands.

A member of the board of administration will be nominated by the Dutch Minister for the Colonies, and the other members elected by the holders (mostly Dutch) of the founders' shares. Two-thirds of these members are Dutch, and reside either in Holland or in the Dutch East Indies. In a word, the majority of the directors must be Dutch. On the other hand, it goes without saying that if this new blast-furnace industry becomes an accomplished fact, which is not yet assured, it will seek to produce on as large a scale as possible, and will only be following the example of its predecessors in seeking to find a market for its products amongst Far-Eastern consumers. This appears to make it sufficiently clear that, although there may possibly be some German shareholders, they certainly have no part in the control of the company."

Johore Iron Ore Exports to Japan

An interesting sidelight on Japanese activities in developing iron deposits in Eastern Asia is seen in the return of exports from the state of Johore in the Malay peninsula. In 1920 an iron deposit was discovered at Bakit Medan by Japanese prospectors. Development work was commenced at once, and all the ore shipped to Japan. In 1921 it was 74,250 tons, value £86,636; in 1922, 111,090 tons, value £129,605; and in 1923, 154,161 tons, value £149,344. For 1924 (nine months) it has been 160,723 tons, value £128,936.

In 1923 the labor force employed numbered 990, and an 80 h.p. air compressor plant was to be installed for drilling purposes. To transport the ore down the river to the sea thirty-one tongkangs and eleven launches and tugs are employed by the company.

Mining Protective Appliances

We have received an instructive catalog illustrating and describing Messrs. Siebe, Gorman & Co.'s breathing and all other safety, protective and first aid appliances. The appliances are useful for fire brigades, mining companies and similar enterprises requiring protective breathing appliances. Simplicity, compactness, absence of complication are the characteristics of these appliances, which are so arranged that telephonic and speaking apparatus are attached to the oxygen tubes. The agents for Messrs. Siebe, Gorman & Company, Limited in the Far East are the Jardine Engineering Corporation, Ltd.

The Iron Mines of Hsuanhua

A monograph has been published by Professor George B. Barbour, of the geology department of Yen Ching University, on the iron mines of Hsuanhua, Northern Chihli, which describes the Hsuanhua mines as being the most important workable iron deposit in China, although it was unknown to the explorer Baron von Richthofen. Professor Barbour says:

"After tunneling under the great wall at the head of the Nankou Pass, the Peking-Suiyuan Railway comes out on the edge of the upper river basin, and has an almost level run of 80 miles to Kalgan, where the Mongolian caravan route strikes north towards Urga. Twenty miles before reaching Kalgan, however, the train stops at the walled city of Hsuanhuafu, which almost hides a narrow gap in the long wall of hills that rise steeply half-a-mile north of the town.

"This innocent-looking ravine appears to be blocked behind by other hills, but the gorge divides abruptly and the eastern opening dives into an irregularly shaped cup in the mountains, which has been half-choked with loess, silt, and river-gravel. The east rim of the cup is formed by Yen-tung-shan (Chimney Mountain), which belongs to what is the richest sector of the iron-field, and the only one so far developed . . .

"The extensive dissection of the mountain by stream action has laid bare such a length of outcrop all around the mountain that the deposit has been worked from the surface by the 'open-pit' method. So far, only one tunnel has been driven through other rock to strike the ore underground.

"The pits being on the hill-side, the ore can be loaded into one-ton trucks, which are hitched to a cable and run down inclined tracks under gravity. The weight of the loaded trucks serves to haul up the returned 'empties' . . .

Ford Building Electric Engine

Henry Ford is building the largest and most powerful electric locomotive in the world, which, when completed, will be used on the Detroit and Ironton Railway, the latest addition to his railway interests, and operating in conjunction with the Detroit, Toledo and Ironton Railroad. This super-engine, which is now under construction in the power house at the Highland Park plant of the Ford Motor Company, presents a most important development in the electrication of steam railroads, and at the same time a radical departure in locomotive construction.

The locomotive is not only novel in electrical design, but embodies many new and important ideas in mechanical design. In size it will be prodigous. It will weigh 340 tons, will be 117-ft. long, fifteen feet and ten feet wide. It will have sixteen pairs of driving wheels and will be capable of hauling a train of 150 or more loaded box cars, each weighing approximately 50 tons. The engine will not be built for speed, the purpose being to use it for freight service exclusively. Its running speed will be seventeen miles an hour, and its maximum speed thrity-five miles an hour.

One of the unique features of this great electric motive unit is that it carries its own converter station. This eliminates establishment of substations along the route, a practice at present general in railroad electrification. Through a regenerative braking system the Ford locomotive will have the ability to develop electric energy at any speed from maximum to practically a standstill.

The mechanical parts of the new locomotive are being designed and built by the Ford Motor Company, while the electric equipment is being built by the Westinghouse Electric and Manufacturing Company under Ford supervision and according to Ford specifications. Another feature of importance is that the trolley voltage adopted for the Detroit and Ironton Railroad electrification is 22,000 volts, twenty-five cycles, alternating current, a trolley voltage twice as high as any previously used in this country.

The Founder of the Chee Hsin Cement Co., Ltd.

The story of a Chinese official who has done much for the development of the industry of his country is given in the biography of H.E. Hsuehsi Chih-chi Chow published by La Librairie Francaise, Tientsin. Mr. Chow, an ex-minister of finance, is connected with the following institutions: Director-general, National Cotton Improvement Bureau, president Wah Hsing Cotton Spinning & Weaving Co., Ltd., director, Wusih Kwang Chin Cotton Moll, director, Peking Waterworks Co., Ltd., president, National Industrial Bank of China, president, Hwa Hsin Bank, managing director, Lanchow Mining Co., Ltd., managing director, Chee Hsin Cement Co., Ltd., managing director, Pu Yu Machinery Co., Ltd., chairman, National Association of Mining Companies.

Mr. Chow's activities in connection with the Chee Hsin Cement Company, Ltd., are particularly interesting. In 1900 Mr. Chow stepped in where his predecessors had failed and resolved to make another attempt. He appointed Mr. Li Shi-ming and Dr. Gunther to organize the Chee Hsin Cement Factory, the capital being advanced from the then existing Kaiping Mining Adminstration. Soon afterwards, the Boxer troubles broke out and this enterprise found itself in serious financial difficulty. Through the efforts of Mr. Detring, at that time Customs Commissioner of Tientsin, the Chinese Engineering and Mining company advanced funds to the company and obtained a lien on its products with an understanding that the arrangement might terminate at any time on giving three months notice. In 1906 the restitutuon to Chinese control was effected by Mr. Chow and owing to the obsolescence of the old plant, new capital was raised to instal a new plant. The sponsors of this movement, H.E. Hsuehsi Chih-chi Chow and Mr. Sun Tao-sun were appointed general manager and assistant general manager respectively. Under this management, the company was carried on more successfuly than at the first attempt. The sub-depôt at Machiakow was established in 1908. At an extraordinary general meeting of the shareholders in December, 1911, it was resolved to form a new company in accordance with the commercial law of China for limited liability companies, to take over the undertaking of the original Chee Hsin Cement Co., Ltd.

China's Railways

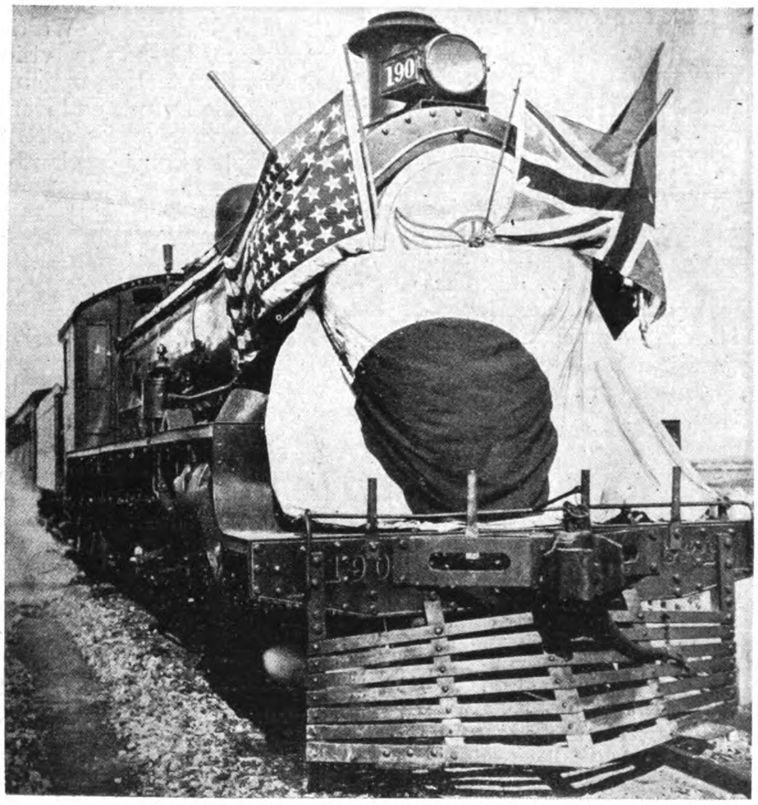
Deplorable Condition of Railway System Due to Civil War and the Seizure of Cars by Militarists

DURING the recent civil war in China, which, by the way, is far from being concluded, the railways of the country were utilized by various generals for the transportation and quartering of troops. The rolling stock, including the very fine "Blue Express" cars, were seized by the various commanders who used them for their own purposes, in a shabby, thoughtless manner. The locomotives were taken from one line to another, each commander hoarding as many as he could get, against the possibility of a hasty retreat. First class passenger coaches became the field headquarters of generals; third class coaches, the barracks of the troops. The destruction of property has been very great, but during the days of fighting there was no power in the country strong enough to gainsay the arrogant militarists.

It must be borne in mind that during the whole period of the war, commencing at the end of August and not yet altogether over, passenger and goods traffic was altogether dislocated. The merchants, particularly foreigners protested, but in vain. No one could question the right of a military man to do anything he pleased, to destroy private or national property, to imperil foreign obligations or domestic responsibility. In a military oligarchy, the whims and wishes of the soldiers transcends all else.

Mr. Yeh Kung-cho, Minister of Communications, an experienced railroad man, states the case clearly and forcefully in a memorandum to the government. He says:

"Worse is the fact that not only have communication affairs not been actively promoted, but they have been thwarted in many respects, revenues along this line being detained, railways being offered as security for negotiating loans, employment of officers and even workmen being interfered with, soldiers and high officials being always exempted from being charged, cars and locomotives being detained in great numbers.



The International Express from Peking to Tientsin; the only safe train for travel out of the capital during the stirring days of the last war

"It was estimated that, up to September, 1924, no less than $707,300,000 should enter the debit side in carrying on (by no means promoting) communication affairs. This figure has neither greatly increased nor decreased, remaining somewhat the same at present. What is most lamentable is that a process of undermining has been going on in the economical foundation of these communication affairs. Scarcely can a balance be kept between receipts from and expenditure for these communication enterprises. Formerly, though the payment of domestic loans had frequently been delayed, foreign loans never failed to be duly repaid. But this is not the case at present. Foreign creditors such as the Japanese Specie Bank, the Ta Pei Company, the Ta Tung Company, and others as domestic creditors suffered delays repayment of both the principal and the interest. As a natural result of this, the credit of the authorities of communications has been destroyed to a large extent."

With the railways so disorganized, it is only natural that the financial obligations of the Ministry of Communications should not have been met. It is interesting to note that Mr. Yeh Kung-cho gives his figures up to September 12 of last year. This is probably due to the political situation in China. The figures would have been much worse if they were given up to January 1, 1925, for they would then have included the three worst months of the war, when the ministry of communications had practically no revenue.

Mr. Yeh gives three methods of solving the problem:

"1. Those, which can be duly paid with available resources as such as the Tsin-Feng Railway loan, Tsin-Pu Railway loan, and Fu-Ling Railway loan, amounting to a total sum of more than $319,200,000. They have and will be regularly paid by the revenues of these railways.

"2. Those which should be liquidated by institutions of telegraphic communications amount to some $80,000,000, and they should be repaid by the surplus derived from these institutions.

"3. A little more than $219,900,000 will be met with ways to be worked in the whole reorganization plan of the country, although a part can be met by the Ministry of Communications, the remainder being beyond the possibility of the ministry.

All these suggestions are premised on the possibility of the railways and telegraphs having full command of their property and the unimpeded opportunity to collect its revenue. This is just about next to impossible at the moment of writing.

Many suggestions have been made for the improvement of China's railways. One is the internationalization of control—an idea which we have opposed as being impractical and offensive to the Chinese people. Another, is a huge loan by the consortium to set the railways straight and to start them off again on a business basis. Whatever plans are adopted, depends largely upon the willingness of China's military men to envisage the situation of China, to realize that in destroying the rolling stock and equipment of the roads, they are sacrificing the interest of foreign financiers in the railways of China, which is a serious matter to a country which has to have foreign capital for the development of the country.

If the militarists in China would only let the railways alone, the Ministry of Communications could effectively handle the proposition. There are a fine lot of young men in this ministry, most of them educated in the United States, trained in railroad engineering and competent to develop a railway system. These men are of the type that Japan sent into Manchuria to build up that wonderful institution, the South Manchuria Railway. They could do good work, if only they had the chance.

Description of a Shale Oil Distillation Plant

Capacity 1,000 Tons a Day

THE shale oil distillation, which promises to revolutionize the industry of Manchuria, now being erected at the Fushun mines of the South Manchuria railway, is attracting so much attention that a description of a proposed plant proves of particular interest. The Fushun deposits are overlaid with an oil shale stratum which will be utilized commercially through the enterprize of the distillation plant. For Japan, this plant is of particular importance, as it supplements the oil-bearing properties obtained in Saghalien in the new agreement with Soviet Russia. This makes for national security and prestige and saves Japan from the necessity of purchasing such huge quantities of oil abroad.

For a plant of this capacity, four banks of vertical retorts of the continuous type, comprising 224 retorts in all, each retort being capable of distilling 4½ to 5 tons of shale per 24 hours is required. The raw shale coming from the mines will be dropped from the wagons direct into the crusher pits where it will be broken to a suitable size for the retorts and then elevated to storage bunkers from which it will be fed into the charging hatches running on top of the retort hoppers. There would be two crushers and elevators each of which would handle 50 to 60 tons of shale per hour so that 8 to 10 hours would normally be required for crushing, that is, during the day-time only. In the event of a breakdown one crusher and elevator could handle the total output by working continuously.

The crushed shale bunkers in two sets of two each would have a total storage capacity of about 350 tons and the charging platform could be so arranged between the two sets so that each set of bunkers could be used for either pair of banks of retorts.

The spent shale will be discharged continuously at the bottom of the retorts by automatic discharging gear into a receiving hopper from which it will be periodically dropped into trucks running on rails underneath whence it would be taken to the cement works.

Condensers

The gas from each battery of retorts can be collected in steel mains and led to the condensers. These consist of steel tubular coolers in which the gas receives a preliminary cooling by water, the resultant hot water being used for boiler feed. After the tubular coolers the gas passes into four batteries of atmospheric condensers consisting of a series of vertical c.i. pipes and U bends.

The condensed oil from each battery of condensers flows through a separator in which the crude oil is decanted from the ammonia liquor and the two products led to their respective storage tanks.

Exhausters

From the condensers the cooled gas passes to the exhauster house. There are three exhauster sets, one of which is in reserve. These provide the necessary suction on the retorts and propel the gas through the remaining apparatus. They are of the rotary type, direct coupled to steam engines and provided with hydraulic regulators to maintain a steady vacuum in the foul main.

In the exhauster house are also placed the crude oil and weak ammonia liquor pumps by which the crude oil is delivered to the oil refinery and the weak liquor to the ammonia scrubbers.

The exhaust steam from the exhauster house is taken to the retorts for steaming the shale and thus increasing the yield of ammonia.

Scrubbers

Alongside the exhauster house in the open are placed the scrubbers in one set of which the gas is scrubbed with the weak liquor to remove the rest of the ammonia and to work up the liquor for distillation in the sulphate house. In the second set the gas is scrubbed with oil to recover the naptha—the pumps for circulating the oil being located in the naptha plant.

Each set of scrubbers is provided with receiving tanks for the saturated liquors from which they are sucked by the still feeding pumps in the sulphate and naptha houses respectively.

Gas Governors

The gas leaving the scrubbers is returned to the retorts for heating, first passing through a governor to maintain a constant pressure on the return gas main and to give uniform heating to the retorts. It is assumed that there will be sufficient gas produced for heating the retorts and no auxiliary heat producers (coal or wood) are required.

On the inlet to the governor is placed a surplus gas regulator which acts as a relief valve and allows any excess of gas over that required for heating to pass off. This gas (if any) could be utilized for lighting or heating in other parts of the plant.

Naptha Plant

In the naptha plant the saturated oil from the scrubbers and the naptha fractionated out from the oil refinery will be handled. Tanks are provided for fresh washing oil, stripped oil and saturated oil, with the necessary pumps for feeding the stills and scrubbers and decanting and manipulating the wash oil. For this last purpose an auxiliary oil tank is provided fitted with steam heaters and run from taps at various levels.

There are two sets of distilling apparatus in which the crude naptha will be distilled from the wash oil. The crude naptha is condensed, passed through a separator to remove water, then into a daily production or measuring tank and finally pumped up to storage tanks placed at a suitable level for feeding the refining stills.

The stripped wash oil flowing from the crude stills is cooled by means of a gilled pipe cooler built in serpentine form under a water cascade, and flows to the stripped oil tank, from which it is again circulated over the scrubbers.

The crude naptha obtained is now washed with sulphuric acid and soda in a lead-lined agitating vessel, the tars run off and the washed spirit deposited in a receiving tank from which it is blown into the first refining still. This still is of the usual type provided with fractionating columns, analyser and condensers and furnishes the first fractionating of the spirit. It may, however, be more convenient in working, to distil the crude naphta without washing and to wash separately the fractions obtained from the first distillation. This will depend on the nature of the naptha.

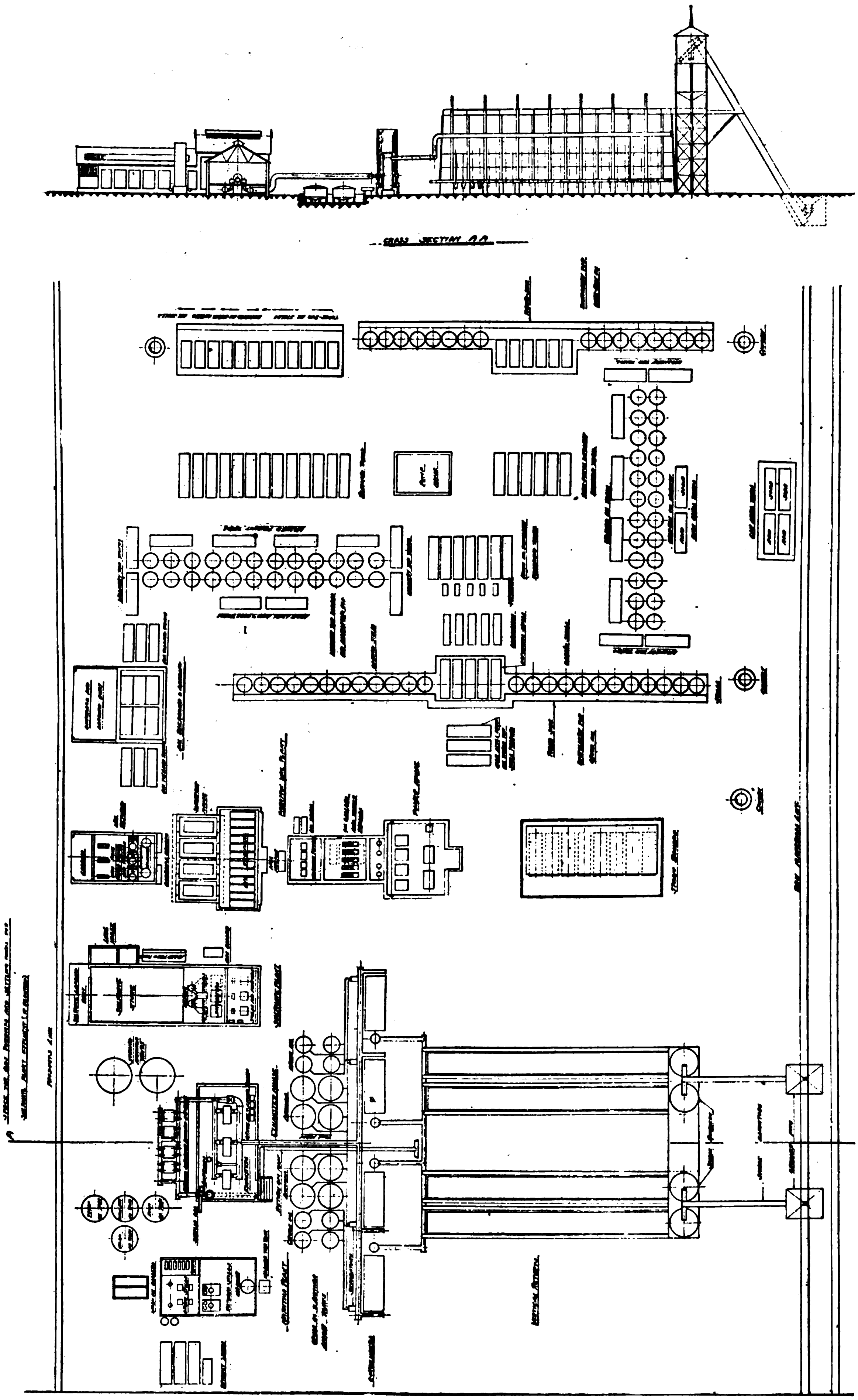
The fractions from the first distillation are then re-distilled in a second refining still similar to the first and the resulting spirit and heavier naptha taken to storage and loading tanks. The still residues return to the wash oil tank.

Sulphate Factory

In the sulphate house will be placed the necessary continuous stills for distilling the ammonia liquor coming from the scrubbers. The liquor is first of all pumped up to a small overhead feed tank to give a uniform flow of liquor. The liquor is preheated on its way to the still by heat from the hot gases given off in the saturators. The stills will be provided with liming sections and a set of lime mixing apparatus will be provided. The ammonia vapors coming from the stills will be led through iron pipes to the saturators.

The saturators will be constructed of heavy chemical lead with timber framing and will be provided with cracker pipes, acid catchers, and copper salt ejectors. The sulphate will be discharged on to lead-lined draining tables from which it will fall to the centrifugal dryers and from thence conveyed to the sulphate store for bagging and shipment.

The waste gases from the saturators will pass, after the acid catchers, into the liquor heaters where they will receive a preliminary cooling and then into a serpentine cooler under a cascade



PROPOSED SHALE DISTILLATION PLANT

of water. Before discharging into the atmosphere they are purified by passing through oxide or lime purifiers built in brick or concrete.

The spent liquor from the stills is settled in brick ponds, if necessary, before discharging to waste.

An acid feed tank is fixed alongside the sulphate house at a suitable level for feeding the saturator by gravity, the acid being blown into the feed tank from the acid receiving tanks near the railway.

Oil Refinery

The 250 tons of crude oil per day will be collected in the cruds oil tanks connected to the condensers. By means of the pumps in the exhauster house it will be pumped up to receiving tanks in the oil distillery; these receiving tanks being fixed at a suitable height for feeding the crude oil stills by gravity.

The first portion of the process consists in the preliminary fractionating of the crude oil into the naptha, once-run green oil and coke. This is accomplished in a battery of five continuous boiler stills in a brick setting and provided with the necessary steaming arrangement, condensers, heaters, separators and receiving tanks. The residue from the continuous stills then passes into a battery of coking stills where it is distilled to dryness. The coking stills are provided with condensers and gas take-offs and connections to the receiving tanks. The naptha fraction is delivered along with similar fractions from subsequent distillation, to the naptha plant.

The "once-run green oil" fraction from the above process is washed prior to further distillation. For the washing of this and subsequent fractions a battery of oil washers is provided consisting of two lines of washers, one for acid washing and the other for soda washing. These washers are steel tanks with covers and conical bottoms and fitted with compressed air agitators. They are elevated on brick walls so that the oil flows by gravity from the acid washer to the soda washer and from the soda washer to the washed oil receivers. From the receivers it is blown by compressed air to the stills. The unwashed oil is delivered to the washers from the still receiving tanks by pump or compressed air. Feed tanks, acid, soda and receiving tanks for the resultant tars are provided.

After washing, the once-run oil is distilled in a battery of six boiler stills also provided with a series of coking stills and from this distillation is obtained, light oil, heavy burning oil (called twice-run oil), green oil and coke.

The "twice-run oil" from the above distillation is then washed

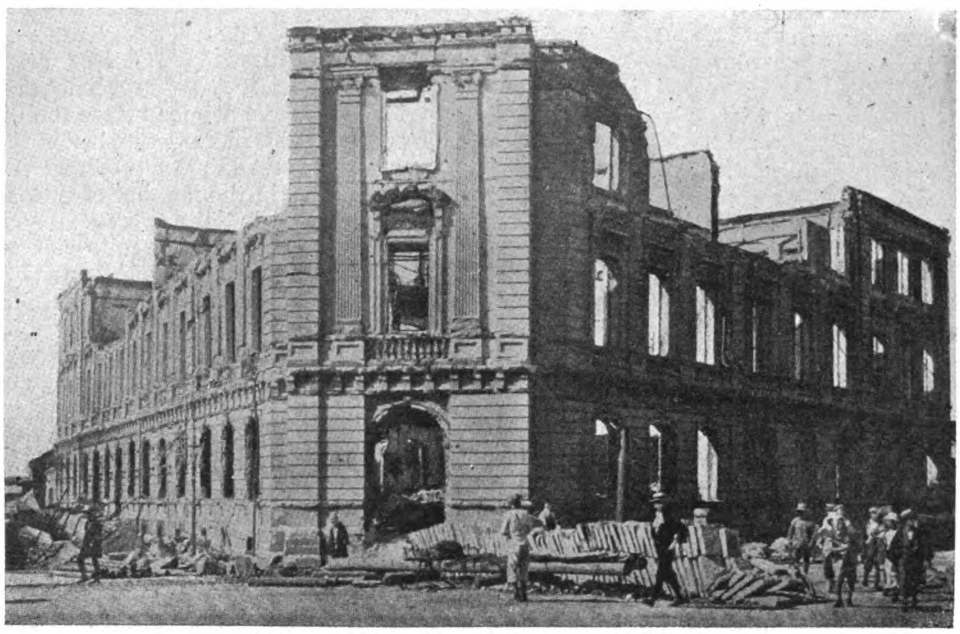
(Continued on page 144).

Earthquake Damages Telegraph and Telephone Installations of Japan

By SANNOSUKE INADA

Chief Engineer of Technical Section, Department of Communications, Japan

THE Tokyo earthquake caused severe damage to the telegraph and telephone installations in Tokyo, Yokohama and their vicinities ; and a majority of the office buildings, equipments, and line plants in these localities was reduced to ashes by the conflagrations which spread immediately after the quake. Damages to these installations were so serious that they can never be fully stated in detail, but it is intended that general descriptions concerning them shall be given.



General View of Tokyo Central Telegraph Office after Fire

Damages to Installations

The number of the first and second class offices damaged is given below :

District	No. of Offices	Burnt or Wrecked
Tokio and its suburbs	23	13
Province of Kanagawa	8	7

The line plants connecting and terminating at the above offices were wiped out by conflagrations. The damages to the Tokyo central telegraph office caused not only an interruption of the entire central service of telegraphic function in Japan, but also of her international communications.

As soon as the quake occurred the 350 telegraph circuits, which terminate at the Tokyo central telegraph office, came to faults of contacts and earth ; and the electrical source for the telegraph was shut down by the tumbling down of the secondary batteries. Thus all the circuits were interrupted, and at the same time all employees, rushing outdoors, barely escaped being crushed by the destruction of walls on third floor. As this building was very old, a new central office in the centre of the city was in course of construction, reinforced concrete being used throughout. In spite of all efforts of the employees, all installations were reduced to ashes by fire on the evening of the first day ; the principal equipments lost being as follows:

Equipment	*Number Lost*
Wheatstone automatic transmitter and receiver	126
Quadruplex and simultaneous A.C. and D.C. duplex	Sets for 19 Ccts. and spare
Duplex and combined Dx-Sx.	Sets for 65 Ccts. and spare
Simplex	Sets for 138 Ccts. and spare
Syphon recorder duplex (for Bonin and Guam cable)	1 complete set
High frequency simplex	1 complete set
Western electric quadruple-duplex printer	1 complete set
Western electric start-stop printer	1 complete set
Teletype	2 sets
Kleinschmidt keyboard perforator	17 sets
Telegraph switchboard	2 sets
Monitoring set	5 sets
Pneumatic tube equipment	14 sets
Ticker	126 sets
Testing equipment	Complete set

The underground cable between Tokyo and Yokohama was burnt or crushed in Yokohama and near the river Rokugo, and totally damaged near the river Banyu, where the cables were suspended by arms attached to the piers of the railway bridge. Disaster in the vicinity of Hakone was so serious that no pole line remained on account of the cracks and failures in the ground. One may easily gage the magnitude of the disaster by referring to Figure 1, which shows the damage done to a pole line in Yokohama.

As a result of the first quake, the Guam cable, the only cable which connects Japan with the United States of America, went down to fault and was interrupted. For urgent repairs the *Okinawa Maru* was ordered to steam hastily from Nagasaki, and after strenuous endeavors, co-operating with two other cable ships, *Ogasawara Maru* and *Nanyo Maru*, faults were cleared on October 27. The latter cable ship, being then anchored at Yokohama, supplied cables and other materials needed for the repair to the *Okinawa Maru*, and the former made hasty trips to supply the necessary cables, carrying them from the cable tank at Nagasaki. The faults of this cable were grappled at 16 points along the route, at distances from 44 to 75 knots from Etchujima cable house, where this cable is landed, operating both inside and outside of Tokyo bay at depths of sea measuring from 300 to 1,160 fathoms. Locations of these faults were as follows :

Fault	*Distance Along Cable from Etchujima*
Point No. 1.	About 44.5 knots (About 5 knots off Kachiyama, westward)
Point No. 2.	About 45.5 knots
Point No. 3.	About 46.1 knots
Point No. 4.	About 46.6 knots
Point No. 5.	About 66.6 knots
Point No. 6.	About 74.1 knots (About 10 knots off Habu harbor in Oshima, westward)

According to investigations, it seems that these faults were due to sudden shocks which were caused by the earthquake. The faults were breaks and grounding, and from an inspection of the faulty parts of this cable it was noted that it was broken with no elongation of armor steel but as if a tremendous stress had been applied suddenly. By the fact that at some points the cable seems entangled forcibly, it can be imagined that these faults might have occurred at points where some part of the cable was buried under the sea bed according to its sudden change.

It may be added, in passing, that the condition of damage on the Sakurajima submarine cable, which connected Kagoshima and Sakurajima island, and which was affected by the eruption of Sakurajima island of January 1914, was nearly the same as that of the Guam cable above mentioned. At one or two feet from the end of the cable break, the inner serving of the former cable was snapped at quite numerous points.

The underground portion of the Guam cable from cable house to Tokyo central telegraph office, which is of four cores of I.R. cables was also burnt at several bridges on its route, but was repaired before communication between Tokyo and Guam was restored.

Emergency Measures

As a consequence of the entire breakdown of the Tokyo central telegraph office system, it was planned on the afternoon of the very day of the disaster to open a temporary telegraph office in the building of the communication officers training institution in Shiba park, but that plan fell through completely, as the building was burnt in the early morning of the second day. Thereupon it was decided, first of all, to connect Tokio with other important cities at some point in the suburbs of Tokyo. For this purpose Senju office, which is situated in a part north-east of Tokyo, was chosen from the standpoint of routing. Communication concerning relief business was successfully opened with Osaka, Nagoya and Sendai at 11 p.m. on the second day. As shown by the map (Figure 3) the central and the busiest portion, or nearly one-half of the area of the city of Tokyo was burnt ; it was a very difficult task to find an appropriate site for the central office.

For convenience sake it was planned to open the temporary central telegraph office in the building of Tokyo central post office, which fortunately escaped the fire. After much effort instruments and materials were gathered from all districts. On the other hand, by jointing together underground cables of telegraph and telephone, which remained undamaged in the city, it was possible to open communication from centre of the capital to the cities of Osaka, Nagoya, Nagasaki, Kobe, Sapporo and Nagano ; one after another in the period from the fifth to eighth day. At the same time a temporary circuit between the central office and the radio station in the telegraph corps at Nakano, a suburb of Tokyo, which served to connect other radio stations and the central office, was constructed by a force from the telegraph corps.

On the 14th the temporary Tokyo central telegraph office was removed to the fourth floor of Eiraku building, where emergency circuits terminating at Senju, Kameido and other places were cut over together. Thus the organization of the plant of the Tokyo central telegraph office was consolidated, which had been rather disorganized since the day of the the disaster. Later, the number of circuits which terminated at this office were gradually increased, making a total of 65 on November 11, and they afforded efficient service to all quarters of Japan.

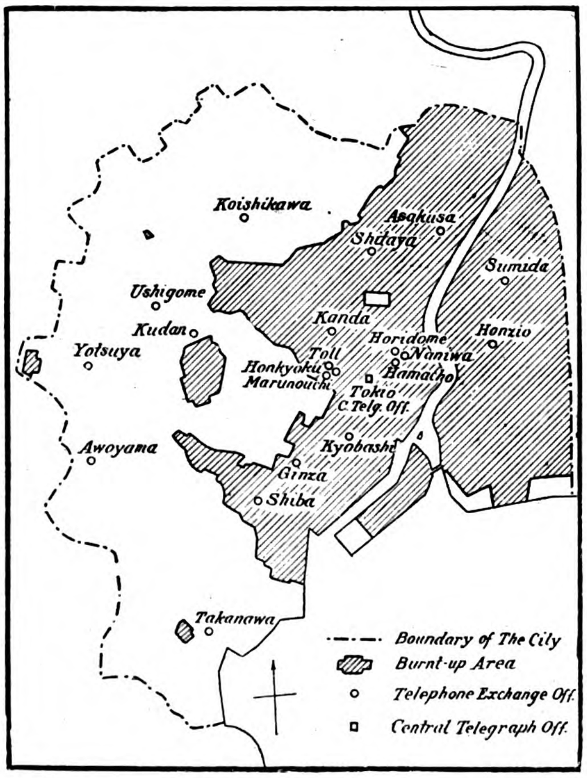


Figure 3.—Map of Burnt Area in the City of Tokyo

At Yokohama, as the damages done to that city were so serious that many of our employees were killed and injured, any sort of planning of emergency measures was very difficult. As nothing could be done in the centre of the city a temporary office was established at Kanagawa station of the interurban electric railway between Tokyo and Yokohama. On September 12, a telegraph service was offered to the public but with some restrictions, serving relief messages only as in Tokyo. Communication from Yokohama to Kamakura and Yokosuka was commenced on the 17th. On October 24, after removal of the temporary office to the barracks at Sakuragicho, communication with Osaka, Shizuoka, Maebashi, Kyoto, Sannomiya and other places was re-opened.

Figure 1.—Cracks in Ground Near a River in Yokohama. Telephone Pole Near Centre of Picture

Traffic in the districts outside the affected area increased extraordinarily, especially at Osaka where it came up to over twice the daily service before the disaster, amounting to something over 188,000 messages on September 5. At Sannomiya foreign messages dispatched during the first ten days of September increased by 80 per cent. in the number of messages and 250 per cent. in the number of words in daily average. As temporary measures for this extraordinary condition circuits as direct as possible from Tokyo to the cities in Chugoku, Kyushu and north-east districts were chosen making use of circuits which were interrupted. Although unexpected, owing to the makeup of the temporary circuits involved, satisfactory results were obtained by putting the duplex Western Electric type printer in use for foreign messages between Osaka and Nagasaki.

Damages to the Telephone

I. Damages to the Office Buildings

Number of centrals and the extent of damages sustained from the earthquake calamity are given in a table elsewhere in this article.

In Yokohama the central Honkyoku was, as shown in Figure 5, wrecked entirely and many employees were killed or injured there. In Tokyo, the central Kyobashi was, as shown in Figure 6, destroyed at its corner and several employees, here also, were killed or injured, the building afterwards burning to ashes. The centrals Shiba, Kanda, Naniwa, Shitaya and Honkyoku, being of brick construction, were damaged seriously and burnt to ashes afterwards. The central Kudan was damaged so seriously that it cannot be used again, owing to the cracks in the walls or unrepairable damages to the main structures. As for the remaining centrals such as Sumida, Ginza, Hamacho, Horidome and Asakusa, damages were comparatively slight and these might be used again by simple repairs. By the conflagrations which spread immediately after the quake all these centrals lost all the equipments, furniture, etc., the main structures of reinforced concrete alone being saved.

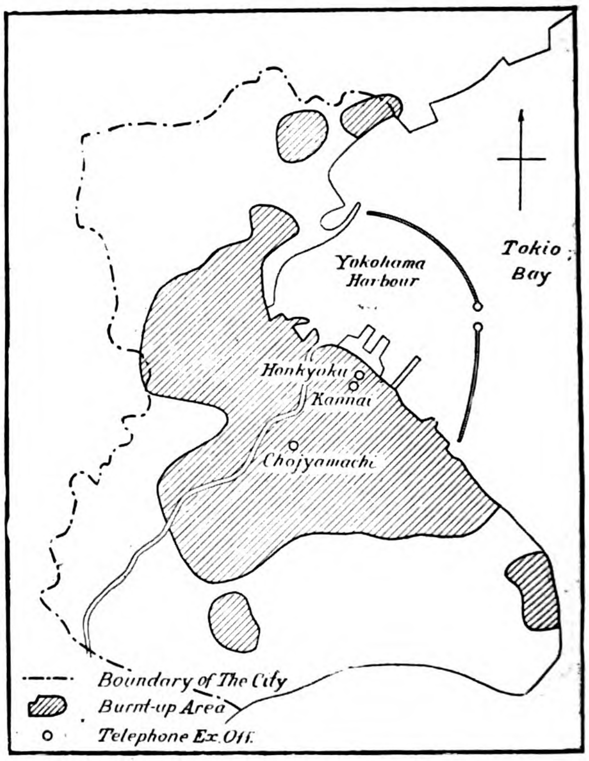


Figure 4.—Map of Burnt Area in the City of Yokohama

Figure 5.—General View of Ruins of Telephone Central Honkyoku, Yokohama

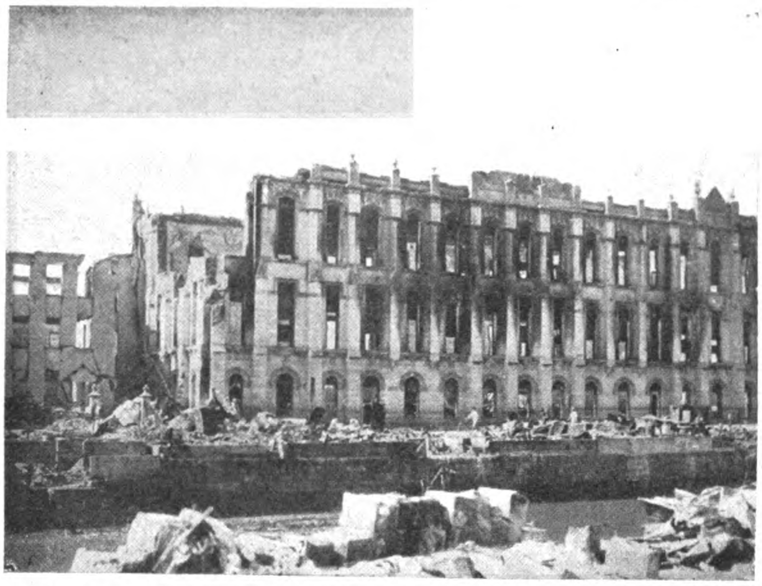


Figure 6.—Outside View of Telephone Central, Kyobashi, Tokyo, After Fire

Thus all the centrals in Yokohama were shut down. In Tokyo two centrals, Kudan and Yotsuya, were not burnt, but became unavailable; 14 of them burnt completely with their equipments; and only four remaining were capable of being opened to renew their service, namely Koishikawa, Ushigome, Awoyama and Takanawa.

City	*Extent of Damage*	*Number of Offices*	*Type of Building Construction*
	Damaged beyond repair	8	Stone work 1; Reinforced concrete 7
Tokio	Structure only saved—equipments, furniture, fittings, etc., burnt—available by repair and re-equipment	7	Reinforced concrete
	Available by reinforcing, though seriously damaged — equipments not burnt	1	Reinforced concrete
	Available by repairing—equipments not burnt	4	Reinforced concrete
Yokohama	Wrecked almost completely and burnt	1	Brick work
	Structure only saved—equipments, furniture, fittings, etc., burnt—available by repairing	1	Reinforced concrete
	Available by repairing—structure only saved	1	Reinforced concrete

II. Damages to Office Equipments.

At the instant of the severe shock, some of the switchboards rocked backwards and forwards, cable runways dropped, M.D.F. and I.D.F. deformed in a corrugated way becoming wavy, relay racks inclined, and meter batteries tumbled down. While these damaged parts were being investigated and restored as soon as possible in order to resume the service the fires started at nearly every part of the city, and spread out at a tremendous rate. While it was impossible at the time to investigate fully the extent of damages done to the equipments in each office, the six surviving centrals were investigated more fully. It should be remembered that the extent of the damage was different in each case, some so slight as loosened bolts, disorder of relay adjustment and running over of electrolyte of storage batteries. These slight damages were present even in the cases denoted as "right" in table on following page showing the condition of damages in six surviving centrals.

A description is given here of the condition of the batteries, which is applicable to all the centrals, and which is of interest in connection with improvement of setting in telephone offices. Damages to other kinds of equipment will be described later.

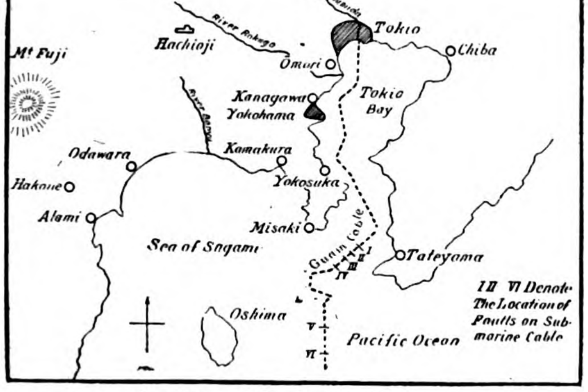


Figure 2.—Map of the Severe Quake Area on September 1, 1923

Electrolyte in cells ran over more or less in all the centrals. The glass type cells for register use (40v) were arranged on two wooden frame shelves, upper and lower, and some of the cells on upper shelf fell down and were broken.

None of the cells of the common battery (24v), which were in lead-lined wooden tanks, tumbled as they were set on the floor and were, therefore, stable. Among damages done to the common batteries in the centrals, Yotsuya, Ushigome and Awoyama, the following may be mentioned. Ears of the active plates were melted as a consequence of short circuit, due to breaking of the supporting side glasses, although they were of a standard size of secondary cell maker. In the case of two cells in Awoyama buckling of plates, which was occasioned by the falling of active materials, caused short circuit of the plates, thereby introducing a small hole in the lining of the tank, which led to running out of electrolyte. This hole, so small as not to be visible, seems to have been caused by sparks at a point where the active materials made a partial contact with the lead-lining. While the above batteries were of the G.S. type made in Japan, those in the centrals Takanawa and Koishikawa were of the Tudor type, and in the latter case there happened no such damage as mentioned above. The difference in the condition of both instances above cited is probably due to the difference in the thickness of the supporting side glasses.

The generating equipments in all centrals were undamaged owing to the good foundations, especially so was this the case in Sumida central. As fire was not so serious there, 10 among 11 cells of common battery of that office

Figure 9.—Ruins of M. D. F. and Office Manhole After Fire in Telephone Central, Ginza, Tokyo

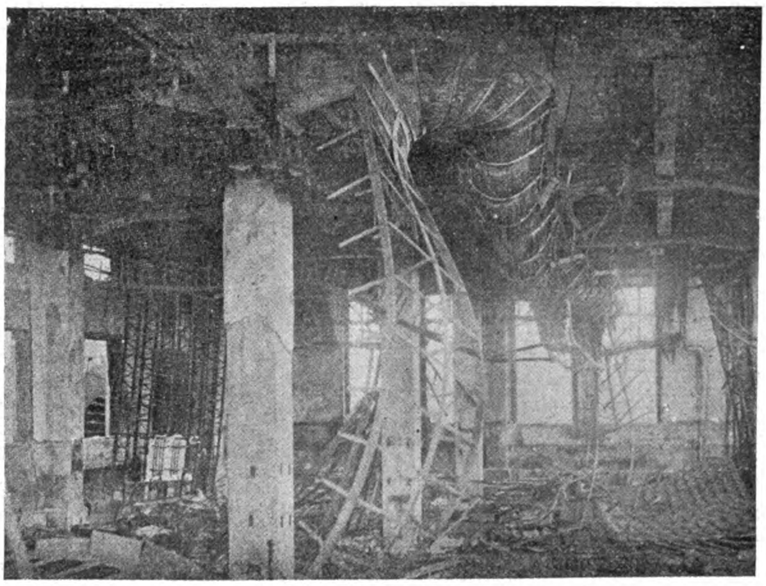


Figure 7.—Ruins of Cable Room after Fire in Telephone Central, Horidome, Tokyo

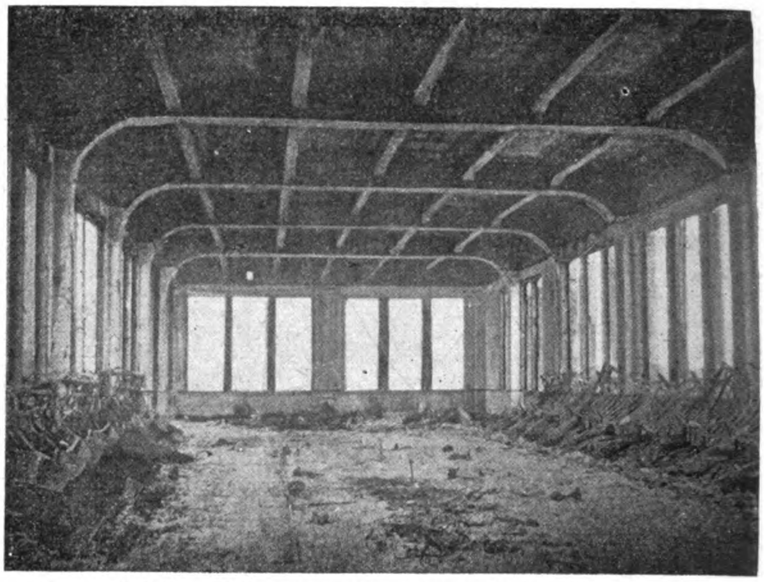


Figure 8—Ruins of Switching Room after Fire in Telephone Central, Hamacho, Tokyo

were utilized again in another central by replacing some of the plates.

III. Damages to the Subscribers' Stations and Line Plants.

TOKIO

Facilities	*Number Before Disaster*	*Burnt or Demolished*	*% Damaged*
Subscribers' stations ..	.. 82,766	50,265	60.8
Poles	.. 58,521	26,598	45.0
Arms	.. 198,622	82,251	41.0
Aerial cable (cable length)	.. 28,543 miles	12,299 miles	43.0
Pot heads	.. 4,897	2,927	60.0

YOKOHAMA

Facilities	*Number Before Disaster*	*Burnt or Demolished*	*% Damaged*
Subscribers' stations ..	.. 10,340	9,740	94.0
Poles	.. 13,350	12,600	90.0
Arms	.. 24,700	21,600	88.0
Aerial cable (cable length)	.. 104 miles	75 miles	72.0

The preceding tables show numerically the damages done to the subscribers' stations and line plants in both Tokyo and Yokohama.

In both of the cities Tokyo and Yokohama, most of the manholes were so deluged that it prevented a full inspection of damages done to the underground cables, but the following table gives the figures for cables which were penetrated by water through damages to the lead sheaths in the Tokyo area.

Cable	*Cable Length Unavailable In Miles*	*Cable Length Before Disaster In Miles*
1,200 pr.	.33	1.00
800 „	.05	.09
600 „	17.30	52.00
400 „	50.00	150.00
200 „	101.00	302.00
100 „	24.00	120.00

As the result of inspection of cables, the following faults on the cables terminating in five centrals were found :—

Cable	*Total No. of Ccts. Prepared for Subcs.*	*No. of Und. Gr. Cables Terminated*	*No. of Faults Location on Und. Gr. Cable*	*Ny. of Faults Location on Aerial Cable*
Koishikawa..	9,000	27	0	50 pr.—15
Ushigome	7,400	12	200 pr.—1 400 pr.—1	50 pr.— 7
Awoyama	4,800	11	0	0
Takanawa	6,200	18	400 pr.—1	50 pr.— 8
Yotsuya	3,600	6	600 pr.—1	0

As the description has been of a general character heretofore, a more detailed summary will be given below :

Toll Lines : Among the damages done to the toll lines, it may be mentioned that the underground toll cable between Tokyo and Yokohama was so seriously damaged that it can hardly be repaired. This cable was installed in 1922 by the latest practice of engineering method. It is of the quadded type, medium heavy loaded, and was manufactured by the Western Electric Company in the United States of America, minute care being taken to minimize capacity unbalances not only between conductors of the pairs but also between pair and pair. On its installation, cores were chosen and spliced, so as to minimize the capacity unbalances between each circuit, at seven points in each loading section. While this cable was installed with such extreme caution as above stated, it sustained from disaster such damages as the crushing of the cast iron conduit, sinking and shifting at the river Rokugo and other places along the route. Such painstaking labors during the cable laying was of no account, and a more minute investigation and electrical measurements wlll be necessary before it will again be available for the restoration of the service. The balancing at those faulty points will be more difficult than in the case of initial installation, because sufficient points cannot be obtained to make the balance.

Kind of Damage	*Amount Damaged Miles*	*Remark*
Cable length burnt	2.5	Total cable length before disaster was 42 miles.
No. of points of punctured or break ..	21	
No. of cables punctured or broken ..	82	
No. of locations water penetrated ..	273	
No. of cable pieces water penetrated ..	420	

It is to be regretted that the scheme of replacing the present aerial toll lines between Tokio and Okayama (nearly 500 miles) by such quadded and loaded cables, with repeater stations ***en route***, will have to be postponed ; as a part of this scheme, the cable working between Tokyo and Odawara was in course of construction. The cable drums had been distributed along the route, so that they sustained haevy damages ; while the loading coils were burnt completely, for they were in course of testing in Yokohama. But it is desired to perform the above scheme as soon as the financial condition of the government admits.

Cables Routed on Bridges : Figures 12 and 13 show examples of the damages done to the cables routed on public bridges in Tokyo, which were found at a point crossing the government railway where underground cables were installed in conduits laid under the road. By the destruction of the embankments at both sides all conduits at points indicated by A and B in the figure and the lower layers of conduits at point C were broken, consequently cables kept their continuity merely by cores, lead sheath being peeled off as shown in Figure 15. This is caused by the shearing force on conduits, caused by the relative displacement between

the embankment and concrete wall. Such shearing or crushing occurred at places where soil and structures of different solidity meet together, for the wave motions in both were different.

Generally, in cases where cables were laid over public bridges or on special telephone cable bridges, it is a matter of course that these cables were burnt where the bridges were burnt, and even in case where the bridge itself escaped the fire, a majority of the cables were burnt by the conflagration of boats which crowded under the bridge for the purpose of getting shelter and escaping from the pouring flames and burnt ashes. In the case of concrete or stone bridges and special telephone cable bridges, which were far from the general public or not crowded by boats, cables were safe.

Figure 11.—New Tokyo Central Telegraph Office after Fire. In Course of Construction

Office Manholes: The office manholes were safe in centrals which escaped the fire, while in burnt centrals lead sheaths of cables were peeled off leaving mere cores as entangled ropes. A majority of manholes placed in front of centrals were undamaged in appearance.

Cables in Lateral Tubes: In the burnt portion of the city a majority of cables in laterals were burnt and melted lead sheaths were stuck in the tube up to near the ground surface.

Manholes: In Tokyo the majority of the damages in manholes were cracks in its walls due to horizontal quake. In Yokohama there were many cases where only a part of the manhole body itself was shifted horizontally, leaving the cover case projecting above the ground surface by one foot or so owing to sinking of the surrounding earth; the entrance arch was damaged and cast iron conduit projected by three feet or so towards inside of manholes. It is remarkable that there were no manholes which sank below the ground surface and this is probably due to the fact that the foundation was somewhat better than the surrounding earth.

Equipment	*Centrals* Koishikawa	Takanawa	Ushigome
Switchboard ...	... Right	Slightly shifted	Right
M.D.F. and I.D.F.	... Slightly inclined	Slightly inclined	Right
Rack	... Inclined	Slightly inclined	Right
Register rack	... Right	Slightly inclined	Right
Battery—24 volt	... Right	Right	2 cells damaged
Battery—40 volt	... Right	1 cell broken	Some on upper shelf broken
Generating equipment	Right	Right	Right

Equipment	*Centrals* Yotsuya	Kudan	Awoyama
Switchboard ...	... Line of surface shifted	Nearly the same as other Centrals—All equipments here were dismantled and added to other Centrals	Right
M.D.F. and I.D.F.	... Slightly inclined		Right
Rack ...	... Slightly bent		Right
Register rack	... Right		Right
Battery—24 volt	... 3 cells damaged		2 cells damaged
Battery—40 volt	... Some on upper shelf broken		Some on upper shelf broken
Generating equipment	Right		Right

Underground Conduits Near Riverside: In the case of roads along the river bank the parts near the river became disturbed, consequently underground conduits and manholes became exposed and cables damaged.

Open Wires: Generally it seems that the damages done to the poles and open wires were most serious where the direction of the pole line coincided with that of the quake propagation.

Damages on toll lines were nearly the same as those of telegraph lines, the number of circuits damaged amounted to 303 terminating in Tokyo, and 111 terminating in Yokohama.

Emergency Measures: The following are the measures performed concerning telephones in consequence of the disaster:

(*a*) Local exchanges: In Tokyo, for government offices pertaining to the temporary relief work and for other important subscribers, the service was opened by means of standard magneto switchboards, each of 100 subscribers' capacity, installed in a room in the Tokyo central post office, which escaped the fire as referred to above; as a next step newspaper offices, banks and other subscribers having close relation with public interest were added as soon as the line plant, instruments and materials admitted. In Yokohama, since no building belonging to the department of communications had survived, a standard magneto switchboard, with a capacity for 50 subscribers, was installed in the branch office of public works of the department for home affairs, thus service was restored to governmental offices and important subscribers just as in Tokyo. Later this equipment was removed to the barracks in front of Sakuragicho railway station.

(*b*) Toll Lines: On September 3 the toll circuits to Sendai and Utsunomiya were opened at Senju like telegraph lines and these were then cut over to the standard magneto switchboards for the toll line purposes, which were installed in the Tokyo central post office at the same time the circuits to Nagoya, Osaka and other important cities were restored. As, owing to the inherent function of the standard magneto switchboard, the toll service could not be given to the subscribers belonging to common battery offices, several pay stations were installed in the Tokyo central post office for the purpose of this service. Later, as the number of circuits increased, restriction for toll service was removed. Owing to shortage of the number of toll circuits, at first the toll service was afforded to messages relating to the relief business. On November 10 the total number of working circuits amounted to 74. Prior to this some modifications were given in order to give toll service to all subscribers in common battery offices.

In Yokohama, at first, the toll as well as telegraph service to Tokyo was opened in the waiting room of the Kanagawa station of the interurban electric railway between Tokyo and Yokohama, later removing it to the barracks above mentioned. The number of circuits to Osaka, Kobe, Nagoya and other important cities was nearly ten on November 11. As restoration of Yokohama was very slow, such number of circuits was sufficient for the toll service.

Damages Done to Radio Stations

The number of radio offices within the area of the disaster is given in the table below, 6 among 20 stations being damaged most seriously:

Administration	*Public*	*Private*	*Experimental*	*Total*
Dept. of communications	0	0	3 (3)	3 (3)
Naval department ..	2		1 (1)	3 (1)
Department of war ..	0	1	1	2
Department of railways ..	0	0	1	1
Factory	0	0	4	4
School	0	0	4 (1)	4 (1)
Others	0	0	3 (1)	3 (1)
Grand Total				20 (6)

Figures in brackets denote totally damaged.

As seen in this table no station for public service was within the area of the disaster, but by means of installations in the military office and a few equipments which survived in the communication officers training institution, immediate emergency measures were performed even before the severe shock hardly

slackened. Unfortunately the installation in that institution was reduced to ashes by fire early the next morning excepting two iron towers.

The burnt out important offices, which have relation with radio engineering, are the electrical laberatory, communication officers traning institution and navel technologic research section. As these possessed the most important laboratories and research equipments in Japan, the loss which our empire encountered is very great; for we have lost importatn research results, documents. reports, etc., together with equipments which were very important for the development of radio engineering, and also preparations for coming conference on international radio communications.

It is reported that on September 1, in the communication officers training institution only a few minutes before the great quake, the resonance condition of the receiving apparatus was exceedingly deranged, when some measurements for the radio communication from North China were being investigated by the operator. Immediately after he had noticed this extraordinary phenomenon he felt the quake. Such a phenomenon might be caused sometimes by the swinging of the antenna, but the antenna in that institution was so tightly stretched that in ordinary heavy storms such a condition was never observed before. It is improbable that the operator was too earnest in inspection not to take notice of the first shock of the quake, because he felt the quake at the same time the others did. The quake in far distance might probably be mentioned as a cause for the above phenomenon, but the exact interval of time which elapsed between the first quake and the feeling of that phenomenon was not observed; so this phenomenon is cited as an instance toward solving the question to be met in the future. It may be added here that in that institution after the quake listening was continued till early next morning when that building was burnt.

Soon after the fire a temporary circuit between the temporary Tokyo central telegraph office and the telegraph corps at Nakano was established ; so that by means of the radio installation at the latter place, communication was begun to all coast stations from Tokio. It is said that in this performance in the telegraph corps, portable radio apparatus proved a great success.

After September 2, as communication between warships, which were anchored at Yokohama or Shibaura (in Tokyo), and land stations increased, their interference in Tokyo bay became fairly strong. Beside the above, Funabashi radio station was successfully used for service. The network of radio communications for the public after the disaster is shown in Figure 19 schematically.

While the above is a general description of the measures which were taken in the environs of the Tokyo central telegraph office, many of the radio stations in local districts took an active part in the communication service. The news of the great disaster of September 1 was received in Hongkong and Manila on that day via Osezaki, which was sent from Choshi and Iwagi, and on the other hand reports were sent from Iwagi directly to the United States of America and Hawaii, to that all the ships at sea listened in to these messages. Furthermore, the Iwagi station continued to send reports to America telling the conditions of Japan and translating news successively. This station contributed to a great extent in arousing in America and Europe profound sympathy for Japan, and it is especially rejoicing to note that the master and the officers of Iwagi station were publicly recognized in America. It must be mentioned here that the ship station on board the *Koreya Maru* and *Mishi Maru*, which lay anchored at Yokohama, served to communicate with every quarter of the empire, day and night on and after September 1 ; also all the coast stations endeavored to serve in a state of keepless and unresting condition for a fortnight. It is also reported that the Ohi factory belonging to the department of railways, and being one of the experimental stations, served to communicate with ferry-boats that ran between Tokyo and Shimizu.

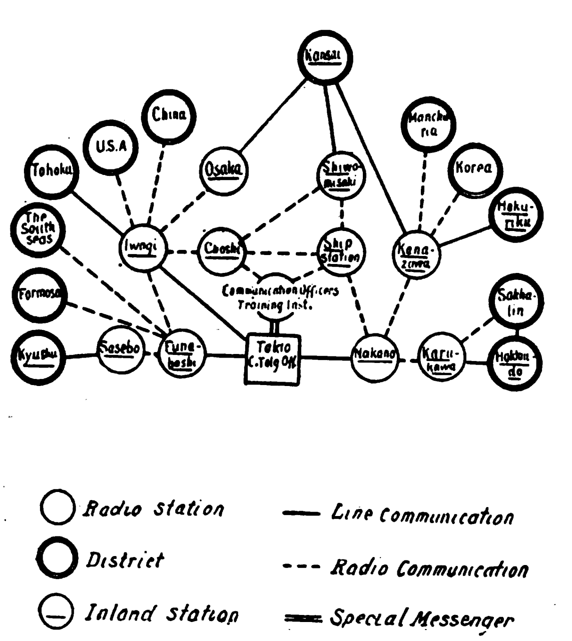


Figure 10.—Schematic Radio Communications After the Disaster

The great difficulty encountered in connection with radio communication was confusion as stated above, but this was restricted to the Tokyo bay, and by order it was practically overcome by means of proper adjustment of the wave lengths.

Other Damage Done

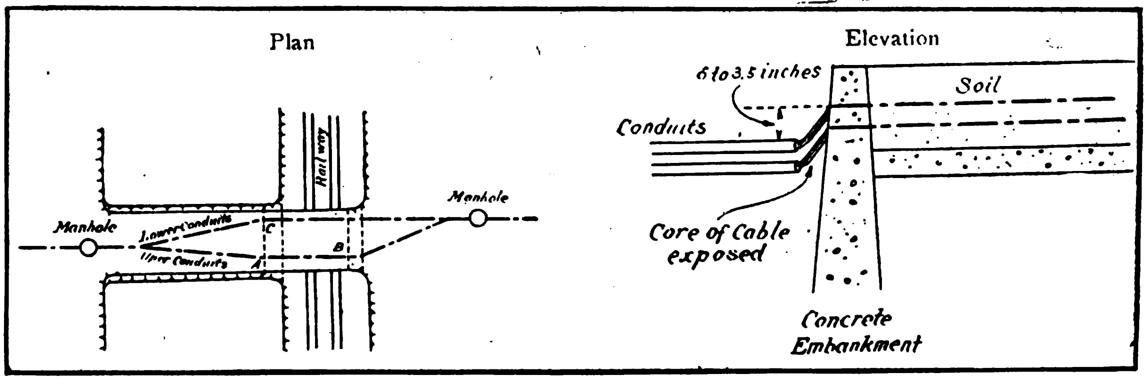
Material or immaterial losses beside those previously mentioned were sustained from damages occasioned to the buildings of the department of communications, electrical laboratorry and technical section of the Tokyo administrative office as well as store-houses which were completely burnt. In these three offices above mentioned were located very important laboratory installations, containing therein reports of research, documents and materials for investigations relating to wired and wireless telegraphy and telephony in Japan which had been prepared by many engineers who spent many years, some in foreign countries gathering valuable reports and papers, and others at home working most painstakingly at their chosen profession. It is to be greatly regretted that these precious documents and installations were reduced to ashes and that nothing can compensate for the loss which cannot be estimated in terms of monetary value.

The disaster caused not only much inconvenience in the preparation of papers for the technical committee on international radio communications, but also it introduced great obstructions for the telegraph and telephone extension plants to be performed in future, which are being proceeded with upon a plan laid out for a number of consecutive years.

While much stock material was in store for emergency purposes much of it was lost by the conflagration, causing great obstructions to emergency measures. On the other hand, much difficulty was encountered as the more inportant business and factory quarters of the city were wiped out.

A few instances regarding information about telegraph and telephone installations will be added below, as such results of investigation of the damages caused are of some value toward preventing such disasters in future.

Office Buildings : It would be very important as well as interesting to architects to investigate the condition of buildings which escaped the damages of the quake and came comparatively unharmed through the fire. Quake and fire proof structures are to be recommended for houses in all



Figures 12 and 13.—Damages to Cables on Public Bridges, Tokyo

the important parts of the city, especially for telegraph and telephone offices. Telegraph and telephone installations are urgently required in times of such disasters, and much thought should be given to selection of proper types to be adopted for these buildings. While most of the brick structures became dangerously shaken by the earthquake, reinforced concrete buildings were immune to both the earthquake and fire. In Tokyo, for instance, the building of the toll and two local exchanges at Marunouchi was destroyed by the fire with all the contents except mere structures, so that the building is being refitted for the purposes of establishing a temporary toll exchange, and housing the Tokyo central telegraph office and one of the local exchanges. Beside this, the buildings of the centrals Ginza, Asakusa, Hamacho, Horidome amd Sumida may also be utilized again by simply repairing the inside fittings. From the above it is evident that reinforced concrete building should be adopted in all cases in future.

By the first shock of the quake all water mains were interrupted, so that fires at almost every part of Tokyo and also of Yokohama got immediate headway at their will and nearly all important parts of Tokyo and the whole of Yokohama were turned into ashes. Temperature of the burning areas reached such high degree that window and other glasses and some metal parts melted as if in hearths and it is also to be noted that metal fire-shutters in all the buildings worked ineffectively. In future, much precaution must be taken in fireproofing windows, which seem to be the weakest point of buildings. Strong cyclones and high winds were caused by local temperature differences during the fires. Some people were blown upwards and carried to places some distance away. It is difficult to say what unexpected events happened during those few days. It is needless to say that all such questions must be taken into consideration by engineers who are to shoulder the responsible work of reconstruction and all measures for fire and quake proofing should undoubtedly be provided for.

Construction of Lines: In the burnt up areas the overhead telephone lines were completely destroyed by fire, though a majority of them were replaced by underground system long since. These overhead lines being for distribution purpose for subscribers, it is desirable to replace them by an underground system, if financial conditions will permit this to be done in the near future. As given in a table previously referred to, damages to the underground cables were rather slight, much less when compared with areial lines, even in the cases where manholes became flooded by water, or cast iron conduits projected into the manholes due to destruction of road and crushing of conduit. From the point of view of beauty and also for reasons of frequent faults in aerial lines, it would be advisable to put the whole system underground in both Tokio and Yokohama.

Construction of Underground Lines: A majority of manholes were flooded by drain due to loosened connections and breakages of conduits. In future, special attention should be paid to workmanship of jointing the conduits and uniformity of foundation beds along the entire underground construction.

River Crossing: For routing cables over public bridges it is safer to choose bridges of fireproof construction, such as concrete or stone work, and to wrap them with some fireproof material. It is preferable to wrap cables with fireproof substance even where special telephone cable bridges are used or to install them under river bed. In the late disaster some cables, which were otherwise undamaged, were damaged at river crossings, which caused delay in re-opening the telephone service to some extent. It would be very interesting as well as instructive to investigate methods of river crossing of cables.

Supply of Equipments and Materials: The most difficult problem encountered in making arrangements for emergency measures was the requisition of instruments and materials. Stocks of instruments and materials, which were lost by the disaster, amounted to an enormous quantity, and because many of the factories were also damaged, their supply was obtained partly from local makers, while some was imported.

Adoption of Automatic Telephone System: It is true that civilization tends to replace the manual power by the mechanical. Though it is also clear that, in case of telephone service, to use a great many operators is both uneconomical and inconvenient, owing to financial reasons the adoption of the machine switching system has not yet been realized. It is firmly believed that this is the best opportunity to replace the former inconvenient telephone by a more up-to-date and convenient automatic system, as both Tokyo and Yokohama are now deprived of telephone service almost entirely.

Installation of Radio Telegraph and Telephone: At the time of the late disaster there were no public radio stations tn the burnt-up area, which catered to the public service, and consequently no radio station was damaged ; but if there had existed an undamaged one we can easily imagine its possible activity. It would have been a foregone requirement that an uninterrupted supply of electric power and a continuous communication between it and the central office were firmly established.

It is to be noted that in the last disaster the entire system of the electric power supply and lighting were interrupted for some time. From these observations it is evident that such installations should be made fire and quake proof, and that interconnections between power houses and transformer stations, between these points and consumers, etc., should be of the underground system.

Broadcasting of radio telegraph served admirably in reporting the disaster to foreign countries as well as to ships at sea. It is firmly believed that telephone broadcasting would have played an efficient part if it had existed, a good reason for its realization.

Store-houses: It is believed that store-houses in future should be not only as rigid in construction as other buildings (or rather more so) but also fireproof, as much difficulty was experienced in executing emergency measures at this time, It is safer not to centralize store-houses, but to distribute them in many quarters of the city, in spite of some inconveniences to be felt in ordinary days from the point of view of storing, shipment and supervision. At the late disaster, for instance, the store house at Shibaura remained undamaged while that in the enclosure of the department of communications was burnt. It is worth while to consider this problem.

Outline of the Program of Reconstruction Executed and Otherwise (March 1, 1924)

Telegraph

Tokio: As a consequence of the removel of restrictions for messages, as above mentioned, the volume of traffic increased tremendously. The number of circuits was increased to 76 in Eiraku building which was the full capacity of that temporary office. On November 23 this temporary office was removed to the repaired building in which the local telephone exchange Marunouchi was located. At that time some suburban circuits were added. The traffic carrying capacity of the circuits has been restored since December 12 to that of as nearly as before the disaster, being increased by 160 ; while some circuits for city branch offices could not be restored owing to the delay in reconstruction of buildings. At the end of the year 1923 circuits were classified as follows :

System	*Number of Circuits*
Automatic duplex	24
Sounder duplex	58
Sounder simplex	144
Morse duplex	3
Morse simplex	14
Siphon recorder simplex	1
Telephone	1
Total	245

With the addition of 11 circuits in January 1924, nearly all circuits were restored to their former capacity with the exception of local circuits in the city. These city circuits will be opened as soon as switchboard and other equipments as well as office accommodations are ready.

As far as the number of circuits is concerned, restoration will be accomplished by April 1924,* while complete reconstruction will be finished early in the year 1925. At that time the Tokyo central telegraph office will be removed to its new building which was in course of contruction before the disaster.

The pneumatic tubes in Tokyo had been installed between the Tokyo central telegraph office and eight branch offices with

*Dates appearing in this article are published without change. Attention is called to the fact that the program of reconstruction is dated, March 1, 1924.

a route mileage of nearly 6. But all the terminals were burnt by fire and the underground tubes damaged also. The present scheme of reconstruction is to connect the first four branch offices with the central when the permanent office is opened ; making a route mileage of 3.5. Successively for 13 branch offices a mileage of 20 in the year 1925, and for four branch offices a mileage of 8.5 in the year 1926 will be added connecting with the central office respectively.

Yokohama: As previously described, 19 circuits were restored by the emergency measures in the temporary office at Sakuragicho, while at the end of November these were increased to 26. 39 circuits were totally restored in the first part of January 1924, the office being removed to the new building. These circuits may be classified as follows :

System	*Number of Circuits*
Automatic duplex	1
Sounder duplex	8
Sounder simplex	28
Morse simplex	2
Total	39

Complete restoration will be accomplished in April, 1924.

Telephone

Tokyo. (*a*) Exchanges: Prior to the disaster, in Tokyo, there were one toll and 19 local exchanges, serving about 83,000 telephone stations. Among them the toll, 15 local exchanges and nearly 52,000 stations were burnt or wrecked by the disaster. An area of 13.5 square miles in the city of Tokyo was burnt to the ground, 30.5 square miles being the total area. The remaining centrals were re-opened on September 29, after urgent repairs to office equipment and line plant. The number of stations in those four centrals are given below :

Number of Stations

Central	*Before Disaster*	*Burnt or Wrecked*	*Opened on Sept.* 29
Awoyama	2,416	0	2,416
Koishikawa ..	6,836	699	6,137
Ushigome	4,172	0	4,172
Takanawa ..	4,473	125	4,348
Total	17,897	824	17,073

Since the localities which are covered by the above centrals are situated on more or less hard bed ground, damages to them were comparatively slight.

It is of interest to give a brief description about the traffic data on telephone service during the first three days after re-opening the four centrals. The average number of calls per station per day was 2.5, while 8.5 was the average during last August, just before the disaster.

Immediately after the above centrals were re-opened efforts were made to connect those subscribers who were most urgently in need of telephone service,and who were scattered over all quarters of the city, to any one of the above four centrals according to their locations, by the aid of inter-office trunk lines. Thus a total of 20,743 stations were restored by the end of the year 1923. The temporary local exchange Ote was opened with a capacity of 4,000 in the burnt building of central Marunouchi. By the end of March the central Yotsuya will be re-opened, after repairs to that building are accomplished. Thus, a total of 30,000 stations will be restored. By the extension of the switchboards in the above six offices, 9,000 stations will be added by the end of August.

Two of the four burnt offices, the buildings of which are in course of repairs, will be re-opened in the fall of 1924 and the other two by February 1925, the common battery system being employed. By March 1925, the total sum of stations restored will be enumerated by 64,100, there being 83,000 before the disaster.

Besides the total of ten exchanges, thus restored, four and five automatic exchanges will be opened by the end of fiscal year of 1924 and 1925 respectively ; one of them being planned to supplant the temporary common battery office Ote. Restoring of the remaining 19,000 stations in Tokyo will be accomplished at the same time.

The program of measures for telephone re-construction is expected to extend for a period of 2½ years, rather longer than usually accepted. In justification to the length of the reconstruction period it might be mentioned as follows. It is, of course, true that restoration of telephone service should be done as quickly as possible, as it is one of the most essential for reconstruction of Tokyo. On the other hand, it may easily be justified that the work of reconstruction of the multi-office telephone area, which has stations numbering more than 80,000, cannot be treated as simply as the case of several independent telephone areas of moderate capacity. For the preparation of switehboards, first of all, a great difficulty is encountered. As several of the factories for telephone industry were damaged it must be expected that a rather longer delivery for home made is inevitable. Many foreign makers also offered earnest suggestions for the restoration of telephone system, but they could not supply switchboards of the specified type at the specified time of delivery. To adopt many different systems of switchboards in the present case in Tokyo, must be carefully considered, from the point of view of inconvenience and want of economy in operation and maintenance.

On the other hand, security of service cannot be expected if telephone offices were installed in imperfect buildings like barracks. Moreover, owing to probable alterations in the street contours, as a consequence of the city's reconstruction planning, construction of permanent buildings is not allowed before that plan is settled. To build offices with risk of removal within two or three years, cannot be thought of. It is thought not unlikely that a total of 30,000 stations can be restored by March, 1924, and 64,000 by March, 1925. With this number it is expected that a restoration of service to all subscribers, at least one substitution for each subscriber, and also a fairly ample service may be given in Tokyo, the condition of general business being depressed to some extent compared with that before the disaster. A careful investigation regarding every point leads to the conclusion to adopt the program of telephone reconstruction outlined as above.

(*b*) Toll Line: After the emergency measures, as previously mentioned, were taken on December 1, 1923, the temporary toll office was removed to the repaired building of the old Marunouchi, where equipments were provided for 164 circuits. The number of toll lines will be increased to 277 by the end of March, 1924, and it will not be so long before all circuits, 317, will be restored ; while in the fall of 1925 the permanent toll exchange will be opened.

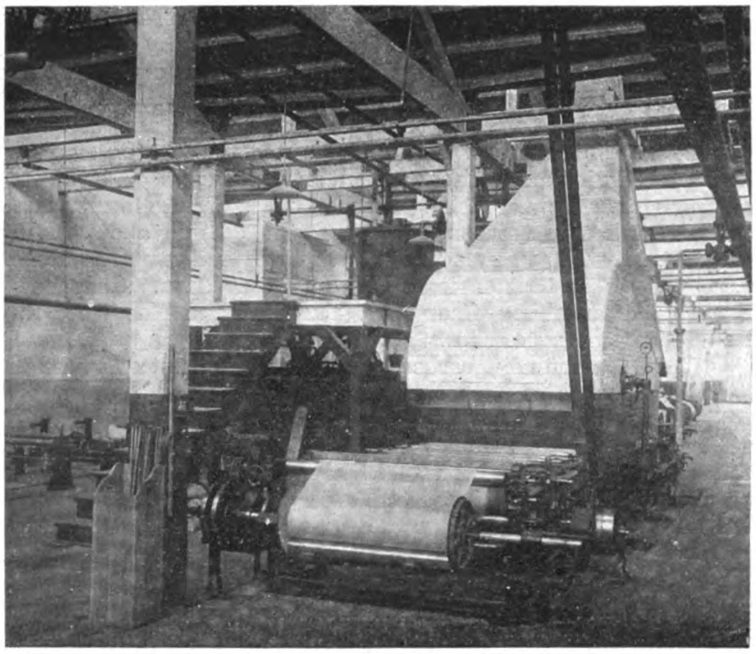
Yokohama. (*a*) Local Exchange: While there were in Yokohama one toll and two local exchanges, serving 10,600 stations, the whole was practically destroyed. On September 29, 1923, 30 subscribers were restored and this increased to 450 by the end of that year. It is planned to restore 2,000 stations in the new temporary office by March 1924, the switchboard being of the magneto parallel multiple type removed from a central which was recently closed in Tokyo ; by June 1924 the sum of stations will increase to 3,700. In the fall of 1925 two automatic exchanges will be opened, where all the subscribers will be cut over and all the remaining stations will be restored at the same time.

(*b*) Toll Line: The number of toll lines in Yokohama before the disaster was 111. Gradually increasing the number of line restored, a total of 35 were completed at the end of the year 1923. The sum of restored lines will become 73 by the end of 1924 and 111 by 1925 ; thus making all restored.

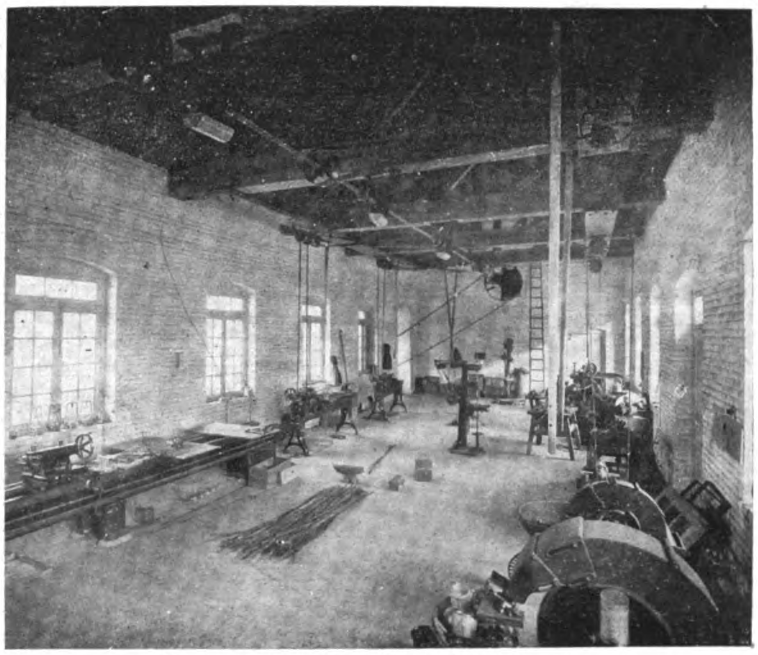
It must be added that when the automatic system supplants the manual local exchange the permanent toll office will be opened.

Motor Trailers for Indian Rajah

An innovation in India is to be the introduction of motor trailer caravans for one of the important Indian rajahs. They are one of Birmingham's latest creations. Two in number are these sumptuous caravans which are fitted with bath, bed, dressing and sitting rooms, and are to be hauled each by one of the rajah's Rolls-Royce cars. In their construction—the size is almost that of a railway coach—they are quite unique productions, being specially designed and protected to resist the tropical heat of the Indian jungle. The fittings are most elaborate, and it is said that these caravans will be used by the rajah on his shooting expeditions across country. Judging by the appearances of his new Birmingham acquisitions he is indeed a favored mortal.



Weaving Room in the Heng Yuen Mill, Tientsin



Machine Shop, Heng Yuen Mill, Tientsin

Cotton Mills and Raw Cotton Supply in Tientsin

AS early as 1910 attempts were made by officials and members of the local gentry at Tientsin to organize a cotton mill, but their plan was frustrated by the outbreak of the revolution. In 1914 the Chihli Model Weaving Co., which has since changed its name to the Heng Yuan Mill was planned and two years later opened. Meanwhile the war in Europe caused the price of yarn and cloth to soar abnormally high, and several mills, including the Yu Yuan and Wah Sing, sprang into existence. At present there are six cotton mills in Tientsin, having a total of 210,000 spindles.

The slump following the conclusion of the European war affected Chinese cotton mills. In 1922, owing to trade depression, the mills in Tientsin proposed to limit their output by partly suspending operations. In February, 1923, the Tientsin mills obtained a ruling from the Ministry of Agriculture and Commerce forbidding establishment of any new mill at places within 500 *li* (200 miles) of Tientsin in the next 20 years. This has effectively put a check on the production of cotton yarn and cloth. The rise of native mills in Tientsin has greatly influenced the volume of yarn import trade.

The following figures show the quantity of cotton yarn in piculs imported into Tientsin from different sources between 1924 and 1922 :—

Year.	From other ports of China.	Japan.	India.	Great Britain.	Total.
1914	130,109	292,800	107,519	384	530,812
1915	147,076	373,834	166,806	141	987,857
1916	178,972	315,994	125,808	—	620,774
1917	186,973	239,050	109,605	—	535,628
1918	159,053	192,822	50,419	—	402,294
1919	155,384	184,269	47,149	—	386,802
1920	122,326	149,585	20,714	2,105	294,730
1921	146,426	177,381	17,002	—	340,809
1922	157,495	191,908	1,842	2,317	353,562

Of the six mills now operating at Tientsin, five are financed entirely by Chinese capital. The Yu Ta is a Sino-Japanese joint undertaking. These have in total 800 weaving looms. Of 210,000 spindles, 147,500 are now operating. The accompanying table shows the capital, working capacity and other particulars of each of the mills there :

	Established.	Capital.	Spindles Erected.	Spindles Operating.
Heng Yuan (North)	1914	$4,000,000	30,000	10,000
Yu Yuan	1916	5,100,000	70,000	47,500
Wah Sing	1916	2,000,000	35,000	25,000
Pei Yang Commercial No. 1	1920	2,000,000	25,000	25,000
Yu Ta	1920	3,000,000	35,000	15,000
Pao Chen	1920	3,000,000	25,000	25,000
	—	$19,100,000	210,000	147,500

	Spindles Being Erected.	Looms.	Varieties of Yarn Produced.	Varieties of Cloth Produced.
Heng Yuan (North)	10,000	300	10, 12, 14, 16 & 20	Canvas and Native Cloth
Yu Yuan	—	500	10, 16 & 20	Native Cloth
Wah Sing	—	—	10 & 16	—
Pei Yang Commercial No. 1	—	—	10, 16 & 20	—
Yu Ta	—	—	10 & 16	—
Pao Chen	25,000	—	10 & 16	—
Total	35,000	800	—	—

Five hundred new homes were recently ordered by the Yu Yuan and are now being installed.

Owing to its political connections, the Heng Yuan sustained serious losses as the result of the Fengtien-Chihli strife in 1922. The Yu Ta is said to be also in financial difficulties. The Yu Yuan made enormous profits during the European war, and this was followed by a rapid extension of the work, with the result that the greater portion of its capital is now tied up in fixed assets. It has been compelled to suspend a part of its work owing to the present slump. The remaining three the Wash Sing, Pei Yang Commercial No. 1, and Pao Chen are all doing well, notwithstanding the depression.

There are reasons why Tientsin is a centre of the cotton industry: (1) It is within easy reach of the large Kailan coal mines, which supply comparatively cheap fuel to the mills, and (2) the quantity of raw cotton produced in its hinterland, especially the interior of Chihli and Shantung, is increasing yearly. Since 1919 Tientsin has become one of the important raw cotton exporting centres in the country.

Several varieties of raw cotton are exported to foreign countries from Tientsin. Most of them are produced in the hinterland of the port, though some come from as far as Shanghai and Chinese Turkestan. The best known is the Yu Ho cotton, which is produced in the south-eastern part of Chihli province and north-western part of Shantung, including Wuchiao, Tsingho, Weihsien, and Nanking. There are really two cotton-producing areas. (1) The belt in the neighborhood of Wuchaio extending 400 or 500 *li*. The annual production in this region is estimated at between 7,0,000 and 80,000 piculs. Cotton coming from that quarter is known in Tientsin under the local name of Lienchen cotton, because the product is assembled at the neighboring railway head of Lienwuchen, before being shipped to Tientsin. (2) The belt in the neighborhood of Chingho with Nankung as its centre. This comprises an area of about 4,000 square *li*, producing between 120,000 and 130,000 piculs of raw cotton. A part of the produce in this neighborhood is shipped to Tsinan, Shantung province, and a part to Tientsin.

Certain districts in Shantung, including Lientsing, Enhsien, Kaotang, also produce Yu Ho cotton. Here the belt with Lintsing as its centre extends from Kaotang and Enhsien in the east to Kwantao, Tungchang, Tangyi and Tsingping, in the south and the banks of the Weiho and the Grand Canal in the north and west, consisting of 8,000 or 9,000 square *li*. The yearly production is estimated at between 200,000 and 300,000 piculs. In a normal year the total production of these regions amounts to over 400,000 piclus, of which between 150,000 and 160,000 piculs are exported to Tientsin, about 100,000 piculs to Tsingtao, and the remainder consumed locally.

The staple of the Yu Ho cotton is soft and white. The average length is between 0.85-in. and 0.87 in. It is extensively used by cotton mills for spinning 16-count yarn. That produced at Wuchiao is of the best quality, and the Weihsien product ranks next. The same variety from other districts is inferior, because its staple is coarse. The farmers seldom gin the cotton or bring the lint to the market, but sell their raw produce to the local cotton dealers through commission agents. The local dealers tranship the cargo to either Tientsin or Tsinan, Liang Chia Chi, Kan Chia Chi, Nankung, Tingho, Kaotang, Hsiatsin, and Lintsing are the local collecting centres for Yu Ho cotton.

Hsi Ho cotton is produced in parts of Chihli and Honan, especially in the Hsi Ho Valley. Generally speaking, this variety is inferior to the Yu Ho, but under favorable conditions it produces longer staple. There are three producing centres: (1) the districts to the south-east of Chengting, Chihli province, such as Kaocheng, Lwangcheng, Yuanshih, and Kaoyi, forming a total area of 9,000 square *li*, with a yearly production of 400,000 piculs; (2) the neighborhood of Hantan, including Hantan, Linglo, and Wuan, comprising 2,000 square *li*, and producing between 50,000 and 70,000 piculs a year; and (3) a belt extending from Tzechow, Chihli province to Changteh, Honan province, covering 1,500 square *li*, and producing between 400,000 and 500,000 piculs a year.

The lint of Hsi Ho cotton is white, with a delicate greenish shade. Its stalpes are short and stiff, but of greater elasticity than other Chinese varieties. By reason of this, manufacturers mix Hsi Ho with wool in weaving felt and rugs. It is also used for making gun-cotton and bandages. Hsi Ho cotton, especially that produced in the valley of the Hu Tu river, makes excellent wadding. Considerable quantities are exported to America and Europe. Cotton produced in the neighborhood of Chaochow, Chihli province, resembles in certain respects both Yu Ho and Hsi Ho cottons, but its staple is longer and finer than Yu Ho, and it is now chiefly used by the Tientsin mills in spinning yarn of 16-counts. The adoption of a new method of seed removing has improved the quality of Yu Ho lint to a considerable extent.

The movement of cotton from the producing districts to Tientsin is generally by waterway, sometimes by the Peking-Hankow railway. Shihkiachwang is the collecting centre for consignments transhipped to Tientsin. Several foreign firms in Tientsin have agents there. Cotton produced in districts to the south-east of Chengting is shipped to Tientsin by the Wuan Yang river and that to the north of Chengting is brought to Tientsin by the Hu Tu river. In both cases the journey takes about ten days, and the cost of transportation ranges from 60 to 80 cents a bale of 120 catties, or 160-lb. Cotton produced in the western part of Chihli province is shipped to Tientsin either by the Peking-Hankow railway to Paoting and thence to Tientsin by native boat, or by the Peking-Hankow and the Peking-Mukden lines. In the former case, a week is taken in transportation and the cost is about $1.75, silver, a bale, while transportation entirely by railway costs about $2.80 per bale, though it takes only four days. Chaochow, Kaocheng, Lwangcheng, Chengting, Yuanshih and Kaoyi are the local cotton trading centres.

Districts in the neighborhood of Hantan are not so suited to cotton growing as are other parts of the province. The yearly crop is about one picul of raw cotton per *mow*, or 800-lb. per acre. The percentage of lint from the raw cotton is below 40. Only a small quantity is exported to Tientsin from this neighborhood. The bulk of the crop is shipped to Honan province and to Hankow. Hantan and Limmingkwan are the local cotton exporting centres. That produced near Changteh, Honan, is generally consumed by local mills. The surplus is shipped to Chengchow and Hankow. But little finds its way to Tientsin.

Shensi is a well-known cotton-producing province, and its output has been increased in recent years. Since the suppression of opium cultivation, cotton has taken the place of poppy. The quality of Shensi cotton is superior to other native varieties. Shensi cotton is chiefly used by the Shanghai mills in spinning 16-count yarn. The bulk of the yearly produce of the province is exported to Hankow and Shanghai. In former years only about 22,000 piculs of raw cotton came to Tientsin every year, but the figure has been steadily increasing since the establishment of cotton mills in the port.

There are three different ways by which shipments of Shensi cotton are brought to Tientsin: (1) from the producing districts by mule carts to the railway terminus at Kwanyintang, Honan province, where the cargo is transhipped to Changchow by the Pien-Lo railway; (2) from the producing district to Changchow by the Wei river and the Yellow river; or (3) by boat to Szeshui, Honan province, where shipments are reloaded in mule carts and brought to Kwanyintang, whence they reach Changchow by the Pien-Lo line. Most of the shipments are carried to Changchow by the Wei river and the Yellow river, owing to the comparative low cost of water transportation, but, in view of the gorges and rapids in the Yellow river near Kwanyintang, this entails considerable risk. One or two junks out of every ten are estimated to be wrecked or overturned in this neighborhood as they pass.

The cotton-producing districts in Shansi are confined to the valley of the Feng river, including such districts as Hungtung, Yungho, Kuwo and Pingyao. The bulk of the crops is exported to Hankow. Only about 20,000 or 30,000 piculs are marketed at Tientsin yearly. Most of the varieties of Shansi cotton are of foreign origin. Their staples are long and soft. Transportation difficulties prevent Tientsin from importing great quantities of Shansi cotton, as it takes about 15 days for a shipment to reach Tientsin. The greater part of the way has to be covered by mule carts. The long journey causes damage and losses to the shipments, due to defective packing.

Tung Ho cotton is an important commodity on the Tientsin market. There are three producing areas, all near Tientsin. Cotton coming from each of these areas is known by different local names in Tientsin. The Hsiao Chi is produced near Fengjun, Chihli province, in a district comprising about 2,000 square *li*, including Hsiaochi and Sukochwang. The total yearly product is about 40,000 or 50,000 piculs. (2) Yangtsun cotton is produced in the neighborhood of Yangtsun, where the producing belt extends to Siangho, covering about 1,800 square *li*, where about 10,000 piculs are produced yearly. (3) That produced in the neighborhood of Wuloyen has no particular local name. The yearly produce from this region, which lies between the other two belts just referred to, amounts to about 8,000 piculs.

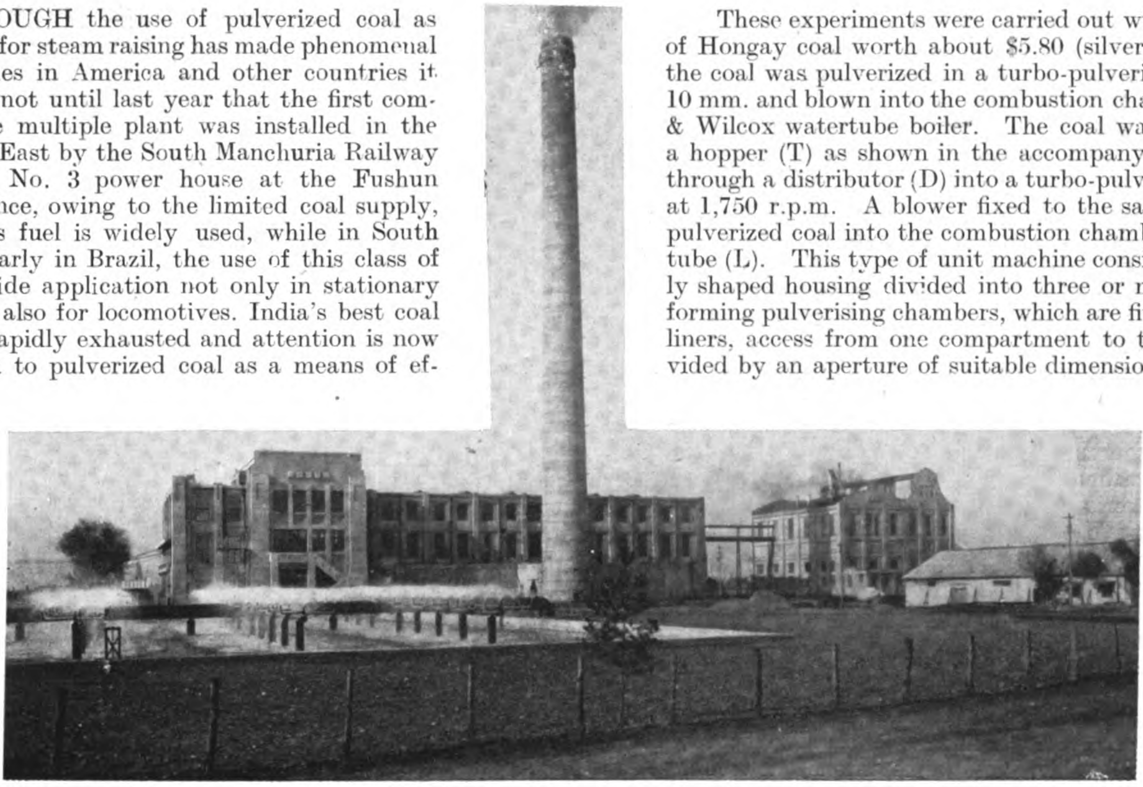
The different varieties of Tung Ho cotton are mostly of foreign origin. The seeds were brought from America by missionaries. The staples are long, fine and soft, and suitable for spinning yarn of medium grade. The cost of cultivation per mow in the neighborhood of Yangtsun is estimated at $16.60 (U.S. $8.30) and a

(Continued on page 127.)

Pulverized Coal Plants in the Far East

The Splendid Record of the Fushun Power House

ALTHOUGH the use of pulverized coal as fuel for steam raising has made phenomenal strides in America and other countries it was not until last year that the first complete multiple plant was installed in the Far East by the South Manchuria Railway Company for its No. 3 power house at the Fushun Colliery. In France, owing to the limited coal supply, pulverized coal as fuel is widely used, while in South America, particularly in Brazil, the use of this class of fuel has also a wide application not only in stationary steam plants but also for locomotives. India's best coal seams are being rapidly exhausted and attention is now being focussed on to pulverized coal as a means of efficiently using the lower grade deposits. In the Far East some interesting experiments have been carried out in Tonkin by the Societe Chanbonnages du Tonkin operating the Hongay coal fields in which a unit system installation was employed for pulverizing and burning.

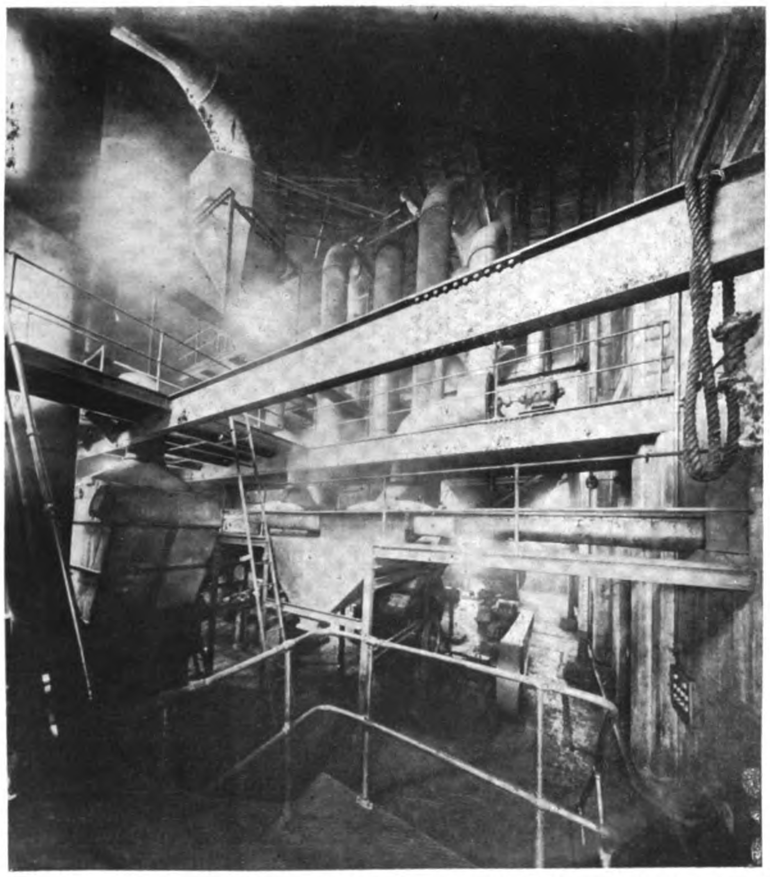


GENERAL VIEW OF NO. 3 POWER HOUSE OF FUSHUN COLLIERY

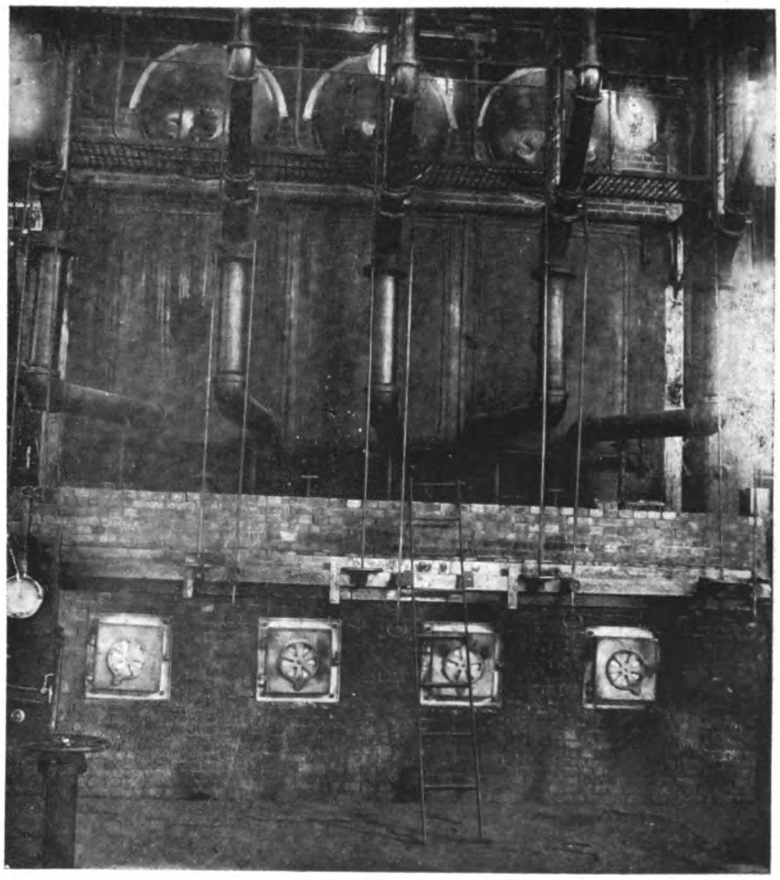
Building to the Right is the Pulverized Coal Plant: Main Building Houses the Boiler and Generating Rooms. Spray Coaling Pond in Foreground

These experiments were carried out with the lower grades of Hongay coal worth about $5.80 (silver) per ton, in which the coal was pulverized in a turbo-pulverizer to a fineness of 10 mm. and blown into the combustion chamber of a Babcock & Wilcox watertube boiler. The coal was fed by hand into a hopper (T) as shown in the accompanying sketch, passing through a distributor (D) into a turbo-pulverizer (P) operating at 1,750 r.p.m. A blower fixed to the same shaft blows the pulverized coal into the combustion chamber (B) through the tube (L). This type of unit machine consists of a cylindrically shaped housing divided into three or more compartments forming pulverising chambers, which are fitted with renewable liners, access from one compartment to the next being provided by an aperture of suitable dimensions.

The pulverising medium consists of a number of rotors equal to the number of compartments, which carry a number of beaters on the periphery, the whole being mounted on a common shaft. A fan, which is also mounted on the shaft, is situated at the opposite end to



Crusher Room of the Holbeck Pulverized Coal Plant at the No. 3 Power House of Fushun Colliery

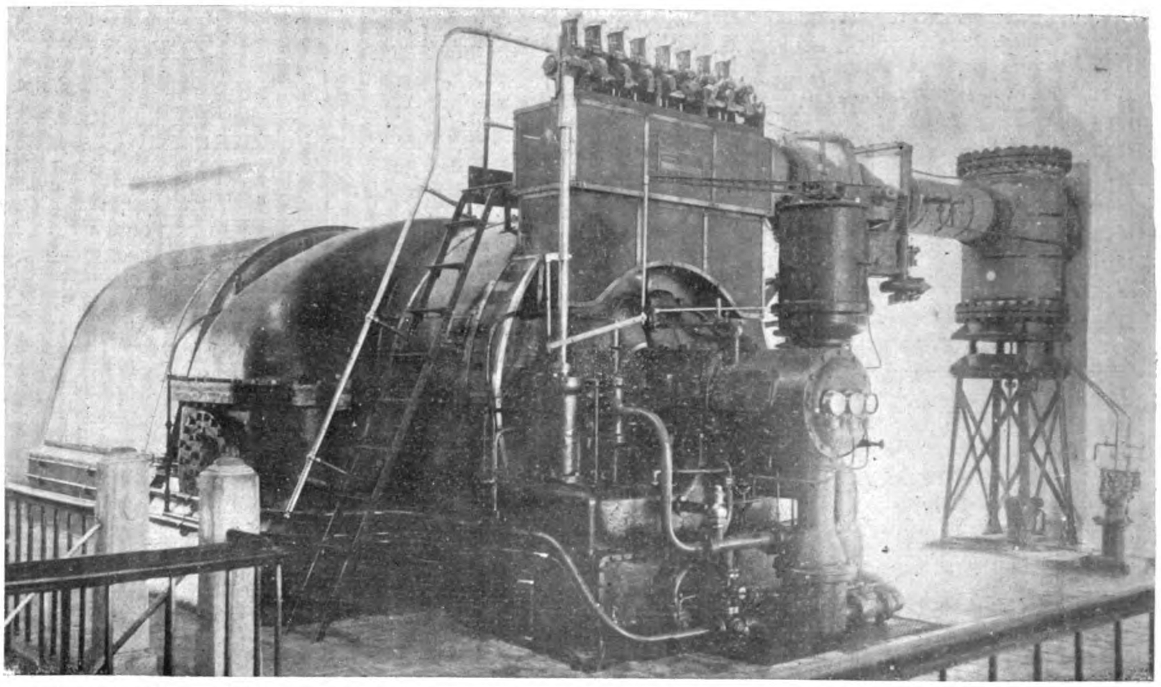


Front View of Babcock & Wilcox Boiler Equipped to Burn Pulverized Coal at Fushun

the feeding gear in a special compartment and its purpose is to induce a draught of air through the pulveriser, which carries in suspension the finer particles from one compartment to another. This installation gave excellent results and further trials are now being carried on in order to obtain the best results from the Hongay coal.

In Formosa, elaborate tests are also being carried forward in order to efficiently utilize the lower grades of coal found in the island.

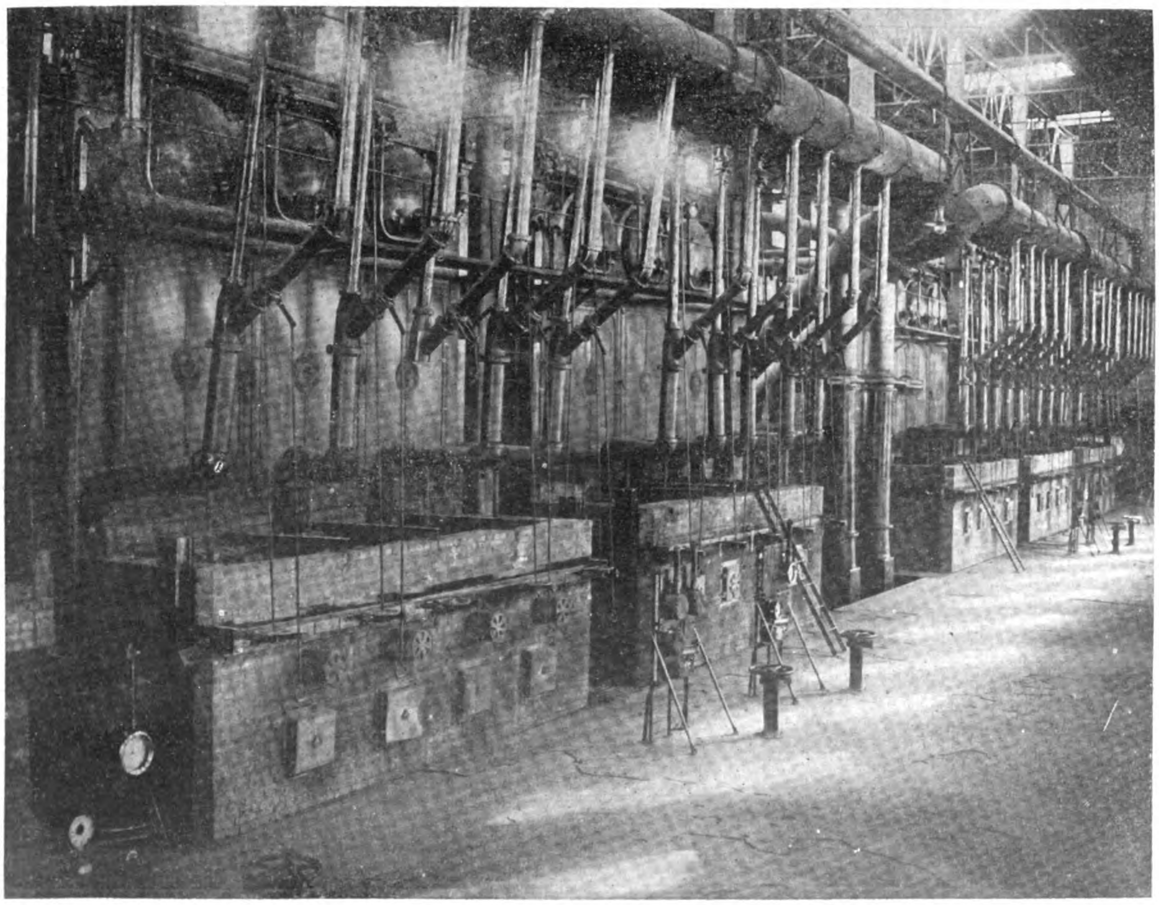
In 1920, the Formosan railway authorities ordered three "Lopulco" pulverized coal equipments and one pulverizing plant for their locomotives. These were placed in operation in November 1922 and gave such excellent results that two more "Lopulco" equipments were ordered. These plants are manufactured by the International Pulverized Fuel Corporation of New York, the foreign department of the Combustion Engineering Corporation, for whom Mitsui & Company are the agents in Japan. The working results of these Formosan plants were published in the November 1923 number of THE FAR EASTERN REVIEW. There is also one pulverized coal plant operating in Japan. Aside from these minor installations, the credit for erecting the first complete pulverized coal plant in connection with a large power house goes to the South Manchuria Railway Company. In this, as in many other engineering innovations, the technical staff of the railway has taken the initiative in applying and trying out under Asiatic conditions the most up-to-date and efficient methods.



12,500 k.w. General Electric Curtis Turbo-Alternating Set in the No. 3 Power House of Fushun Colliery

In designing the new power-house for the Fushun colliery, the S.M.R. engineers decided to install a pulverizing equipment that would utilize the dust and inferior qualities of coal, of which about 500,000 tons per year are mined at Fushun and for which there is no market. This new power house, specially designed to generate and transmit power over fifty miles from Fushun to Mukden and Liaoyang, is equipped with one General Electric-Curtis turbo-alternating set of 12,500 k.w. operating at 1,800 r.p.m. delivering 820 amperes at 11,000 volts. There is also a spare G. E.-Curtis set of 1,500 k.w. capacity, delivering 1,569 amperes at 2,300 volts. Steam is produced in a battery of six Babcock and Wilcox water-tube boilers especially equipped to burn pulverized coal.

The S. M. R. engineers recommended the use of the multiple or central milling plant system for pulverized coal burning in which the coal is prepared in a separate building and transported therefrom to the furnaces, and adopted the equipment manufactured by the Holbeck Engineering Company of Cleveland, Ohio. The diagram shows the general layout and working of this system. In the Fushun plant three Bonot's pulverizers having a capacity of five tons per hour reduce the coal to a fine dust after which it passes through the various stages to be fed into the combustion chamber of the boilers mixed with air.



Boiler Room Equipped with No. 4 Babcock & Wilcox Water Tube Boilers fitted to burn Pulverized Coal at No. 3 Fushun Power House

The general principles of pulverized coal consist in crushing the coal and passing it over a magnetic separator to get rid of any iron particles. The crushed coal is then dried down to 1 to 2 per cent. moisture. The dry coal is then pulverized in ball-mills, the latest average practice as regards fineness being that 90 per cent. will pass through a 100 mesh, and 65 per cent. through a 200 mesh. The pulverized coal is conveyed through troughs to bunkers, and then to feeders which mix the coal with 10 per cent. of the air required for combustion and deliver it to the burners, in which 90 per cent. of the air, preheated to a high temperature, is then added. The result is an intensely hot flame of over 2,000° F. under the boilers,

with complete combustion, 17 to 18 per cent. CO_2, no CO, and entire absence of smoke.

The efficiency of the Fushun power plant has more than met the expectations of the engineers. Running with an average load factor of about 65 per cent. and using the poorest grade of coal, the fuel record for over a period of several months is 17,500 b.t.u. per hour with 250-lbs. boiler pressure and 200 deg. superheat. According to one of the highest American engineering authorities this constitutes a record not only in the Orient but in all Europe. In fact, he contends, it is nearly a world record for efficiency. He says

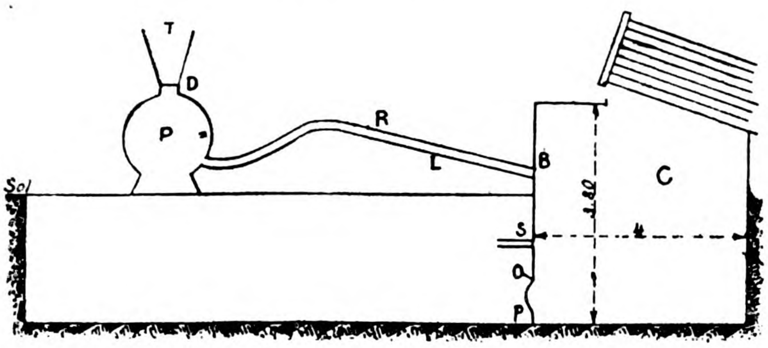
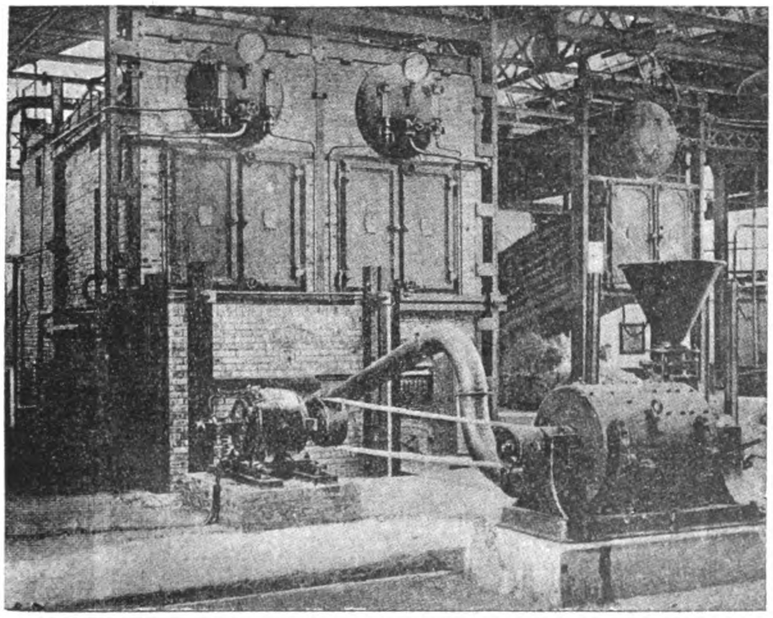


Diagram of Unit System

it is the best run and best managed station he has seen and gives great praise to the engineers in charge, Mr. R. Ohashi and Mr. T. Matsumoto. The record, he adds, is double fine in view of the low grade of coal consumed which is almost twenty per cent. ash and worth about a yen per ton.

The success attending this plant induced the S.M.R. authorities to duplicate the order with the Holbeck Company for the power house at the Anshan Iron and Steel Works. This plant is now in process of erection and another plant is to be erected in connection with the Hamacho power house at Dairen also under the control



Pulverizing Plant and Coaling Station for Locomotives

of the S.M.R. It is possible, however, that in this plant another system will be installed.

Although the results obtained at the Fushun power house constitute a wonderful efficiency record, it must be borne in mind that this applies only to low grade fuels which do not burn perfectly on a grate. It is yet to be scientifically demonstrated that the system is more efficient or economical where coals of British quality are used, but it is generally conceded that the pulverized coal plant in connection with steam plants at or near the mines and for cement and blast furnaces, is the most economical.

Cotton Mills and Raw Cotton Supply in Tientsin

(Continued from page 124.)

mow yields about 150 catties of raw cotton. The local market price is about \$14.50 a picul (133⅓-lb.) of raw cotton, \$45 for a picul of lint and \$1.50 a picul of cotton seeds. Tung Ho cotton is moved from the producing districts to Sukochwang at a cost of 38 cents per picul, including the cost of packing. The railway freight from Sukochwang to Tientsin is \$36.75, silver, a ton.

In recent years shipments of Turfan cotton produced in the neighborhood of Turfan, in Chinese Turkestan, have arrived in Tientsin. Before the European war, Turfan cotton was exported to Europe by the Trans-Siberian railway through Russian Turkestan. The yearly product of Turfan cotton is quite limited, but it is of good quality, being suitable for spinning yarn of fine counts.

The following figures show the quantity of raw cotton shipped to Tientsin from the interior districts, both under transit certificates and otherwise, during the four years ending 1922 :—

	Piculs Under Transit Certificate.	Piculs Not Under Transit Certificate.	Total
1919 ..	576,064	72,453	648,517
1920 ..	351,332	35,625	385,957
1921 ..	589,840	45,442	635,282
1922 ..	862,533	81,633	944,166

Of the above figures, about 60 per cent. is Hsi Ho cotton and 20 per cent. Yu Ho. This is a rough estimate, as the native customs keep no classified statistics. September, October and November are the busiest cotton trade seasons on the Tientsin market, although considerable business is done in March, April and May.

The figures of raw cotton exported from Tientsin to foreign markets, including the consignments transhipped to other Chinese ports during the past eight years ending 1922 are : 1915, 444,732 piculs ; 1916, 282,499 piculs ; 1917, 158,192 piculs ; 1918, 327,609 piculs ; 1919, 530,881 piculs ; 1920, 258,568 piculs ; 1921, 454,898 piculs ; 1922, 548,963 piculs.

Of the 548,963 piculs exported in 1922, 70,885 piculs went to other Chinese ports, 353,213 piculs to Japan, 104,828 piculs to the United States, 9,688 piculs to Great Britain, 6,196 piculs to Germany, 1,153 piculs to Italy, 1,061 piculs to France, 857 piculs to Korea, 369 piculs to Denmark, 303 piculs to Hongkong, 241 piculs to Portugal and 169 piculs to Holland.

Tientsin imports quantities of raw cotton of both native and foreign origin, as is shown by the following figures. The bulk of the native cotton comes from Shanghai.

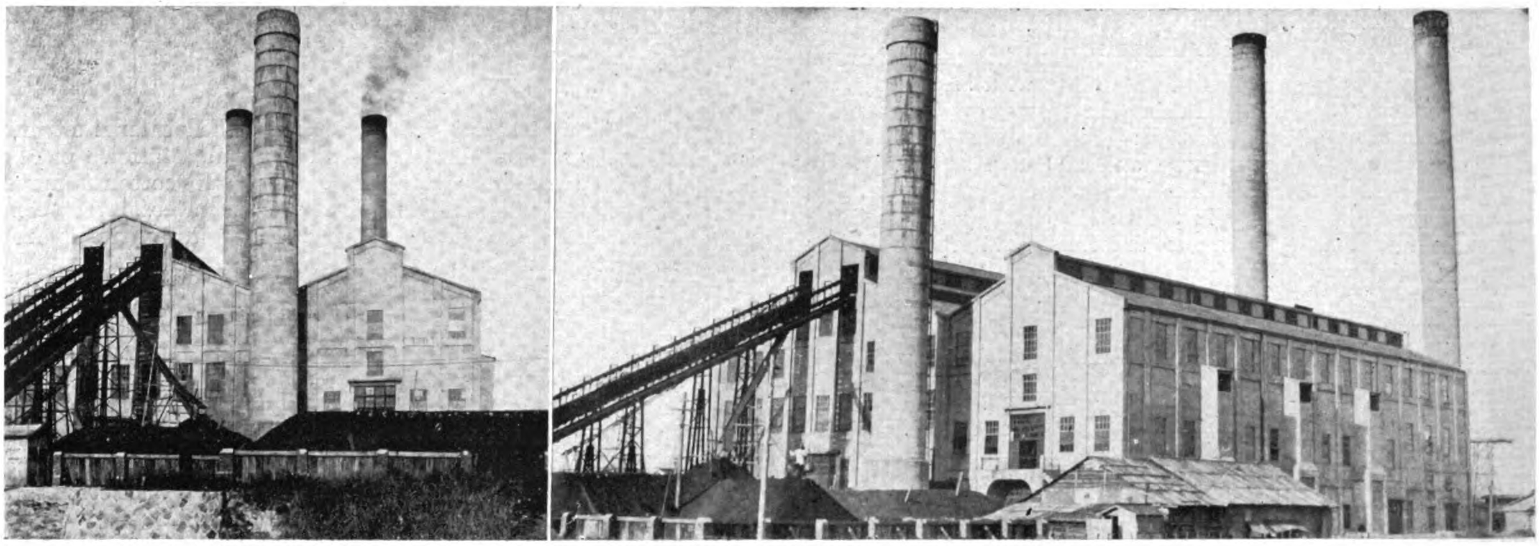
NATIVE FIBRE.

	Piculs Imported.	Piculs Re-exported.	Net No. of Piculs Imported.
1919	20	—	20
1920	3,816	1,146	2,670
1921	18,197	—	18,197
1922	11,491	—	11,491

FOREIGN FIBRE.

	Piculs Imported Directly from Foreign Countries.	Piculs Imported via Other China Ports.	Total.
1919	1,548	—	1,548
1920	5,992	8,353	14,345
1921	65,403	64,773	130,176
1922	101,979	61,818	163,797

The bulk of the foreign cotton comes from India, although the United States contributes some. Of the 163,797 piculs imported into Tientsin in 1922, 40,564 bales were Indian and 9,684 bales American.



Steam Plant of the Imazu Hatsuden Kaisha. Power of the Hanshin Express Electric Railway is furnished by its sister company, the Imazu Hatsuden Kabushiki Kaisha, from its steam power plant near Nishinomiya, equipped throughout with General Electric machinery and material

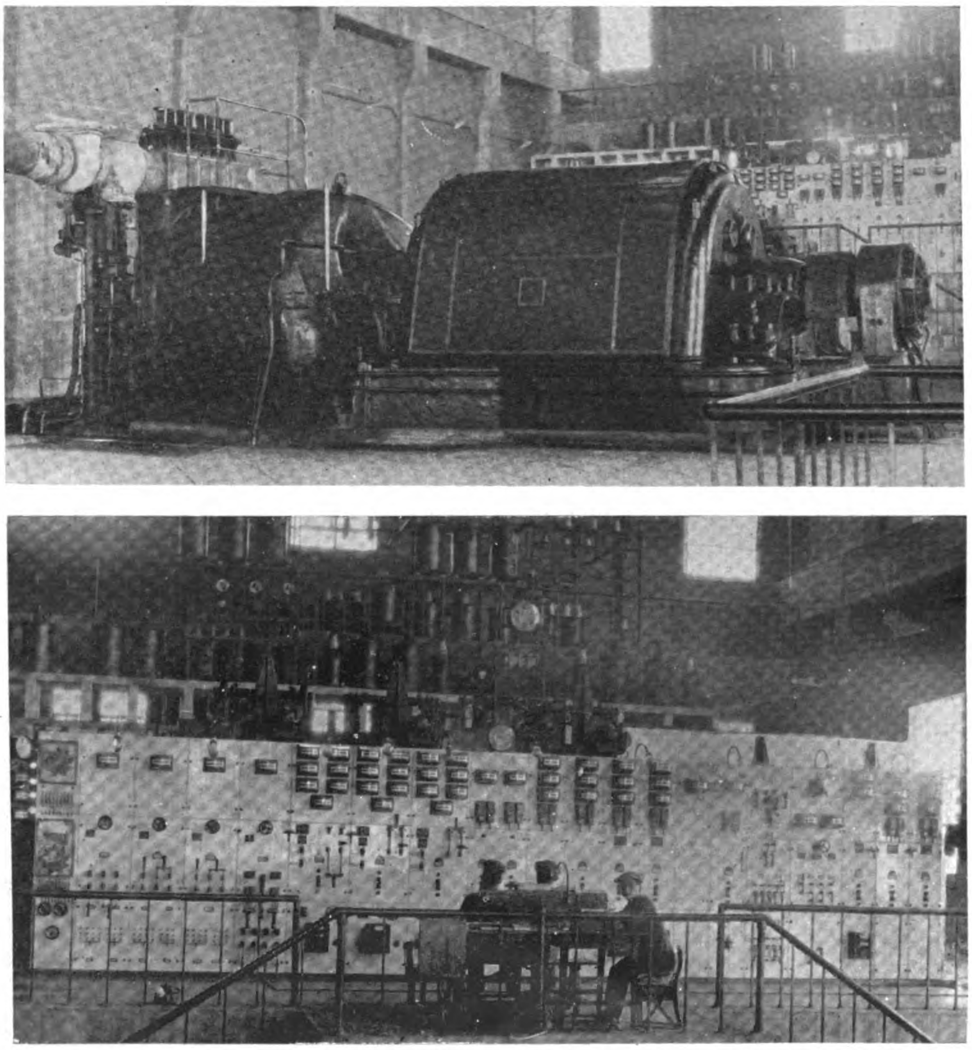
Notes on the Hanshin Express Electric Railway.—Kobe-Osaka

ONE of the most important electric traction developments in Japan is seen in the rapid growth of the lines controlled by the Hanshin Electric railway serving the territory between Osaka and Kobe. Starting in 1903 with a line between Osaka and Takaradzuka, the new rapid transit service materially contributed towards building up the thinly populated surburban districts into prosperous towns and municipalities. From the main line various branches have since been built linking together practically all the principal towns in the district. The main line provides transportation between Osaka and Minono Park, famous for its scenic beauties and maple trees and the hot springs at Takaradzuka, equally famous as a health resort and the source of Tansan water.

Here the Hanshin Electric railway company built the Takaradzuka opera house with a seating capacity of 4,000 and in other ways improved the place as a holiday resort for the workers of Osaka. From here the line was to have been extended to Arima, another famous hot spring resort but excessive grades and heavy tunelling compelled the abandonment of the scheme.

From this main line several branches and extensions were built, until in 1920 the company completed the construction of a through line into Kobe and inaugurated an express service between the post and the manufacturing centre of Japan. The system as it now stands embraces the following lines :—

1. Osaka-Kobe, 18 miles double track
2. Osaka-Takaradzuka, 15.5 miles double track
3. Nishinomiya-Takaradzuka, 4.8 miles double track
4. Tsukaguchi-Itami, 1.5 miles single track
5. Ishibashi-Minono, 2.8 miles single track

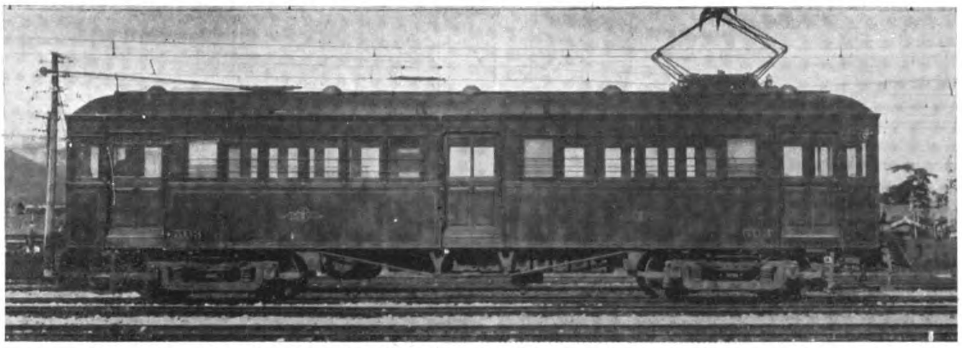


Imazu Hatsuden Steam Power Plant. Top, one of the three General Electric 10,000 k.w. turbo-alternators: bottom, G.E. Switchboard

6. Shukugawa - Kyo-en, 1.4 miles single track

Total, 44 miles double and single tracks.

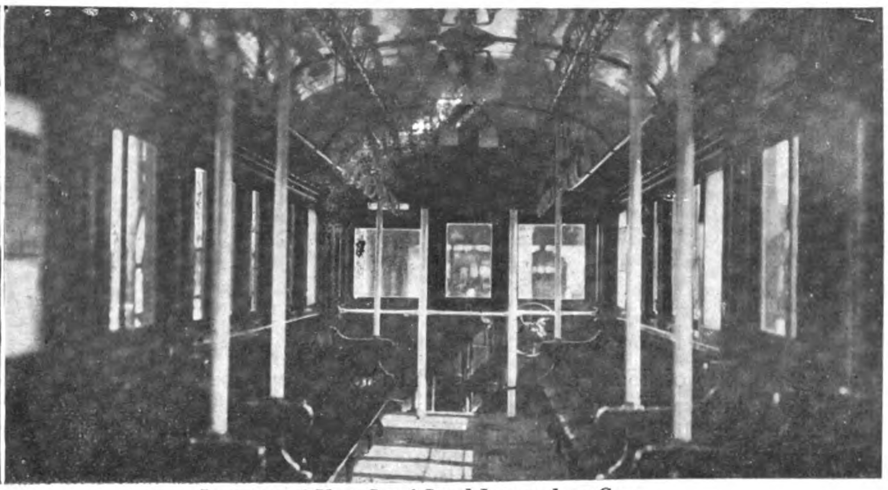
The company now plans to extend its service from Nichinomiya to Imaza, Tsukaguchi to Amajasaki and to Takaradzuka from Itami.



New Interurban Cars for the Hanshin Express Electric Railway_Semi-Steel Construction

The Osaka-Kobe express service is operated on a schedule speed of 28.2 miles per hour and 20.7 miles on the Takaradzuka line, with a headway of four to ten minutes between train. The present service is of single and double cars, which is to be extended to three

Operating Cab

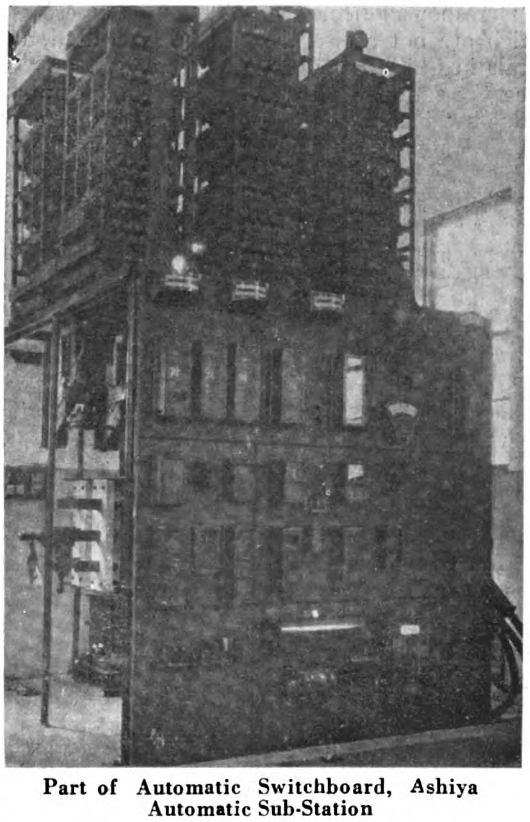


Interior of New Semi-Steel Interurban Cars

Practically all its electrical equipment has been furnished by the General Electric Company.

The power for operating the line is received from the steam generating station of the Imazu Power Generating Company equipped with three 10,000 k.w. General Electric turbo-alternating sets delivering current at 22,000 volts. The six sub-stations are also all furnished with General Electric equipment. They are located as follows :

Kanzaki-gawa	3—1,000	k.w. converters.
Nishinomiya ..	2—	,, and 3—500 k.w.
Ishibashi ..	2—	,,
Takarazuka ..	8— 500	,,
Ashiya.. ..	1—1,000	,, full automatic.
Rokko.. ..	1—1,000	,, and 2—500 k.w.



Part of Automatic Switchboard, Ashiya Automatic Sub-Station

car trains in the near future. The motor car equipment is as follows :

33 cars G.E.—90-B 4 motor, MK control and G.E. air brakes.

36 cars G.E.—263 motor, PC control and G.E. air brakes.

10 cars G.E.—240 motor, control and G.E. air brakes.

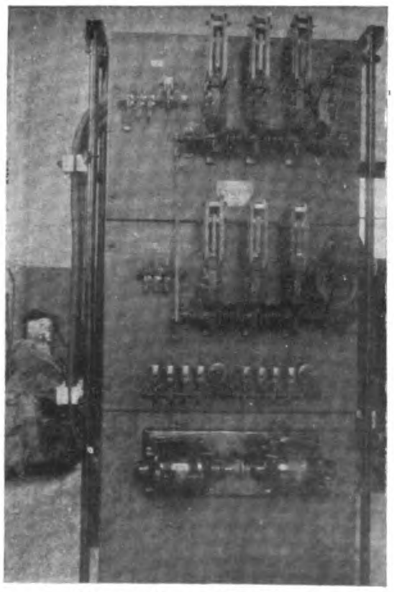
11 cars G.E.—203-P 2 motor, K control and G.E. air brakes.

12 trailers now under construction.

15 freight cars—G.E. 260 or 90-B or 203-P with PC or K or B control. (Three types used).

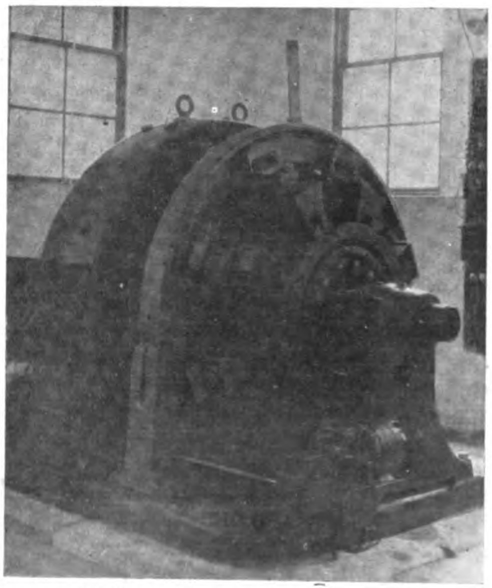
12 sets Baldwin trucks, remainder Brill.

The subscribed capital of the company is Yen 30,000,000 of which Yen 24,000,000 is paid up. For the past two terms a 12 per cent. dividend has been paid.

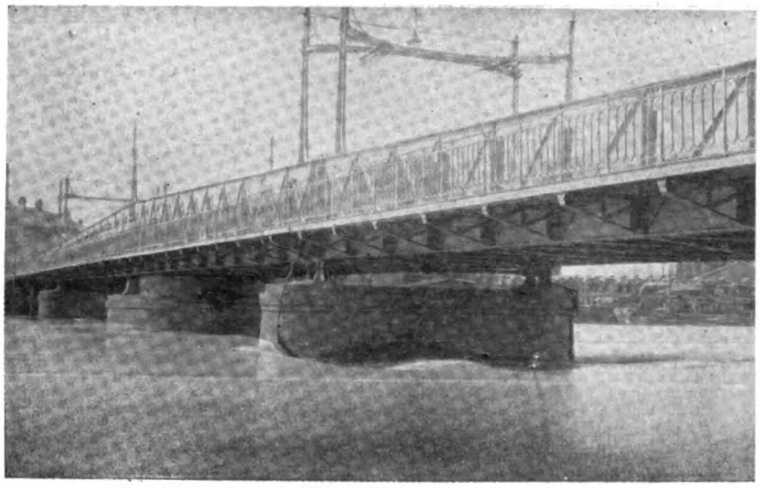


Master Controller Panel

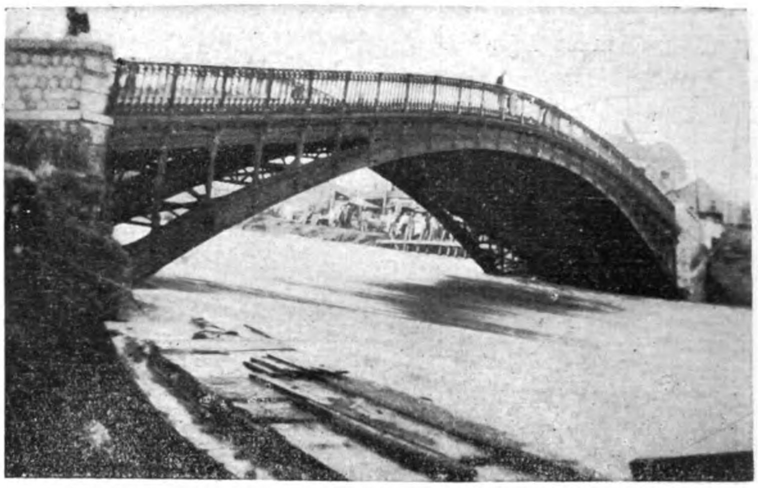
Automatic Sub-Station at Ashiya Exterior



1,000 k.w. Synchronous Converter



The Hung Chiao Red Bridge, now at the bottom of the Hai Ho



The International Bridge—To be Replaced by a New Bridge

A Year in Tientsin

Flood, Famine and Prosperity Mingle in Northern Metropolis

IN spite of floods and famine and the depredations of the soldiers, Tientsin continues to develop industrially. The following notes give but a slight indication of the prosperity of this growing city.

Tientsin is the distributing centre for the northern provinces of China, it is the key to Peking with which there is connection by rail, and the Grand Canal is responsible for the transportation of native goods to places which are not accessible by rail. In favorable years the yield of cereals in Chihli province is large, but owing to the flood menace during the summer of 1924 the crops of the locality were destroyed ; the flood which threatened Tientsin during the months of July, August and September, caused the inundation of several districts in the interior, with the result that much of the farm produce such as ground-nuts, cereals, etc., could not be taken to the market at all. Goods such as skins, wool, etc., could not be brought to town, villages were submerged, communication was entirely interrupted ; the roads were like rivers, bridges were carried away by the flood, and only small quantities of goods could be sent in by the aid of boats.

The force of water broke away parts of the embankments, which served as roads, the water rushed in and destroyed the crops ; several miles of land were under water, nothing was visible on the surface but the tops of the trees, and when the flood abated the trees were all that was left on the fields.

When the flood menace ceased in September, the local war started. Railway cars were commandeered by the military for army use ; soldiers, houses, and war-material were rushed to Peking, from there to Shanhaikwan, and the trade of Tientsin suffered from political unrest, war and flood.

800,000 acres are planted with cotton in the province of Chihli, and 130,000 in Shansi, yielding 242,000,000 and 33,000,000 pounds of cotton respectively, but 50 per cent. of the Chihli cotton is not expected to materialize this year ; all Chinese-grown cotton is poor in quality, and unfit for manufacture of fine grade yarn, and foreign cotton is imported for the purpose of mixing with the local product.

A good quantity of wheat of an inferior quality is produced in Chihli. This arrives from the country in a dirty condition, which is due to the fact that it is threshed on floors made of mud, most of it is ground in local flour mills, and used for native consumption.

Perhaps the peanut trade suffered more from flood than any other industry; the whole of the Chihli province is noted for peanuts. The best quality of peanuts are grown in the locality of Lanchow, the nuts produced there have thin white husks, which are in great demand in the American market. Almost every Chihli farmer has a portion of his ground allotted for peanuts, no parts of these nuts are thrown away or wasted ; the creepers on which the nuts grow are used for fuel, the kernel is a valuable article of food, no Chinese dinner being complete without peanuts, either roasted or salted, and the husk, which ignites quickly, is used for starting fires.

When peanuts arrive in Tientsin from the country, several thousand women and children are employed in picking and sorting them ; the first quality (about 30 to the ounce) is usually sent to the United States, the second and third qualities are also exported abroad, and the nuts which are not fit for exportation yield a fine amber-colored oil.

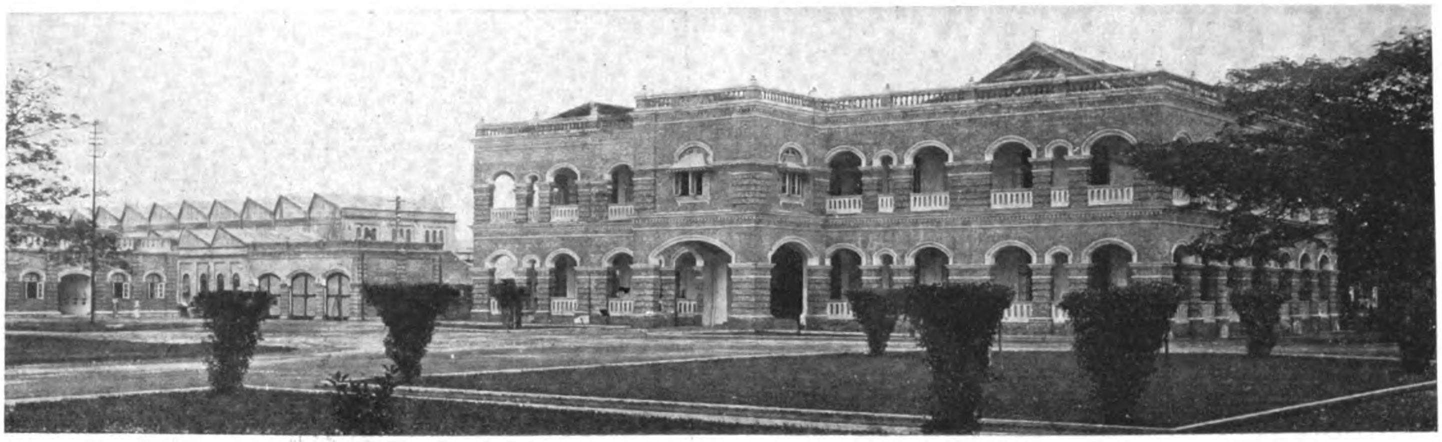
Shantung is also a large peanut-producing province. The oil is pressed and sent to Tientsin, where it is cleaned or refined and repacked into barrels for exportation to London ; after the oil is pressed from the nut, the residue left over is made into round cakes and used as a fertilizar. Many merchants are engaged in the peanut business, walnuts and peanuts both shelled and unshelled, form some of the most important articles of the Tientsin export trade.

Owing to the shortage of wool, which could not be sent to town during the summer, the carpet-making industry was curtailed, these carpets command a high price in foreign markets, and are exported in large quantities to the United States ; there are some local carpet factories, but those exported are chiefly made in small native work-shops.

A new factory for the purpose of making glass and crockery-ware has recently been erected in Chingwantao ; the capital for this plant was invested by Belgiums and Chinese, and the business is controlled by the Kailan Mining Administration, whose building on Meadows Road is a large institution. The word Kailan was derived from Kaiping and Lanch'ow formerly the names of two coal mines, which were amalgamated.

At the corner of Bruce and Devonport Roads Messrs. Elbrook & Co. (*Hai-Ching-Kung-Si*) have started a dyeing and spinning factory, which is equipped with the latest spinning machinery. There are two large spinning mules containing 390 spindles each ; this plant can dye from 1,000 to 1,300 pounds per day in fast colors.

Troop Trains at the Tientsin Station

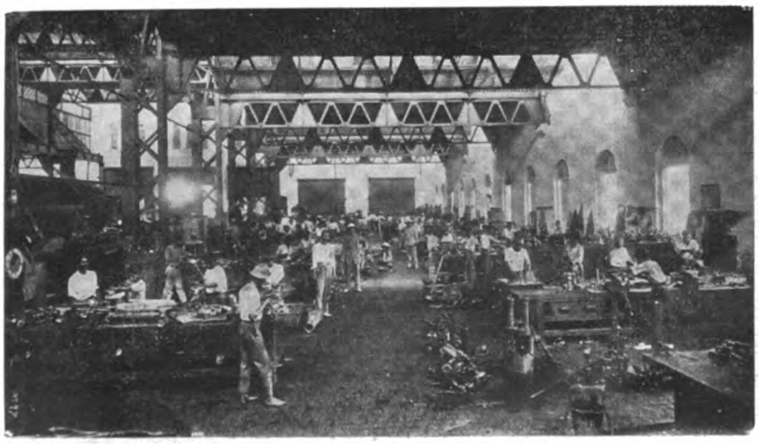


Locomotive Department Offices of the Central Workshops of the F.M.S. Railways at Sentul

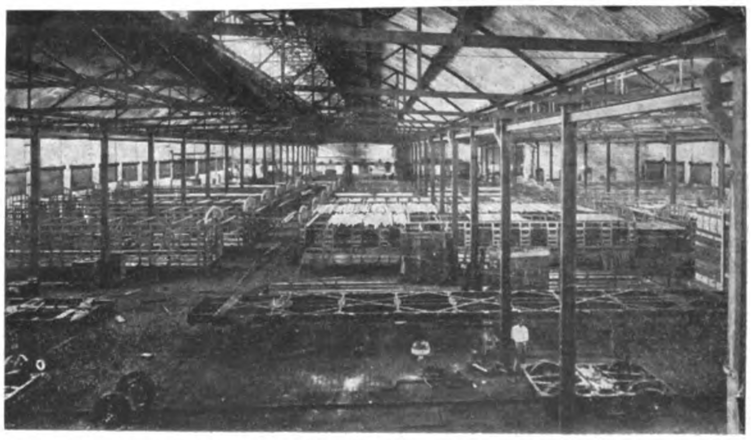
Central Workshops of the F.M.S. Railways

THE central workshops of the Federated Malay States railways are situated at Sentul, 3 miles from Kuala Lumpur, the central point of the railway system. In the year 1904 the federation of four of the protected Malay States led to a combination of the various railway systems and to the construction of modern workshops for the unified undertakings. Since that date the shops have expanded in accordance with the requirements of a rapidly growing railway and are to-day capable of keeping in proper working condition, an equipment consisting of 252 locomotives, 4 rails motor cars, 598 coaching vehicles and 5,872 wagons. Access to the shops is from the branch line leading from Kuala Lumpur to Batu caves and it will be noticed from the illustration that the works are divided into two parts by a traverser the table of which is 60 feet long and capable of taking the longest vehicles on service. To the south of the traverser are the erecting and machine shops, the foundry and locomotive stores, while on the north side lie the carriage and wagon shops, the saw mill and the boiler and smith shops. The erecting shop is 603-ft. long, in the centre of which are 3 pit roads spanned by two overhead cranes each of 20 tons capacity. On one side are the fitting benches for motion, rods, axle boxes, etc., and outside there is a boiler which supplies steam for the "bosh" as well as for testing injectors, etc. One end of this bay is set aside for the mill wrights. On the other side of the erecting shop is the machine shop 603-ft. long by 40-ft. wide. The machinery installed is of general utility and is all electrically driven. A monorail crane serves the wheel lathes and other machines taking heavy work. The last extension of these shops was in re-inforced concrete and an upper storey is provided, where an electrical shop is now situated. A similar gallery over the machine shop is provided

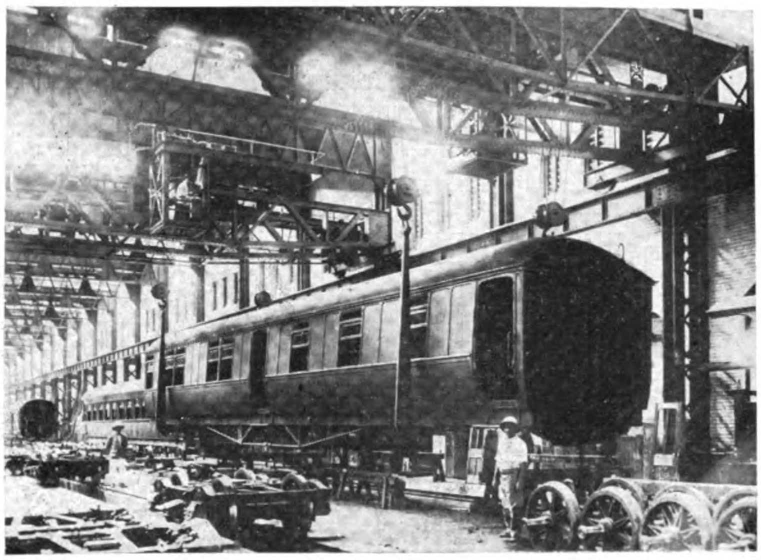
General View of Workshops Looking Down Traverser

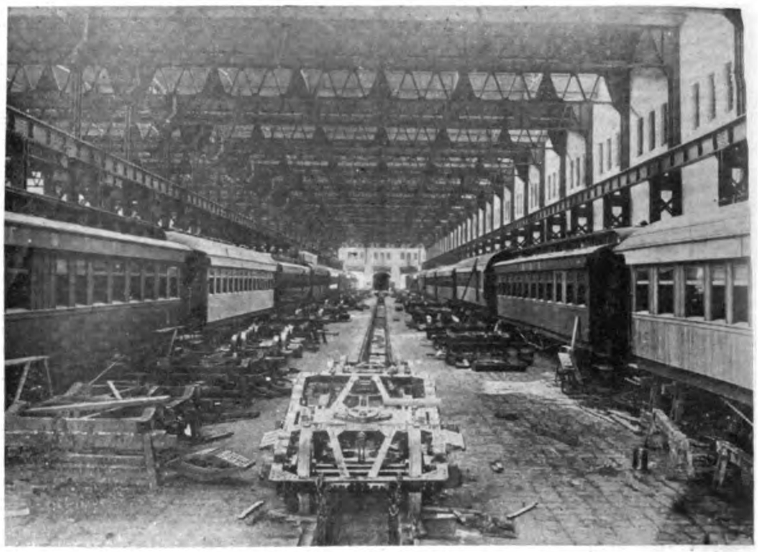


Fitters Benches in the Erecting Shop



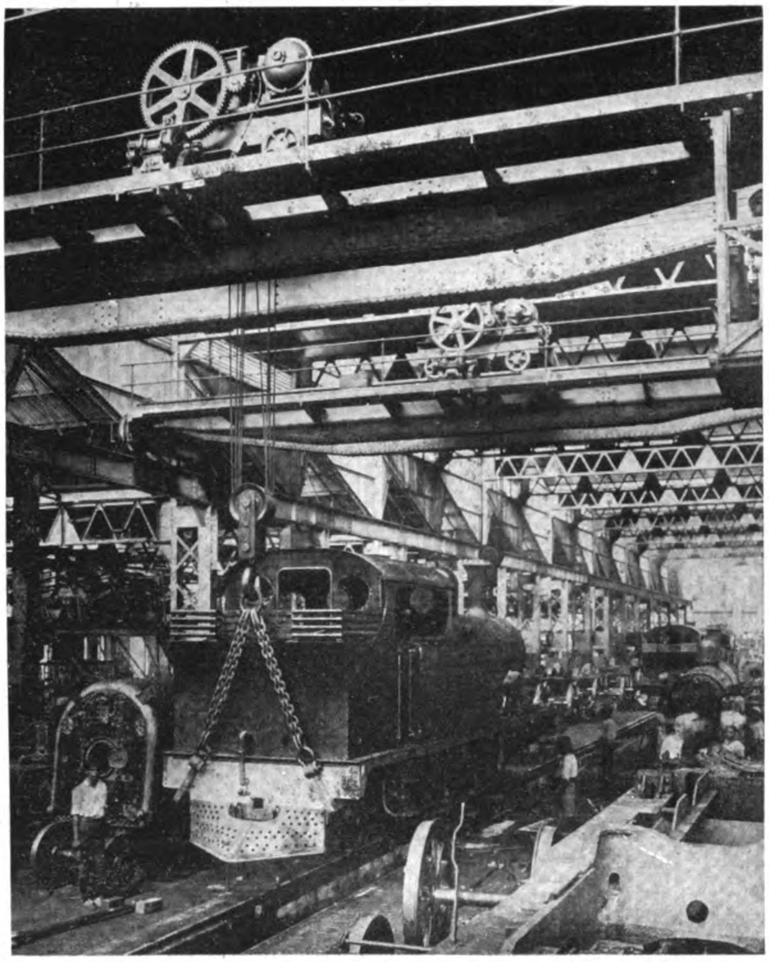
Carriage Body Binding

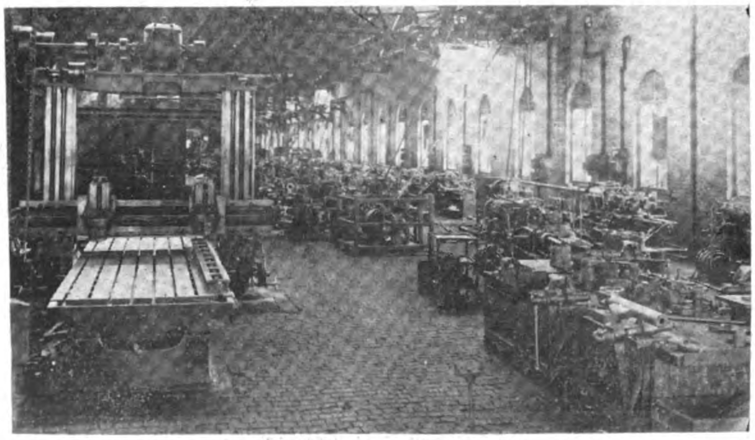

Carriage Shop

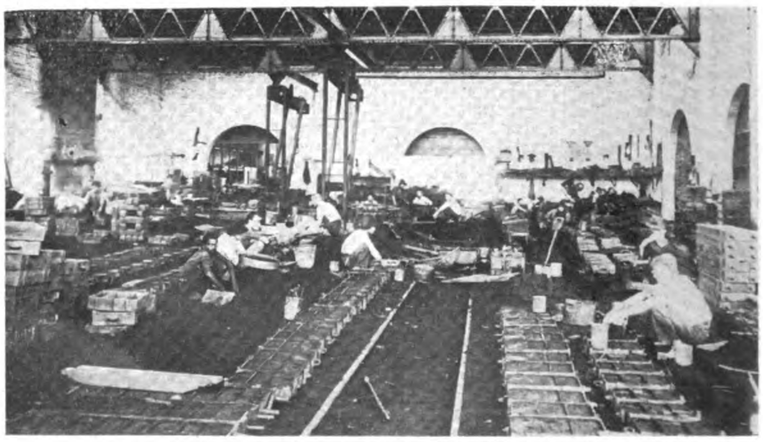

Carriage Shop

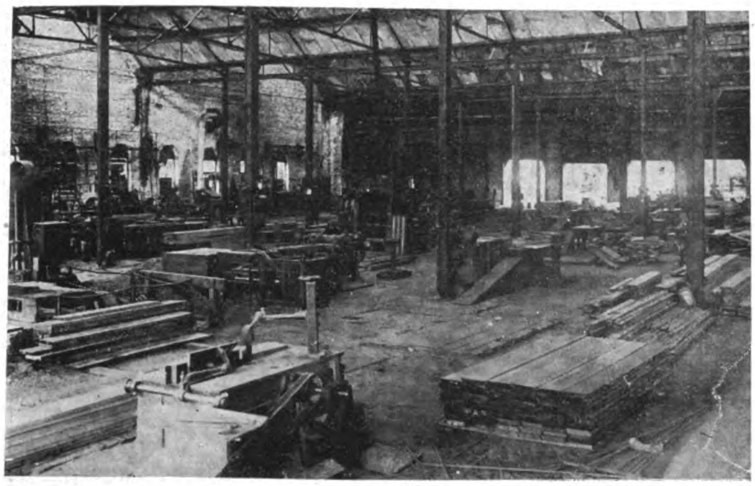
for future expansion and will become a brass finishing shop. Approximately 110 locomotives are repaired annually, a number which could be increased, given additional machinery. Adjoining a yard used for stripping engines is the foundry with a cupola of 5-ton capacity. The floor is covered by two five-ton foundry cranes. The whole of the requirements of the locomotive department are cast in this shop. Chinese labor is employed and no difficulty whatever has been experienced in producing complicated castings such as cylinders, without waste or defect. Adjoining is the brass foundry where a pit furnace for 6 crucibles is installed and also a Morgan tilting furnace. A small pattern shop completes the lay-out. The locomotive stores, which is a branch of the general stores department, is situated within close reach and stocks all articles in daily consumption as well as locomotive and other spare parts. A large copper and tinsmiths shop completes the lay out on the south, or locomotive side of the traverser.

Opposite is the carriage shop 660-ft. long by 90-ft. wide served by three 15-ton overhead cranes, two being arranged on one bay. There are three roads on each bay, the centre road being for wheeling out-going vehicles. The shop repairs and repaints 240 vehicles a year, and is capable of a considerably larger out-put, if required. Adjoining is a building in which is housed ratan workmen and upholsterers. A small paint shop for furniture, sign boards and other light articles is situated next to a paint mixing room from whence all paints and painting materials are issued to the whole of the works. Here too is the electrical train lighting establishment consisting of a fitting shop, lead burning room and cell cleaning and carriage shop, A pit road runs past the shop thus facilitating the work of fitting out carriages with electrical equipment. West of the carriage shop is the smith shop which is equipped with 5 steam hammers varying from 3 cwt. and 15 cwt. capacity. Tyring is done here, a crane being arranged for handling the wheels. Spring making and repairs is, of course, an important activity. Next is the boiler shop on two bays of 37 and 51-ft. wide 342-ft. long. These are served with a 15 and 12-ton crane respectively.

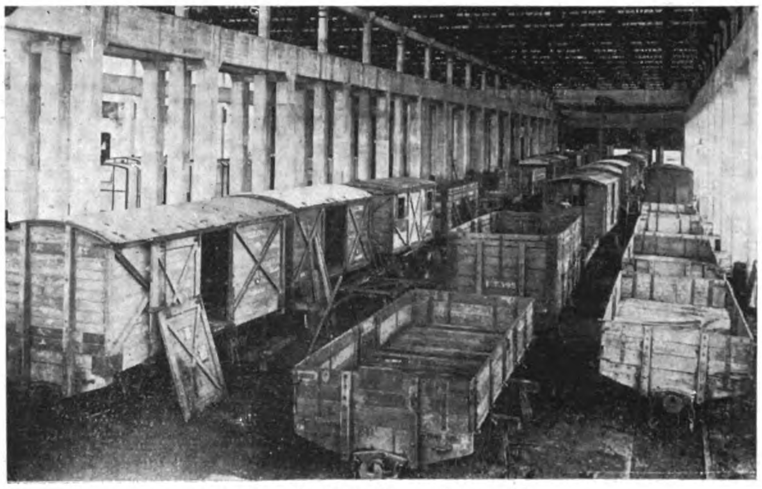

Erecting Shop


Automatic Lathes, Machine Shop


Corner in Foundry



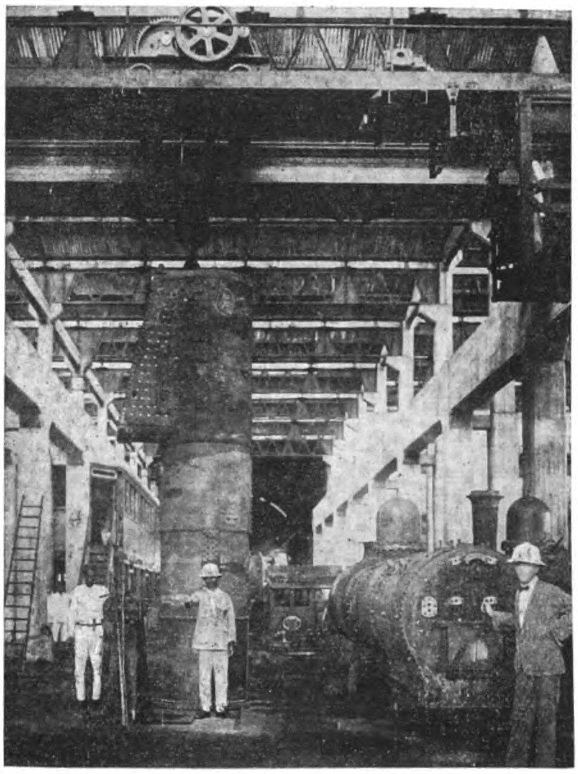
Saw Mill



Wooden Vehicle Bay, Wagon Shop

This shop, recently extended in re-inforced concrete is supplied with machines, rolls, shears, etc., necessary for boiler makers' work. Here is located the oxyacetylene welding branch, a department which is daily increasing its business. A plant for hydraulic rivetting and light press work is also supplied. Conveniently adjoining is the steel wagon bay of the wagon shop, a re-inforced concrete structure consisting of two bays each 562 ft. long by 60-ft. wide. Each bay is served with one 12-ton overhead traveling crane. Two drills and a wheel lathe are provided. Facilities are provided for testing the tightness of steel covered goods wagons, an essential precaution for the safe transport of goods in a country subject to exceptionally heavy rainstorms. Heavy repairs to approximately 30 wagons are completed weekly.

The old carriage shop which adjoins the saw mill is now used for carriage and wagon body building. It has been the practice for several years for the F.M.S. railways to construct their own carriage bodies and wagons out of local timber and no fewer than 250 carriages, and 2,000 wagons have been locally constructed.

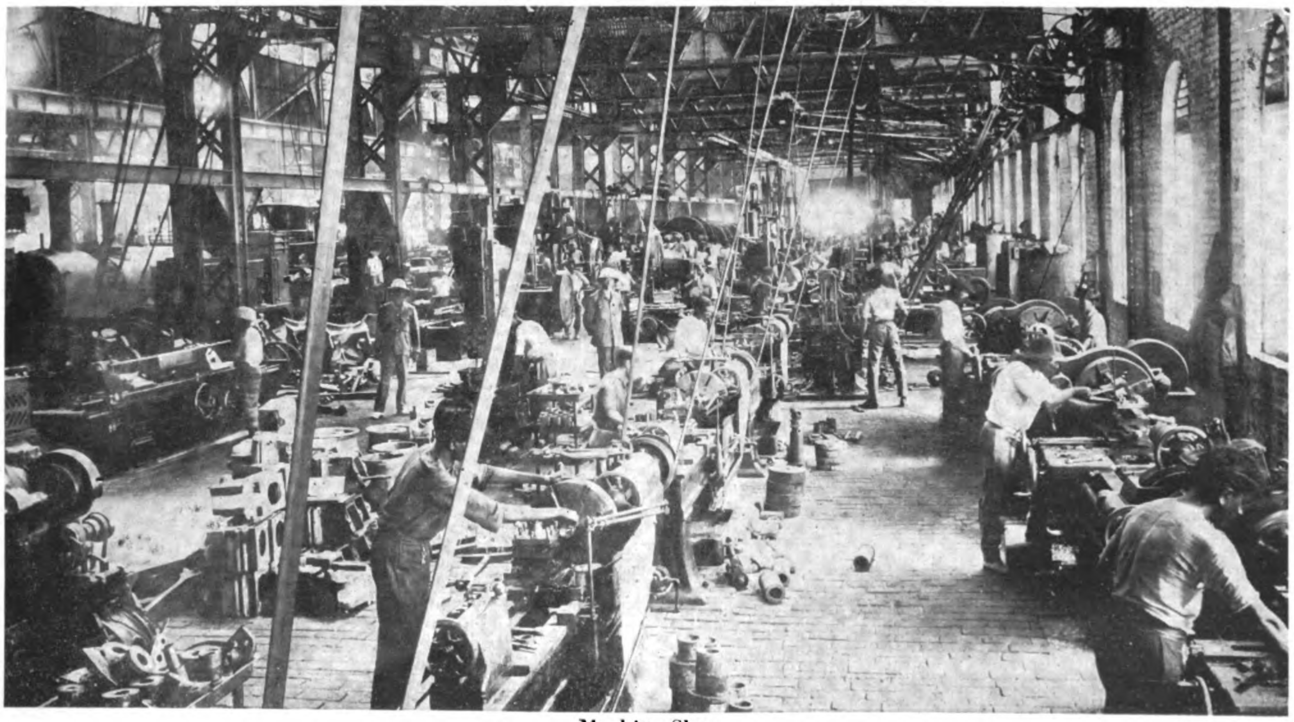


Hydraulic Plant, Boiler Shop

For this purpose the saw mill in addition to the usual breaking down saws, is provided with heavy machines for planing, morticing and end tenoning of the heavy timbers used in rolling stock construction. A copying lathe for producing tool handles out of local timber is installed, it being found that the native employee is not critical of the hammer and "changkol" handles he uses. By this means no small amount of wastage is put to use. A cyclone extractor is installed and serves the main saws.

The workshops are electrically driven, power being partly obtained from the public works department supply and partly generated by a 250 k.w. Allen set supplied with steam from a Babcock and Wilcox boiler. Water supply is from a stream 400 yds. from the site and is pumped into an elevated tank of 30,000 gallon capacity by two electric turbine pumps.

The European staff including that of the stores department number 21 and is housed a short distance away in roomy bungalows. Upwards of 1,800 men of different races are employed, Chinese and Tamils being the two chief sources of labor.



Machine Shop

Manufacture of Lime in China

One of the Oldest Industries but Not One Modern Lime Plant

By M. H. Chou, M.S.

IT is a very hard matter to trace the time when the lime was first made in China, or first used for building purposes, or as fertilizer. It is understood that the Chinese have used it at least several thousand years.

Occurrence

Limestone occurs very abundantly in China. We can find it in every province. Moreover, there is quite a bit of dolomitic limestone, as reported in the record of the geological survey.

Manufacture

The process of manufacture of lime from limestone, as practiced in China, is entirely in the hands of farmers or those laborers who are employed by some companies for manufacturing lime.

First, limestone in the quarry is broken by hand or by gun-powder. Big lumps of limestone are piled up to form a kiln where wood and straw are burned until most of carbon dioxide is driven off.

Another method of manufacture, as shown in the view herewith, is very interesting. First of all coal dust is wet and pressed into cakes together with mud. Then the coal cakes and limestone lumps are piled together one upon another. The whole pile is surrounded by some fire-resisting clay-stone. Fire is started from a small opening at the top of the pile. The pile burns for a week. After that the surrounding claystone is taken away and the lime formed is sorted out from the pile. It takes an enormous amount of labor. This process is quite feasible in China because of unparalleled cheapness of labor in China.

Native Chinese Method of making Lime

The price of lime in Shanghai is two Mexican dollars (equivalent to $1.50 gold) per 250-lbs. It is extensively used for building purposes. The farmer uses it as a fertilizer. The paper manufacturer uses it to disintegrate the bamboo. It is used as flux for making pig iron in many iron works in China. The wine maker cures the sourness of wine by adding lime to it and filtering. The pharmacist uses it for dehydrating purposes. The cement maker uses it for making cement.

However, the use of lime can be greatly extended as fertilizer by the farmer, if there is a new modern grinding mill to reduce lime into powder. As there is practically no work done either by the government or by private interests to test the acidity of the farm soil, it is very hard to convince the farmer to increase the amount of his crops by means of lime.

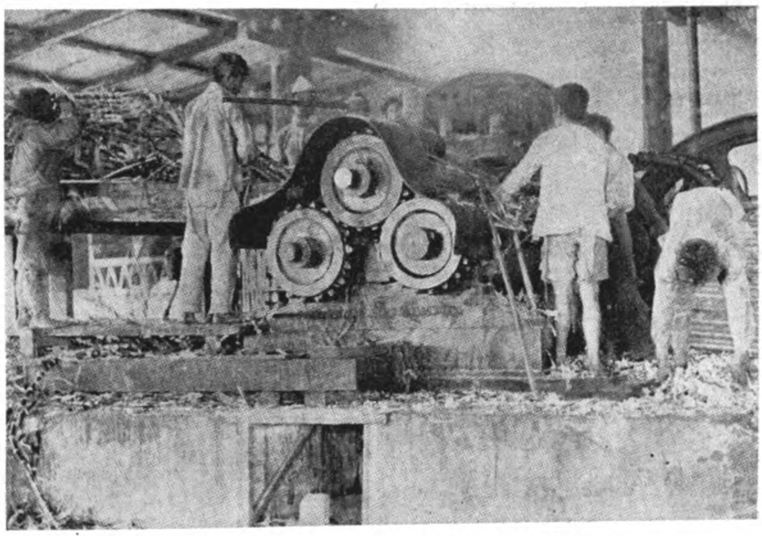
Future Outlook

The lime industry in China has not yet been modernized. But it will be eventually done in the near future, for there is a great demand for the lime of better quality. It will present a great opportunity to American manufacturers of lime kilns to introduce their equipment into the field of manufacturing activity in China. So far as I know, there is no single concern which is employing a modern lime kiln for the manufacture of lime.

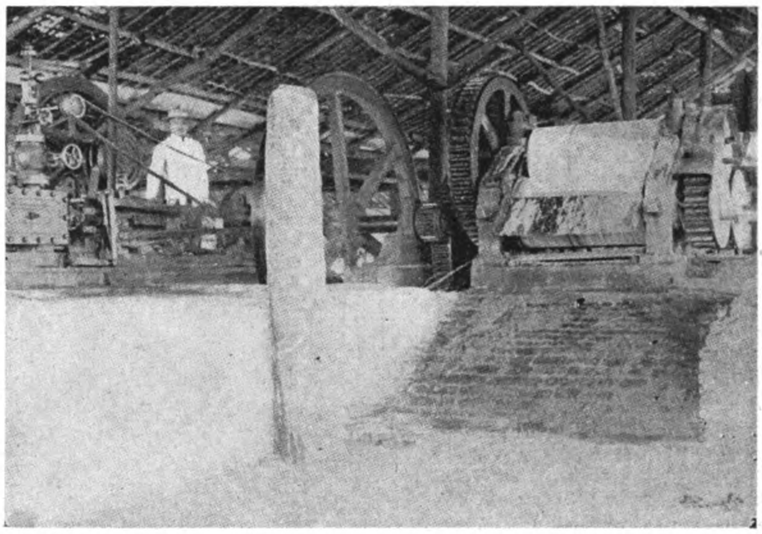
Locality	SiO_2	Al_2O_3	CaO	MgO	CO_2
Han-chin (Mukden)...	.393	1.754	37.893	7.676	49.890
Ka Ban—					
Sample 1	4.80	2.30	18.52	24.51	42.95
Sample 2	1.60	.47	36.94	9.27	47.76
Sample 3	10.44	.99	28.49	15.68	41.58
Sample 4	6.893	1.185	29.993	28.208	40.609
Sample 5	9.74	1.50	26.57	17.25	43.62
Sample 6	9.39	.66	32.48	8.76	45.77
Nee Hsin—					
Sample 1	.13	1.18	42.47	11.68	—
Sample 2	.10	.25	50.24	6.10	—
Sample 3	1.18	.32	46.83	8.34	—
Wusih—					
Sample 1	5.39	6.13	41.25	7.78	39.24
Chao Hsin	15.18	7.13	39.85	5.14	30.80

The analyses of some nearly pure high calcium limestones are as follows :

Locality	SiO_2	Fe_2O_3 & Al_2O_3	CaO	MgO	CO_2 $+H_2O$
Wusih—					
Sample 1	.39	.19	54.58	.71	43.74
Sample 2	Trace	.20	55.51	.53	43.61
Sample 3	.10	.17	54.66	.93	43.68
Sample 4	2.95	1.10	52.30	.51	42.43
Sample 5	4.02	2.25	50.47	.99	41.31
Sample 6	1.83	.71	52.05	1.43	42.44
Nee Hsin—					
Sample 1	.41	.10	53.18	.90	—
Sample 2	.49	.12	52.94	2.31	—
Tung Ting—					
Sample 1	.05	.14	55.38	.43	—
Sample 2	.43	.15	53.51	2.11	—
Sample 3	.29	.23	54.87	.82	—
Sample 4	.05	.08	55.50	Trace	—
Kan Tze—					
Sample 1	.05	.11	55.04	.13	43.70
Sample 2	.42	.32	54.18	.22	43.38
Sample 3	.15	.20	54.96	.18	43.75
Ching Kiang—					
Sample 1	1.83	1.10	53.50	1.74	42.76
Sample 2	1.10	.27	54.75	.64	43.21
Sample 3	1.79	.49	53.87	.53	43.02
Lungtah—					
Sample 1	.36	.30	55.44	.43	43.75
Sample 2	.09	.11	55.43	.16	—
Tong Shan	2.22	.42	52.46	.30	42.80
Wuchow	.06	.09	55.94	.18	43.75
Unknown—					
Sample 1	.22	.18	55.91	.32	—
Sample 2	3.38	1.50	53.61	.62	—
Sample 3	3.57	.39	51.09	2.98	—
Sample 4	.99	.27	54.63	1.19	—



Crushing Sugar Cane, Bago, Occidental Negros



Hacienda San Jose—Mill and Engine, San Carlos, Occidental Negros

The Manufactures of the Philippines

Rapid Strides Being Made in the Development of Industry

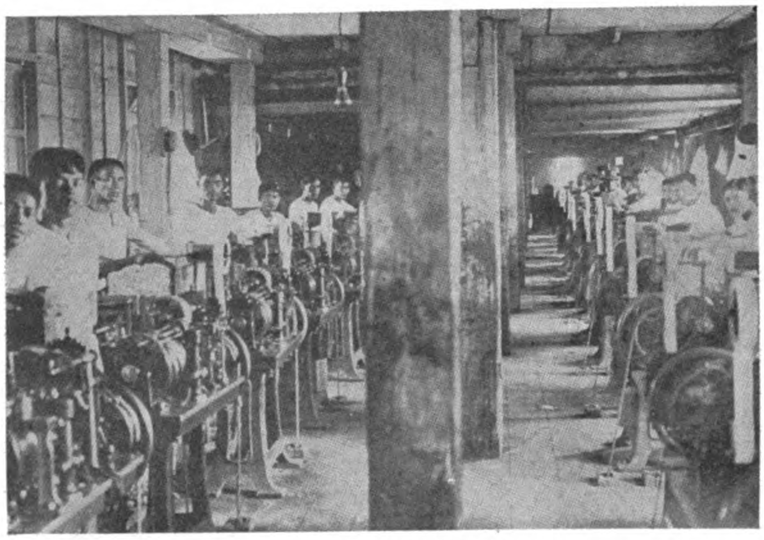
MANUFACTURING in the Philippines in general was confined until recently to small shops that produced barely enough to meet the immediate and local wants of the inhabitants. The manufacture of cigars and a few other commodities, however, was carried on on a large scale prior to the American occupation. In recent years modern machinery has been introduced into various industries, and the results are shown in the notable strides in the exportation of manufactured and partly manufactured articles. From a total value of about P.2,000,000 in 1900, these exports rose to over P.128,000,000 in two decades. The greatest bulk of the exports in these articles in 1900 consisted of cigars, the rest being cigarettes, cordage, and a little coconut oil. In 1923, sugar valued at P.69,038,246 still kept its place at the top of the export list; cigar exports increased fivefold; coconut oil reached the amount of P.28,133,164; embroideries, P.12,746,529; and cordage, P.1,497,769. Many other important manufactures, such as hats, knotted hemp, pearl buttons, ilang-ilang oil, etc., figured in the list of exports.

As has already been stated, the Philippines is not as yet a manufacturing country and will probably not become so for some years to come. The foregoing figures tend to indicate the extent of its possible development along industrial lines. The available local supply of raw materials is extensive and skilled labor can be secured. Among the available raw materials are Manila hemp for cordage, twine, hats, cloth, etc.; ilang-ilang for perfumery; lumber, shells, etc. Only a small beginning has so far been made in manufacturing these raw materials into finished products before being exported.

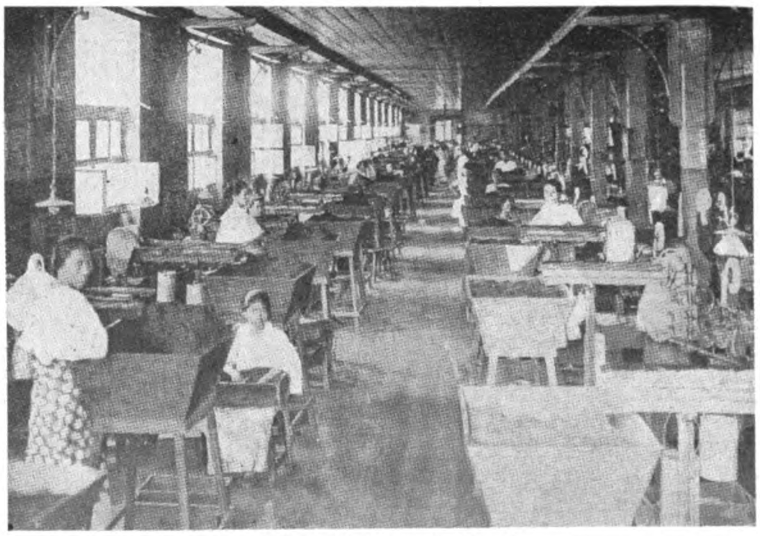
Sugar Centrals

The last seven or eight years have witnessed by far the greatest development in the history of the Philippine sugar industry. The establishment of modern sugar centrals was an important factor in this development. The first modern sugar central in the Philippines was established in 1910, by the Mindoro Sugar Company, at San Jose, on the island of Mindoro. Many other centrals with improved machinery were subsequently installed in almost all the leading sugar provinces of the islands, so that following 1910 sugar production and exports considerably increased. Early in 1924, thirty-one sugar centrals with a total capacity of 22,970 tons of cane per day were in operation. Most of these centrals are located in Negros. The majority of them are owned by Filipinos and most of them are engaged in both milling and cane-growing.

The principal kinds of sugar produced in the country are centrifugal and "muscovado." A small amount of refined sugar is also now being produced and exported. Centrifugal sugar is produced in sugar centrals, while the "muscovado" is crude or brown sugar manufactured in the antiquated mills and made to crystallize in open trays. These two kinds of sugar are graded



Cigarette Machines, Manila

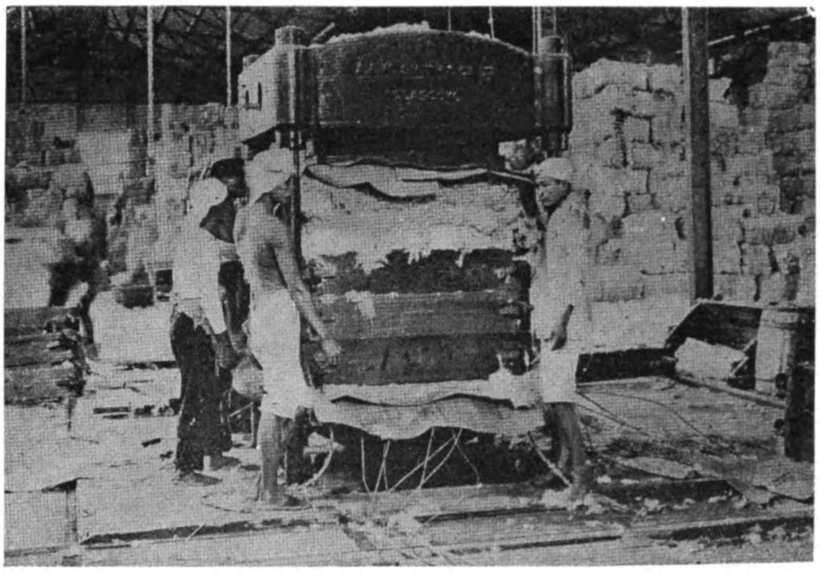


Cigarette Factory, Manila

according to the degree of polarization. Centrifugal sugar ranges from 96° to 99° polarization although very little above 97° is actually produced. The different commercial grades of "muscovado" sugar, based on polarization, are as follows:

Grade	In Manila	In Iloilo
No. 1	86°—88°	87°—90°
No. 2	84°—85.9°	85°—86.9°
No. 3	82°—83.9°	82°—84.9°
No. 4	80°—81.9°	80°—81.9°
No. 5	78°—79.6°	76°—79.9°
No. 6	76°—77.9°	70°—75.9°
No. 7	below 76°	

Sugar of lower polarization than 70° is called "corriente" in the Iloilo market, and is of a very dark color.



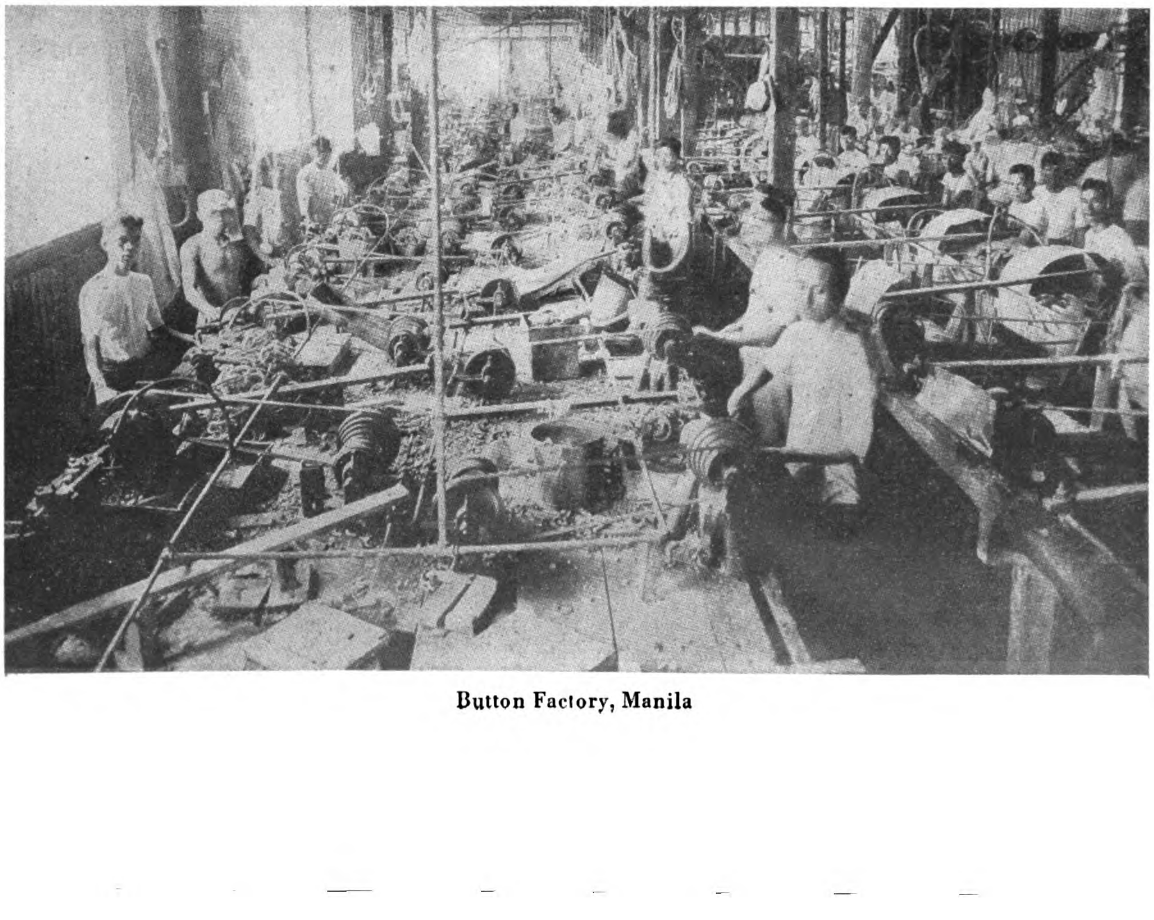
Baling Native Cotton, Manila

*Muscovado sugar is usually packed in buri bags. The bags are then tied with rattan. Centrifugal sugar is packed in jute bags of convenient size (50 kilos) for handling. These are sewed up with jute strings. Buri bags are manufactured in Bantayan island, in Cebu, and in some towns of Capiz province. Jute bags are imported from India. They are more durable but much more expensive than buri bags.

The present sugar production of the Philippines could be more than quadrupled if all suitable sugar lands in the country were cultivated and additional modern mills or centrals constructed. The centrals are now limited to a few provinces, and their construction in other regions would be a large factor in the stimulation of increased acreage devoted to this staple, especially among small farmers and producers. With many of the old wooden mills still in use and relatively few sugar centrals now in operation, the annual sugar production reaches from 300,000 to 400,000 tons. On the other hand, Cuba, with an area only about as large as Luzon and Negros combined, produces about 4,500,000 tons of sugar every year. In 1923 Cuba had 182 sugar centrals while the Philippines had only 31.

Coconut Oil Mills

The first concern to engage in the production of coconut oil in the Philippines was organized in 1909. Previous to that time the oil was produced by crude methods and exports were almost negligible. Before the war broke out in Europe only one oil mill was in operation in the islands. During the latter part of 1918, it was estimated that the thirty-one oil mills in operation, which produced an average of 1,300 tons of oil per day, required a yearly supply of 800,000 tons of copra, as against the islands' annual production amounting to only 300,000 tons. There were, therefore, more mills than was warranted by the available local supply of copra, and when the demand slackened many of these were forced to close. At the present writing there are but a few mills in actual operation. Almost all of these mills are located in Manila, Cebu, and San Pablo. Their aggregate monthly output is approximately 12,000 tons.



Button Factory, Manila

The classifications for coconut oil are not so definite as for sugar, tobacco, and hemp. Several grades of oil are, however, known in the world market as the Cochin, Java, Ceylon, Japanese, and Manila grades. This classification is based on the fatty acid contents of the oil, the less free fatty acid it contains, the better the quality.

Tobacco Factories

Originally the bulk of the tobacco exports from the islands consisted of leaf tobacco but the present tendency is to encourage exportation of its manufactures, such as cigars, cigarettes, etc. At the present time more than half of the annual tobacco exports is composed of cigars alone. In 1923, there were 88 cigar and 33 cigarette factories in operation, most of which are found in Manila. During that year, they manufactured 84,329,254 cigars and 4,485,775,960 cigarettes for local consumption, and 339,219,783 cigars and 39,426,606 cigarettes for export to foreign countries. Some of the bigger factories own plantations in the provinces from which much of their supply of leaf tobacco is taken. The greater number of the factories, however, get their supply from producers in various parts of the islands.

All leaf tobacco to be manufactured is taken to Manila by agents or individual sellers who dispose of it to the manufacturers or exporters. Agents of most of the Manila firms are stationed in all the leading tobacco-producing regions of the islands, to buy leaf tobacco either direct from the producers or through individual buyers.

The tobacco leaves after being dried reach the manufacturers in hands or "manojos," and the manufactured cigars and cigarettes are shipped in boxes properly labeled and stamped, after being rigidly inspected and carefully classified.

Skilled workers, a majority of whom are women, supply most of the labor needed in the tobacco factories in Manila and new workers can always be secured, so there is little of a labor problem to handicap the industry. All cigars are made by hand.

Manufactured Philippine tobacco is known in the trade as Manila cigars and cigarettes, but each tobacco factory has its own trade names, and altogether there are more than 3,000 different brands. Standard Manila cigars rank with the best and choicest smokes of their kind in the world markets to-day. The markets for them are still growing, particularly in the United States. The present

problem is to get them more widely known. A tobacco agent of the Philippine government has been appointed in the United States to popularize and look into a more extensive market for Philippine tobacco. With the steady growth of the market for Manila cigars and cigarettes, the amount of production has correspondingly increased every year.

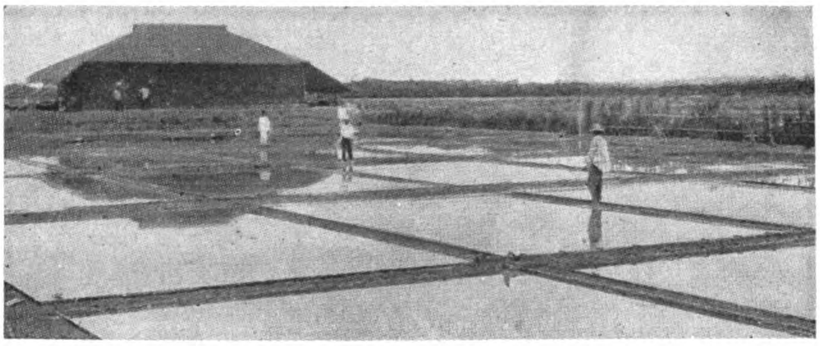
Hemp Articles Manufactured

Unitl recent years almost all the Philippine exports of hemp consisted of the raw fiber, and even at present most of the exports are in this form. The cordage factories in the importing countries make the fiber into ropes, cables, and different forms of twine and coirs. There has lately been noted, however, an increasing development of manufacturing industries which turn out hemp-made articles. The most important among these are rope manufacture, the making of hemp braids and hemp hats and the old industry of utilizing the fiber for textile purposes.

Abaca as Cordage Material

Abaca is the premier cordage fiber in the world, owing to its relative lightness, tensile strength, durability, and high resistance to the action of water. The Philippines has a complete monopoly of this cordage fiber, which is greatly in demand in maritime countries. But although hemp as cordage material is unsurpassed especially for maritime use, it was only in 1913 that cordage appeared as an export article. The cordage industry received a great impetus during the war when the demand for cables and ropes was especially great. To-day there are several rope factories in the islands. There is also evidently a steady market for Philippine rope in the United States.

The manufacture of ladies' hats, for which the raw material used is hemp braid, is a young and growing industry. Formerly hemp braids were largely imported from Japan. At present most of the raw material is supplied by a Filipino concern. The making of hemp-braid hats has proved to be so successful in the past that many new concerns have recently been established. As a result the demand for braids now exceeds the supply, and frequently hat makers are unable to fill big orders coming to them due to shortage of hemp braids.



Salt Works, Malabon, Rizal

Besides being manufactured into ropes and braids, abaca fiber is also used in the manufacture of cloths. It is woven with cotton in numerous varieties of patterns and the fabrics thus produced are in every degree of fineness, from delicate silk-like textiles to the coarse material used for fishing nets. The inferior grades and the waste of abaca fiber afford an excellent material for the manufacture of paper of good quality, but this industry has not yet been established.

Rice Mills

In the earlier days the use of rice mills was unknown. Threshing of " palay " by carabaos and pounding in mortars were the common methods. The growers then consumed practically all the rice they raised, and the need for wholesale milling of rice was very little realized, if at all. The localization of rice cultivation in a few regions, because the cultivation of the export crops became more profitable in the places where rice was formerly grown, made rice milling in the former localities imperatively necessary to cope with the growing rice trade. Year by year new mills were therefore established. The local trade in rice has continued to develop and the installation of rice mills has become more widespread.

In 1922, more than 450 rice mills, with a maximum daily capacity of 67,346 cavans, were in actual operation. These mills were distributed in twenty-five different provinces, as follows :

Provinces	Number of Mills	Kinds of Mills: Steam	Hydraulic	Man or Animal	Cavans produced
Albay	15	3	12	—	42,555
Ambos Camarines	24	10	14	—	39,612
Bataan	4	4	—	—	40,555
Batangas	71	70	—	1	209,958
Bohol	7	—	—	7	1,642
Bulacan	44	44	—	—	1,109,547
Capiz	5	5	—	—	71,055
Cavite	25	23	1	1	199,312
Iloilo	9	8	—	1	137,219
Laguna	78	55	23	—	343,318
Mindoro	3	3	—	—	10,590
Nueva Ecija	18	18	—	—	337,485
Occidental Negros	6	6	—	—	35,973
Pampanga	42	42	—	—	627,803
Pangasinan	8	8	—	—	269,970
Rizal	18	18	—	—	82,268
Sorsogon	6	1	5	—	4,555
Tarlac	16	16	—	—	414,266
Tayabas	37	22	14	1	83,816
Zambales	3	3	—	—	5,748
Other provinces	13	11	1	1	218,747
Total	452	370	70	12	4,381,994

Most of these mills are run by steam and motor and some by hand, water, and other means. A great deal of pounding and hulling of rice by hand is still being done in the provinces ; but the need for rice mills is now realized in many of the centres of production, and the mills are becoming more widespread. The number of rice mills already established is deemed adequate to handle the present output but a better distribution of the mills is needed. The government is urging a more extensive production of the cereal, and as production will increase, a corresponding greater number of rice mills will be required.

Distilleries

The manufacture of distilled spirits, wines, beer, and fermented liquors has been carried on since the earliest days of Philippine history. At first the output was probably confined to supplying the immediate wants of the makers with little, if any, used in trade. Spain encouraged the importation of wines and liquors, and the fermentation of the nipa sap and sugar juice became more widespread. Distilleries were later established in different parts of the country, though catering mostly to local demand. Beverages did not become an item of export until the year 1915. The total value of the entire output of liquors in the Philippines is estimated to be between P.16,000,000 and P.20,000,000 annually. The total number of lagorers employed in this industry ranges from 1,000 to 1,500. At present the liquor exports are mostly to Hongkong, Japan, and the French East Indies.

Among the most important local materials used in the manufacture of distilled alcohol is the sap of the nipa palm, which grows extensively in various parts of the islands. The nipa swamps are most abundant in Bulacan, Laguna, Pangasinan, Pampanga, Capiz, Cagayan, Surigao, Samar, and Tayabas. " Tuba," as the nipa palm wine is called, used to be the favorite drink of the inhabitants. Besides the nipa tuba, other important products are used in the Philippines in the manufacture of alcohol, namely, corn, rice, sugar cane, molasses, and coconut sap.

Shoe Manufacture

There are two types of shoe-making establishments in the Philippines, namely the modern factory using labor-saving ma-

chinery, and the small shops in which shoes are made by hand. In 1918, there were 138 shoe establishments and factories with a total production of P.2,350,327. The amount invested aggregated P.1,677,616.

There are only a few modern shoe factories in Manila at the present time. In 1918 sales of these factories were estimated at about 200,000 pairs valued at P.2,000,000. These modern factories manufacture a great variety of shoes for sport and outing, military, and everyday wear.

At present there are about one hundred and forty small shoe shops in Manila and probably about the same number in the provinces. These shops are owned mostly by individuals or partnerships, with small capital. Their output depends upon actual local demands, but although it is much less in quantity than that of the modern factories, there is a greater variety of styles to suit the tastes and whims of buyers. It would be very difficult to classify the great variety of shoes made to order in these small shops, but it may be said that they are usually made in accordance with the latest styles in the United States.

The actual demand for shoes in the islands is far greater than what the present factories and numerous shoe shops in the country can meet. Over two million pairs of shoes valued at about four and a half million pesos were imported in 1918, decreasing in 1922 to only over 703,000 pairs valued at P.1,226,460, and in 1923 to 73,421 pairs valued at P.277,759. These figures indicate the ample room for the native shoe industry to expand. The local market for shoes is assured. The establishment of more modern shoe factories will reduce considerably the present importations of shoes into the Philippines from the United States, Europe, and China.

Philippine Furniture

The making of furniture is carried on extensively in the Philippines, generally as a household industry, there being an abundance of raw materials on hand, such as hard woods (narra, molave, ipil, etc.), soft woods (almon, lauan, and others), bamboo, and rattan and other vines. In the large cities, especially in Manila, there are large establishments engaged in the manufacture of high-class furniture, such as beds, tables, chairs, settees, office furniture, etc. A conservative estimate of the yearly output may be placed at around P.2,000,000. All kinds of excellent furniture are also manufactured on a big scale by the inmates of Bilibid prison, the insular penitentiary of the islands, the articles produced being destined for both local and foreign markets. Different kinds of bamboo and rattan furniture are common chiefly because of their lightness, durability and cheapness. Mention may be made of the San Miguel rattan chairs which are manufactured in Bulacan on a large scale and distributed throughout the entire archipelago. The familiar Hongkong bamboo and rattan chair is manufactured from materials exported from the Philippines. This is rapidly being supplanted, however, by the San Miguel product which is steadily increasing.

Electric Light and Power Plants

There are in all about 35 electric light and power plants in the Philippines, not including small lighting systems for private use, in which over P.31,000,000 have been invested. Each plant operates under a special franchise and is under the supervision of the office of the public utility commissioner. The largest electric light and power plant is the Manila Electric Company situated at Manila. This plant has a present capacity of approximately 17,000 kilowatts, normal rating. It supplies the city with both illumination and power, conducts an electric street railway system within the city and its suburbs.

It will be realized, that even with all these electric light and power plants already installed, many towns in the islands are still in need of such facilities. Hundreds of the big towns, provincial capitals, and centres of population have none, and the demand will grow as they increase in population and wealth. That capitalists as well as individual citizens have not been slow to answer this demand, may be noted from the ever-increasing number of electric and power plants installed and new franchises granted for this purpose in late years. In 1918, there were only 14 plants in operation, and in April 1924, this number had increased to 43. The notable increases of the yearly importations of the equipment and machinery needed for these plants, further corroborate this.

Almost all of the electric light and power plants' equipments and apparatus are of American manufacture. In 1923, the islands imported electrical instruments and apparatus to the value of P.2,331,090 as compared with P.1,891,967 during the next preceding year. It may safely be stated that the United States supplies over ninety-five per cent. of all electrical instruments and apparatus used in the Philippines.

Salt Manufacture

Nothing definite is known as to the beginnings of the salt industry in the Philippines, although its existence has been traced back by Spanish writers to over three hundred years ago. It is probable that families dwelling on the sea borders of the Philippines manufactured salt in past years in the same manner as they do to-day, at least for their own consumption. At the present time the industry is common in the provinces of Rizal, Cavite, Cebu, Iloilo, Bulacan, Ilocos Sur, La Union, Pangasinan, Ilocos Norte, and other provinces on the coast.

The annual output of salt in the islands is large, as shown in the following figures :—

Year	Kilos	Value
1911	18,333,000	P.350,000
1912	19,147,000	574,511
1913	19,500,000	575,000
1914	20,000,000	590,000
1915	22,500,000	600,000
1916	24,750,000	742,500
1917	26,000,000	780,000
1918	30,000,000	900,000
1919	32,000,000	900,000
1920	62,383,000	1,401,307
1921	31,247,000	800,686
1922*	32,878,000	386,850
1923*	31,306,000	530,401

Of all local industries few lend themselves more readily to comparatively easy means and effort than does the salt industry. The manner of production, as exemplified in the evaporation of sea water, is very simple. The expense of the operation is small; the raw material, which is sea water, may be had at any time without cost; and no skilled labor at all is needed. The article produced is rather coarse and used mostly in salting shrimps and fishes. For table use of the well-to-do families, refined salt has to be imported.

Candy Factories and Bakeries

Although candy making was long ago introduced into the islands, the industry is still in the infant stage. To-day there are only fourteen candy factories in existence, all of which are found in Manila. Of this number two are owned and managed by Americans, four by Filipinos, three by Japanese, three by Chinese, one by English, and one by Spaniards. Three of these are equipped with modern machinery. There are, besides, about 1,000 bakeries, confectionery, and caramel factories.

Materials for candy making abound, such as coconuts, casoy nuts, peanuts, pili nuts, chocolate, milk, and flavors. Sugar, coconuts, peanuts, and casoy nuts are produced locally. Peanuts are also imported from China and Australia. Pili nuts and chocolate can be obtained locally, but great quantities of these are imported to meet the demand of the factories. Canned milk and flavors are also brought in from foreign countries. The output of these factories is sold in tin cans, bottles, and boxes.

The candy industry in the islands is still capable of expansion. Among the important factors favoring its development, mention may be made of the abundance of sugar, the feasibility of increasing the supply of tropical nuts of different kinds, and the ever-expanding local demand for candies. However, the industry is confronted with the present insufficient supply of containers. The establishment of bottle and can factories is needed.

Soap Manufacture

The manufacture of soap is carried on a big scale in the Philippines. The industry is found mainly in the city of Manila. Some factories are also found in the provinces. There are at the present time one big factory and about eighty other soap manufacturing

*Production of 20 provinces only.

establishments in Manila, the majority of which are owned by Chinese. These soap establishments produce only the crude article for laundry purposes. The single big soap factory can fill but a small percentage of the local demand for toilet soaps, as may be seen from the increasing importations of this commodity. These imports which amounted in 1910 to only P.338,202 in value, increased to P.1,376,948 in 1920. In 1923, the amount imported was only P.786,932. The production of soap in 1918 amounted to over P.350,000.

The basic ingredients in the manufacture of soap, whether it be the ordinary kind used for washing clothes and cleaning utensils or the delicate toilet soaps, are oil and alkali; the latter may be in combination with sodium hydroxide or potash. The ordinary Chinese soap generally used in the Philippines for washing clothes is a combination of coconut oil, water, salt, and sodium hydroxide, commercially known as caustic soda. There are two kinds of soap manufactured by the Chinese. One is hard and white, the other is soft and yellowish with a hard white portion at one side or at the end. The ingredients used in the manufacture of both kinds are the same, except that the former contains a greater percentage of caustic soda.

Cement Manufacture

The raw materials needed in the manufacture of cement are found in a number of islands. Among the most important of these are the calcareous materials which include pure and hard limestones, and the argillaceous materials which include shales, residual and transported clays, and volcanic tuff.

The following localities possess special advantages as cement manufacturing sites: Cebu island, Mactan island, Albay province, Masbate island, Polillo island, Bani in Pangasinan, Romblon island, Balayan and vicinity in Batangas province, and Loay in the province of Bohol. All these localities have abundant raw materials for cement manufacture as well as water power, or in the absence of water, coal mines that could be utilized for fuel, and excellent facilities for transportation.

The best site for the industry, however, is in the island of Cebu, which has adequate harbor facilities, a good local fuel supply, abundant raw materials, suitable millsites, good roads, and railroad facilities. Labor in Cebu is abundant and is cheaper than in Manila. The island of Negros near Cebu has several lumbering concerns where cement barrels could be manufactured. The Cebu Cement Company, capitalized at P.5,000,000, has recently constructed one of the biggest cement plants in the Orient at Naga, Cebu. The company is now almost entirely capitalized by the National Development Company, a government business organization. It is stated that the plant has a maximum capacity of 5,000 barrels per day, and the reports of its activities are very promising.

There are several thousand other industries some of which might be treated individually because of the magnitude of their production or because Philippine conditions warrant their establishment on an extensive scale. Of the former, may be mentioned sawmills of which there were 68 in March 1924; lithography, printing and book-binding; carpentry; shrimp and fish drying and salting; copra drying; macaroni, spaghetti and vermicelli making; the ice plant industry; gold and silversmith industry; and corn milling. Of the latter may be mentioned the manufacture of dyestuffs, silk, desiccated coconut, pineapple, glass, paper, coir mat, perfume, roofing materials, starch, and papaya gum.

Ship Building

Before the Spanish regimé, shipbuilding was carried on extensively in all the provinces on the sea coast. Wooden ships known as "naos" and "paraos" were built, some as large as the 2,000-ton vessels of to-day, having over 100 oarsmen and capable of carrying several hundred soldiers. These were undoubtedly of large tonnage then, and were used on the high seas. In the Moro regions, "vintas" and other vessels have been extensively built for years, these being large enough for trade with the northern islands and the Dutch East Indies. These fact illustrate that shipbuilding in the past was great industry, and that the people were very skillful as navigators.

In 1918 there were 35 concerns in the boatbuilding business with an aggregate investment of P.12,295,951 and an output of P.P.2,656,508, eighteen of these being distributed in Manila and in seven different provinces as follows: Cagayan, 1; Cavite, 2; Iloilo, 4; Occidental Negros, 1; Manila 4; Pangasinan, 2; Sorsogon, 3; Zamboanga, 1. These concerns are prepared to construct craft of 250 tons or more. Some of them have already turned out vessels of such capacity and have even built much larger ones. Most of these concerns, however, devote their efforts to the construction of small vessels for Philippine waters.

All provinces where the industry is carried on have an almost unlimited supply of timber close to the place of construction. Many other provinces also have abundant timber and labor. A preliminary survey of the shipbuilding industry in the Philippines indicates that the supply of timber and unskilled labor can stand a bigger demand, especially in the provinces of Pangasinan, Cavite, Sorsogon, Zamboanga, Manila and in Laguimanoc, Tayabas, where other might well be located. Shortage of labor is reported only in the province of Cagayan.

In a country where freight rates per mile are even double the overseas charges, and where shortage of prime necessities frequently occurs because of lack of bottoms to transport the products, the need of more ships is indeed apparent. Extensive shipbuilding may and should be done in the Philippines to revive an industry that was once general and profitable. The provinces of Cagayan, Cavite, Iloilo, Pangasinan, Sorsogon, and Zamboanga have facilities for the construction of 250-ton craft. Many others not mentioned are engaged in building smaller vessels. Iloilo builders have constructed vessels of 400, 700, and even 2,000 tons, and are somewhat in the lead, although Cavite, with less definite reports of construction, has equal facilities. Albay and Laguimanoc, Tayabas, might well construct 250-ton or larger vessels.

Iron Foundries and Machine Shops

Practically all the foundries and machine shops now operating in the Philippines are located in the city of Manila. A few of them may be found also in other big cities and towns in the islands, as Iloilo and Cebu. During recent years the great increase in the use of machinery of all kinds in connection with agriculture and manufacturing, has greatly augmented the number and activity of the foundries in the country. There are at present more than twenty machine shops and foundries in Manila, varying from the biggest plant equipped with all kinds of machinery for repair and employing several hundred men, to the several small ones using rather simple devices and equipment, and with only a few laborers employed. Some of these plants are both foundries and machine shops. The foundries do casting both in iron and in bronze. Besides these foundries and machine shops, there are at present over a hundred vulcanizing plants, carriage and auto repair shops doing business in the city of Manila and in the provinces.

Mineral Waters

The use of artesian and distilled water is quite common in Manila. It is estimated that the total daily consumption of artesian and distilled water in Manila is 11,452 gallons. This on the basis of an average daily consumption of 2,863 demijohns of water, each containing approximately four gallons. Not all the inhabitants of the city use artesian or distilled water, however; in fact the majority of the laboring class drink the ordinary water from the Montalban reservoir, which is the source of the water supply of Manila. During the rainy season, however, when the water from Montalban is muddy, artesian water is more generally used. The government ice plant sells an average of 1,063 demijohns daily, both of distilled and artesian water to government offices, hospitals run by the government, schools, and to the general public as well.

The soft drink industry in the Philippines is at present mostly in the hands of small manufacturers. Of the twenty-three aërated water factories in Manila, only a few are incorporated companies, the rest are partnerships or individually owned. Twelve of these factories are owned and managed by Filipinos, seven by Chinese, three by Americans, and one by Japanese. There are also small aërated water factories in many of the provinces.

The most important materials used in the local manufactures of soft drinks are bicarbonate of soda, sulphuric acid, refined sugar, and numerous extracts for different flavors, and corks or tin caps and bottles. Many kinds of soft drinks are made, the most common among them being lemonade, sarsaparilla, and cream soda. The big factories make twenty or more different flavors.

The industry has a purely local market, although one of the big factories is said to have begun exporting some of its products to Java and Indo-China. With few exceptions, the output of each

factory is consumed within the narrow confines of the districts were the factory is located. The local demand for aërated water products is not steady throughout the year, the most prosperous period for the industry naturally being the hottest months. In addition to the output of the local factories, the islands import from P.40,000 to P.60,000 worth of aërated water annually.

Cloth Manufacture

Among the oldest as well as the most common household industries is the weaving of cloths, which is now confined to a few regions. Originally intended only for supplying the immediate needs of the family, the cloths thus manufactured later assumed an important rôle in the domestic trade of the islands. The output of the simple looms increased as the industry found an ever-widening local market, P.680,246 worth of textile articles having been produced in 1918. The most important cloths manufactured are the "sinamay" and the "abatex," both of which are made mostly from the abaca fiber ; the "piña," made from the pineapple fiber ; "jusi," made from imported gummed spun silk fibers in threads mixed with mercerized cotton or the native abaca, piña, and maguey fibers ; and the "Abel Iloco" or Ilocano cloth, manufactured in the Ilocos provinces from both native and imported cotton threads.

The "sinamay" cloth is the most common material used for making dresses for Filipino women. It is also used to a certain extent for the "camisa de chino," and "barong filipino" by the male population. The leading producers of "sinamay" in the Philippines are the towns of Jaro, La Paz, Arevalo, Dumangas, Santa Barbara, Pototan, and Oton, all of which are in the province of Iloilo ; Calivo and a few other towns in Capiz province ; the different towns of the Bicol provinces, of which Legaspi is the centre of production and trade ; and Rizal and Bulacan.

The "*jusi*" cloth woven in the Philippines is made of different materials, the sources of which are both local and foreign. The "jusi" fibers or threads are imported from China. The jusi is a cheap kind of silk spun into fine threads and later gummed. The "jusi" cloth is made of this jusi fiber in combination with fine or mercerized cotton threads. Other fibers which go into the make-up of "jusi" cloth are the native abaca, piña, and maguey. In making the best and most expensive "jusi" cloth, spun silk is used instead of cotton threads and the fine native fibers. Among the leading producers of "jusi" cloth in the island are Malabon in Rizal province, and Hagonoy in Bulacan.

"*Abel Iloco*" or Ilocano cloth is the general term used for all kinds of cloths—blankets, towels, napkins, table covers, etc.—manufactured in Ilocos Norte, Ilocos Sur, La Union, Abra, and the Mountain province, where cotton is raised to some extent. Although probably most of the cotton thread used in weaving comes from China, the United States, the United Kingdom, and other foreign countries, a considerable amount of cotton is raised locally. Cloths made from the Philippine cotton thread is more durable, but owing to the crude local methods used in spinning the thread, it is much more expensive. The "Abel Iloco" is woven in many designs and is suitable for all kinds of cloths. The main quality of the Ilocano cloth as compared with the other native cloths of local manufacture is its superior strength and durability. The weaving of the "Abel Iloco" is carried on in many households in the Ilocano provinces. It is not produced in commercial quantities, except in the town of Paoay, Ilocos Norte, where towels and blankets are extensively produced ; in Bangar, La Union, where blankets and table covers are manufactured for trade ; and in the towns of Bantay and Caoayan, Ilocos Sur, where a great deal of light dress goods for women, and silk fabrics and handkerchiefs are turned out. In other towns, the production is barely sufficient to meet the family needs.

In the manufacture of all these cloths, simple wooden looms operated by hand are used. One woman is generally sufficient to operate one loom and the rate of production depends on the skill of the weaver and the intricacy of the design. There are only two factories for weaving cloth in the islands, both of which are located in Manila.

The Leather Industry

The preparation of raw hides and skins is an industry that has hitherto not received the attention it deserves. There are in Manila seven tanneries, owned and operated by Chinese. The town of Malabon, Rizal, boasts of the only modern tannery in the country. Small tanning factories are also in operation in Dagupan, Pangasinan ; Naga, Camarines Sur ; Taal, Batangas ; Cebu, Cebu ; and Meycauayan, Bulacan. The Philippine Tannery Company in Malabon turns out approximately 15,016 pieces a year. Twelve tanneries are in operation, having a combined output of from 2,500 to 5,000 pieces a month. The annual leather consumption of the shoe shops and factories is constantly on the increase. Salted hides which are used by the Meycauayan and Manila tanneries, come from the provinces. There are certain localities in the islands which graze big herds, but most of the supply of hides is obtained from localities where cattle and other animals are slaughtered for the market. Among the most important are those in Batangas, Mindoro, Jolo, Zamboanga, Masbate, Catanduanes, Misamis, Cebu, Palawan, Romblon, Pangasinan, Nueva Ecija, Tarlac, Pampanga, Ilocos Sur, Ilocos Norte, and Bulacan.

The only tanning materials used in the Philippines are the barks of the Philippine species of mangrove and of the camanchile tree. The former is very plentiful and cheap, selling at from P.3.50 to P. 4 per picul of 63.25 kilograms, in the Manila market. Good light-colored leather can be produced by combining the camanchile and mangrove barks, as shown by experiments performed by the bureau of science. The mangrove barks are not commonly used by local tanners outside of Manila, as they make leather harsh and of a dark red color. However, it is widely used in Europe and America. Camanchile bark is used almost exclusively by Philippine tanners, who prefer it on account of the light-colored leather that it produces. The price of air-dried camanchile bark has risen to as high as nine pesos per picul in the Manila market. The tree is widely scattered throughout the islands, especially in the Ilocos provinces, Batangas, Nueva Ecija, Rizal, Laguna, and Cavite.

Dye-stuff Materials

There are over one hundred species of dye-yielding plants in the Philippines, but so far only two have entered commerce to any appreciable extent, namely, indigo and sappan or sibucao. Indigo, locally known as *tayum*, *tagum*, *tayumtayum*, and *taguntagung*, has depreciated in commercial value as a result of competition by the coal-tar dye industry and the manufacture of arificial indigo. At present, it is cultivated on a small scale only in certain sections of northern Luzon, particularly in the Ilocos provinces, whence a little surplus of the local output is exported.

It is believed that the prospect of reviving the indigo industry in the Philippines is not altogether hopeless. Dyeing materials are greatly needed for coloring abaca, piña, cotton, and other articles, such as mats, hats, and baskets.

Sappan wood, commonly known as sappan or sibucao, is an uncultivated shrub found all over the Philippines, particularly on Guimaras island and in some parts of Panay. The dye it yields is brown ; but this may be converted into other hues depending on the ingredients with which it is mixed, as black, when employed with iron sulphate of iron rust ; red, with potassium bichromate ; and dark red, with lime. Other shades may be obtained by combining sappan with such materials as the bark of a Philippine tree known as "aro-o" with the root-stock of "kunig," in which cases the resultant dyes are reddish brown and golden or yellowish, respectively. It has been found by the bureau of science that the wood also contains brazilin, a certain coloring matter yielded by a Brazil wood which, however, is objectionable as a dye because it is not fast and is very sensitive to acids and alkalies.

Among the dye-stuff materials of minor importance, mention may be made of the barks of "bayog," "bancudo" "dungon-late," mangrove, the wood of "bancal" and the seed of "achuete."

Limestones, Bricks, etc.

According to the Bureau of Science "limestone of excellent quality is abundant throughout the Philippines, and guarantees to this archipelago important industries, among which is the manufacture of artificial stones and bricks from sand and lime." Among the many uses to which either the reconstructed stones or the sand-lime bricks can be applied, are the manufacture of building blocks, sills, caps, fence posts, slabs, tiles, wall-copings, templates, jambs, lintels, steps, landings, curbstones, pipes, sidewalk slabs, and ornamental work such as elaborate moldings, and artificial marble.

Common siliceous sand is said to be the most desirable and the cheapest source of silica for the sand-lime brick industry,

being comparatively pure and fine for a cheap and durable product. Silica is often obtained from quarry débris, soft stone, and volcanic tuff. Siliceous sand, soft stones, and volcanic tuff occur abundantly in many parts of the country.

The Bureau of Science reports that " the most generally distributed calcareous material in the islands is a hard limestone of the Miocene age, which is usually associated with shales and sandstones, and occurs abundantly in nearly every island of the archipelago. It is uniformly pure. In general the physical condition of the Philippine limestones is very satisfactory. Their hardness, while sufficient to insure solidity during the burning process, is not great enough to prevent easy quarrying."

In the vicinity of Manila, " quarry débris is available. The amount of rock and crushed stone used in Manila break-waters, macadam roads, and concrete structures is considerable, and at present four quarry sites are operated to meet the demand, namely, the Rizal, the Manila city quarries on Talim island, Carabao island quarry in the south channel entrance of Manila bay, and the Sisiman quarry near Mariveles."

The three most commonly used materials for roofing in the Philippines are nipa, galvanized iron, and imported tiles. Nipa, the cheapest and most common of the three, is, due to its inflammability, bound to be proscribed in the bigger towns. Galvanized iron is an excellent but rather costly material, and so with imported roofing, tile. The need, therefore, of a more suitable material, cheap, easily obtainable, and if possible, of domestic manufacture, has for the last few years aroused popular interest.

Various tests and experiments along the line of devising a substitute that may be used for all time have been made. The bureau of science has combined clay and tuff, clay and sand, and glazed tiles with varied success, glazed tile proving to be the best, so far as imperviousness to water is concerned. The high price of imported glazing materials, however, is its serious disadvantage. From the tests made by the Bureau of Science, it has been demonstrated that suitable and economical roofing can be made almost exclusively from Philippine materials.

Match Factories

There is, so far, only one match factory in operation in the Philippines, this being located in San Felipe Neri, Rizal province. This factory was established some twelve years ago, and uses the available Philippine raw materials. After repeated trials and experiments the Philippine wood suitable for match sticks and boxes was found. The tropical climate in the islands, with its rapid atmospheric changes, created a problem for the manufacturers different from anything based on European and American experiments. It was especially so in connection with the formula used in the preparation of the composition of the match sticks and in the impregnation of the match sticks themselves in order to give the maximum of safety and reliability. The difficulty was satisfactorily solved, however, and the local output of matches by the factory improved from year to year. The native lumber now used by the factory is growing plentifully near Manila, around Laguna de Bay and on the island of Mindoro.

That the present output of the factory is insufficient to meet the local demand for matches is shown by the increasing amount of yearly importation into the islands of this commodity. The value of the annual imports of matches into the Philippines has grown from about P.900,000 in 1910 to P.872,289 in 1920, and P.761,119 in 1923. Most of the match imports come from Japan and China, the rest from the United States.

Button Manufacture

Button manufacturing is still capable of expansion. The vast supply of raw materials that could be obtained locally, together with the wide market for pearl buttons is a strong guaranty for the success of the button industry in the islands. Only two button factories have so far been established in the Philippines, both of them being situated in Manila. These two factories can use ouly a small fraction of the vast shell resources of the country. Because of its proximity to the supply of raw materials, its excellent shipping facilities, and the availability of water power which may be used advantageously for the industry, Zamboanga in Mindanao, is considered an ideal site for a button factory. The port of Zamboanga has direct steamship connections with foreign ports, as well as with Manila and other ports of the islands, so the handling of the product for trade would be easy.

The United States alone imports pearl buttons to the amount of nearly P.4,000,000 each year. Japan is now supplying almost half of this amount and the Philippines only an average of P.500,000 worth of the article.

Desiccated Coconut

The production and exportation of desiccated coconut offers one of the best opportunities for investment in the Philippines at the present time. The United States is the biggest market for this product, that country now importing an average of over five million pesos worth of desiccated coconut every year.

Ceylon is now getting most of this trade. That small island, with an area of only a little over one-fourth of that of the Philippines, exported in 1920 not less than 58,191,326 pounds. In 1923 there were only three desiccated coconut factories in operation in the Philippines and our exports of this product to the United States amounted to only 4,349,152 kilos (9,568,134 pounds). The Philippines abounds in nuts just as good as those grown elsewhere and there is no reason why this industry cannot be developed here as in Ceylon. Under the new Tariff Act of the United States, desiccated coconut imported from foreign countries pays a duty of 3½ cents gold per pound, whereas, desiccated coconut from the Phillipines enters the United States free of duty.

Pineapple Canneries

Although local conditions favor the development of the pineapple industry on a big scale, only one pineapple cannery has so far been established in this country. The demand for canned pineapples in the world is ever growing. The canned fruit is in big demand in the local markets and in the United States, in China, Japan and Europe. The United States alone now consumes over forty million pesos worth of pineapples every year.

The biggest source of supply of this product at the present time is Hawaii. Experience has shown that pineapples grown in the Philippines from Hawaiian seeds produce good-sized fruits with comparatively sweeter flavor than those raised in Hawaii. Thus the Philippine pineapple will require less sugar when canned. It also has less acid content than the Hawaiian product. Hawaii now seems to have reached the point where it can expand its pineapple industry only at the expense of the sugar industry there. Land in Hawaii, being in great demand particularly for sugar cultivation, now commands a high price. In the Philippines, on the other hand, there are extensive uncultivated lands available for pineapple growing and which may be leased or purchased on comparatively easy terms. The trained labor needed for the canneries can also be supplied locally.

Glass Manufacture

Glass manufacturing could be profitably established in the islands, on account of the enormous demand for glasses and glass containers. The experiments of the Bureau of Science have definitely shown that good grade of bottle glass can be manufactured from Philippine materials. Over half a million pesos worth of glass bottles, dishes, and similar glass manufactures are being imported into the islands every year, mostly from Japan. The local market for these articles is still growing steadily.

Paper Manufacture

The abundance of the local supply of raw materials for paper manufacture has been ascertained, while suitable sites for paper pulp mills have been found. The most important local raw materials for the manufacture of paper in the Philippines is *cana bojo*. This bamboo species is found in large stands in many parts of the islands, mainly in the province of Bataan, near Manila bay. " Cogon " and " talahib " grow in almost all the uncultivated regions of the archipelago and the waste of abaca and maguey affords an adequate supply. Other minor sources of pulp material are coconut coir, nipa palm stalks, parts of the betel nut and buri palm, and the split of the bejuco. Paper pulp could also be made from the chips from lauan, cupang, and other soft Philippine woods.

Three localities are known to be especially adapted for paper mills—Orani in Bataan, Manila, and Masbate. Orani is considered to be the best site on account of its adequate supply of labor and fuel, and its proximity to shipping centres. Manila has the disadvantage of distance from the source of raw materials and of the comparatively high cost of labor prevailing in the city. Masbate, on the other hand, has large deposits of limestone and fuel.

Act No. 2742, which came into effect in February 1918, authorized the Secretary of Commerce and Communications to guarantee profit of not to exceed four per cent. per annum for six years upon any capital actually invested by a person or corporation in a paper and pulp factory within a year from the passage of the act. The local capitalists failed to take advantage of this offer.

The Perfume Industry

The Philippines is especially rich in plants which produce terpenes. An exhaustive investigation of the Benguet pine by the Bureau of Science has shown that excellent turpentine and colophony, practically identical to the products in America, can be produced from this source. Many fragrant plants and flowers possess essential extracts and oils. Among these are ilang-ilang, champaca, orange, lemongrass, vetiver, cinnamon, and ginger. Several of these may be used in the manufacture of non-alcoholic beverages and fruit flavors. " Ilang-ilang " oil, which is not edible, is among those produced in the Philippines. This oil comes from the flowers of the ilang-ilang tree which grows abundantly though uncared for in many parts of the country. In 1923 the Philippines exported 1,940 kilos of ilang-ilang oil, valued at P.118,888.

Vegetable Oils

Aside from coconut oil, other important vegetable oils are produced in the Philippines from the oil-bearing seeds of lumbang, castor, casoy, and kapok. Lumbang or candlenut oil is used principally in the caulking of vessels, in the manufacture of soap, as a substitute for linseed oil in the manufacture of paints, for plaster, for adulterating coconut and olive oils, and for waterproofing lanterns, umbrellas, aeroplanes, and balloons; and the cake left after extraction, for fertilizer. It ranks second to coconut oil, the annual demand ranging from 5,000 to 10,000 gallons.

Castor oil, from beans known locally as tañgan-tañgan, is used in medicine, in the arts, and, in some places, for cooking purposes, but its principal use is in printing and dyeing. It is also utilized as an illuminant. As much as 100,000 tons of castor oil are needed by the United States every year. The plant is not cultivated here to any appreciable extent.

Other oils in the Philippines are casoy oil, which may be used as a substitute for olive oil, and kapok oil, which has an agreeable taste when properly extracted.

Caustic Soda

The key to the successful establishment of many new industries in the Philippines is found in the local manufacture of caustic soda. A considerable amount of caustic soda is needed in the manufacture of various articles of trade, such as paper and paper pulp, glass and soap. It may be found advisable first to increase the domestic supply of caustic soda before undertaking many other new industries.

Electrical Starter for Semi-Diesel Crude-oil Motors

As is well known, the starting of semi-Diesel engines is combined with certain difficulties, which comprises the use of blowlamps. Many inventors have from time to time aimed at overcoming these difficulties and many experiments have been made with varying results with electrical ignition. However, these experiments have for the most part failed utterly to bring about the results aimed at. The chief reason being the difficulty to find an ignitor, which would resist the developed high temperature.

A Swedish inventor, however, Mr. C. A. Rudquist, C.E., has recently succeeded in solving this problem in a manner, which is entirely satisfactory. This invention for electrical starting of a semi-Disel engine is as easily applied and with equally successful results as can be obtained on a gasoline-motor. The arrangement consists of a coil placed in the cylinder of the motor, of a material of ever lasting durability, and this coil is connected with a storage battery fed by a small generator coupled direct to the motorshaft. The time required for starting of a motor is by this new process reduced down to 15-25 seconds only.

A company was formed in 1922 for the purpose of exploiting the invention and their efforts have proved a great success. Many thousands of these aggregates are already delivered and installed on new, as well as old, motors and agreements have been entered into with representatives in most parts of the world, whilst certificates from well-known authorities prove the efficiency and durability of the new arrangement.

The storage battery connected with the arrangement may also be used for lighting purposes and the cost of installation is therefore well compensated for by this fact alone.

Mr. Rudquist has also invented an electrical manœuvre-arrangement, which can be placed in the navigation-room and by means of which a semi-Diesel engine can be started, reversed, the speed altered, etc., from this point. The more or less complicated arrangements which are now in use for reversing a propeller are, through this new system, quite unnecessary.

The Trade Outlook in China

Writing before the outbreak of the recent civil war, the British Commercial Counsellor at Shanghai, in his report to the Department of Overseas Trade to June, 1924, says that the investment of capital in China's industries in the more remote centres is attended with serious risks. Such developments as have taken place have mainly been confined to the neighborhood of the larger treaty ports. Progress is greatly hampered by insecurity and maladministration.

Apart from those difficulties there are other factors which help to explain the fact that while the total volume of imports and exports shows small sign of falling off, and even tends to expand, the merchant houses are finding it more difficult to carry on business at a profit, or even to cover expenses. First and foremost must be placed the excessive competition for the limited trade offering either in imports or exports, and this remark applies not only to the foreign merchant firm, but also to the Chinese dealer.

For the manufacturer who is not prepared to establish his own sales organization, the British firms in Shanghai, Tientsin and other ports offer the most satisfactory method of marketing British goods, and if the manufacturer is prepared to provide his agent with technical assistance, samples and advertising materials his prospects of securing adequate returns will be largely increased.

Although the exports from Great Britain to China in 1923 show some falling off from the previous year's, there are good grounds for saying that British goods are still holding their own in the face of ever-increasing competition.

Conditions as regards machinery and engineering have been extremely unfavorable, and merchants have had to devote attention mainly to the settlement of old contracts and to attempting to collect long overdue accounts rather than to booking new orders. Very few new contracts of importance have been placed, and apart from deliveries of machinery ordered in previous years business has been confined, as a rule, to supplies of various kinds and extensions of existing plants.

Within the next few years heavy replacements will be essential on all the railways, but unless the rapacity of the military can be checked and a reasonable proportion of the revenues be devoted to maintaining the efficiency of the lines, it is difficult to see how the purchases can be financed. Every foreign firm who has had dealings with the railways has heavy claims outstanding against the government.

The electric light companies at Canton, Mukden, Soochow and other cities have installed large extensions of plant. A very large proportion of this business has gone to Germany, the prices quoted by German firms being frequently from 30 per cent. to 50 per cent. below English and American prices.

Electrical Goods in Java

By Can. Government Trade Commissioner A. G. Muddiman

DEVELOPMENT of its water-power resources is a question of paramount importance in the Dutch East Indies. It is estimated that five and a half million horse-power are available for this purpose in the archipelago. West Java is better developed than other areas ; in this district energy from the big power stations at Bandoeng and Buitenzorg is supplied by the government at cost price to municipalities and private companies. The generating machinery in these stations is of the most up-to-date type, and the engineers are said to be of the highest class. The cost of electrical energy in the Preanger district of Java is about 4.25 guilders per kilowatt month. In electrical lines, as with other products in the area, intense competition is to be encountered, and, as a rule, the cheapest producer wins out.

Legislation of Electricity.

According to a semi-official statement, " since August, 1917, the new service of water-power and electricity has been detailed to utilize in a practical way the hydraulic energy, now for the greater part still lying dormant in different parts of this island empire, as well in the interest of the state as in that of private industry. . . The natural conditions which everywhere contribute to create important water-power supplies may be said to be very favorable in these countries."

In drawing up its regulations, the department of water-power and electricity in its policy of guidance has laid down that no electric-power can be erected without a concession. The right to grant concessions may ultimately be transferred to local authorities subject to rules drawn up by the government. By these means it is hoped that the necessary uniformity in the supply of electricity will be permanently guaranteed. It has also been laid down that wherever desirable in the interests of adequate exploitation of natural sources of power (such as water, lignite coal-fields, etc.), the generation of electricity should remain in the hands of the government without necessarily implying the establishment of a monopoly of generation of electricity. For electrical distribution and sale, power companies on a community basis are hoped for. Their tariff policy should be such as to popularize the use of electricity as much as possible.

Electric Power and Water Power Resources.

Sixteen cities have electric light and power, supplied by private companies, including Bandoeng, Sourabaya, Semarang, Batavia and Medan. The government owns several power stations in connection with state industries. Moreover, there are a great number of plantations and factories having their own electric supply.

The surveys necessary to an accurate report of the water-power resources of these colonies having not yet been completed, the following estimate of the minimum water-power which can be developed in Netherlands East India must necessarily be considered approximate: Java, 500,000 h.p. ; Sumatra, 2,000,000 h.p. ; Borneo, 2,000,000 h.p. ; Celebes, 1,000,000 h.p.—a total of 5,500,000 h.p.

Only 25,000 h.p. have been developed, and another 25,000 h.p. are being developed for general distribution of electric energy for light and power in the cities, for agricultural enterprises and manufacturing industries, for railroad electrifications, for wireless telegraph stations and other government institutions.

Cheap water-power is available for electrochemical industries, In round numbers at least 500,000 h.p. on the islands of Sumatra. Borneo and Celebes have been located for use in connection with electrochemical industries for the manufacturing of nitrogen fertilizers. Calcium carbides, it is stated, can be made here ; the raw materials are available in good quality and quantity.

Switch Boards and Gear.

American equipment is found in use such as the General Electric and Westinghouse Companies use. Cell oil switches are used at some stations. For high-tension schemes ironclad control panel units are in use.

Transmission and Distribution.

Generally speaking, on the island of Java about 60 miles of transmission line for 25,000 volts and about the same length for voltages of from 3,000 to 5,000 volts are in use. On the island of Banka a 30,000 volt transmission line of 60 miles in length is partly in use, partly under construction. On the island of Sumatra some 10 miles of 6,000 volt transmission line are in use ; a line for 25,000 volts 15 miles in length is under construction. Transmission lines for higher voltages up to 100,000 volts are planned.

Alternating current is generally used. Direct current is only in use in small plants in sugar mills. In regard to overhead wire, high-tension wires (following the European principle) are always bare ; low-tension wires are only insulated for crossing telephone lines, etc. Underground laying even in cities is very uncommon. The government is making an effort to standardize distribution of electric energy in all municipalities. Such standardization in regard to voltages will save stocks of unnecessary spares being maintained by importers. The voltage for light is 220/127 and for power 380-220 on the four-wire principle. The voltage for high-tension feeders is 30,000 A.C. and will in future be 70,000 A.C. All cables are armored between transformers.

Demand for Bare Copper Wire.

There is a good demand for bare copper wire, but for the present prices have been drastically cut.

Insulators.

To obtain a suitable high-tension insulator for a tropical climate is no easy matter. Pin insulators and metal cups over suspension have been employed, and the latter are not entirely satisfactory. The writer found that at present high-tension insulators made in the United States were obtaining favor. In view of this he sees no reason why Canada should not obtain a share of the business, if prices are competitive, and if Canadian insulators can stands up under the climate. Double and triple sheds are used. The rapid changes in temperature quickly crack porcelain insulators if at all faulty or not properly baked.

Switches, Etc.

Switchboards must have all conductors at least 5 cm. from the wall and be backed with fire protection, such as asbestos. No automatic switches shoul be used with ground wires. Single and double switches should have a contract surface carrying capacity of at least 6 amperes. Switches in wooden cases may be used having a maximum current carrying capacity of 35 amperes and a working pressure of 220 volts. Motors, it is said, with a consumption of over one kilowatt must be provided with automatic releases in their respective starting equipments. Metal-covered uninsulated switches are prohibited.

Carbons.

There is a fair demand, it would seem, for special carbons for the projectors of moving pictures ; these might be marketed through local film houses to the two hundred odd moving picture houses in Java.

Electrical Machinery.

The greater number of electrical machines are supplied direct by Holland, while Germany, the United States, and Japan have delivered considerable quantities. Of generating plant. Holland supplies about 50 per cent. of the total imports, while the United States, Great Britain, and Germany are also well represented.

Conduits.

Metal conduits must be galvanized and smooth finished. Through walls and floors seamless conduits painted with white lead are to be used. Seamed conduits are not to be bent, or if so the seam must be underneath. Bent conduits must have a radius of at least 8 c.m. at each bend. A common size of seamed conduit in use would appear to be ⅝-inch and seamless ¾-inch in diameter.

Opportunities for General Articles.

There is not a large demand for bells and buzzers. There is a fair demand among the Chinese and Japanese for cheap Japanese-made electric torches, with which Canada cannot compete. There is only a limited demand for electric irons, but Canada ought to be able to supply them. Lamps are generally of Dutch origin, and it would be extremely difficult to sell against these with any financial success. Cartridge fuses are said not to be popular because of their cost. There is no real call at present for cooking and heating

appliances, as far as the writer could ascertain. Storage batteries in this climate have a difficult time and must be imported inert. There are surprisingly few electric fans in use in the Netherlands East Indies as compared with the Straits Settlement. The Dutch seem to dislike them and some of the best hotels are without them. An American ceiling fan at time of writing is being brought into Singapore, in the Straits Settlements, for $24 c.i.f., to compete against a well-known Italian make, but the American is said to lack finish, design and durability.

SAMPLES.

Samples of all installation materials such as wires, conduits, insulators, etc., should be deposited at Bandoeng in order that they may be approved by the authorities. The type of installation proposed should be shown where necessary.

ELECTRIC LAMPS.

While far short of 100,000 dozen oil lamps, hanging and wall, were imported in 1923, the demand for electric lamps in the cities is growing. It is true in 1923 importations fell to a value of 182,738 guilders from the previous year's 436,288 guilders. But under normal conditions this demand can be expected to increase. The supply is controlled from Holland, and it is very doubtful whether Canada can compete.

METAL TELEGRAPH POLES.

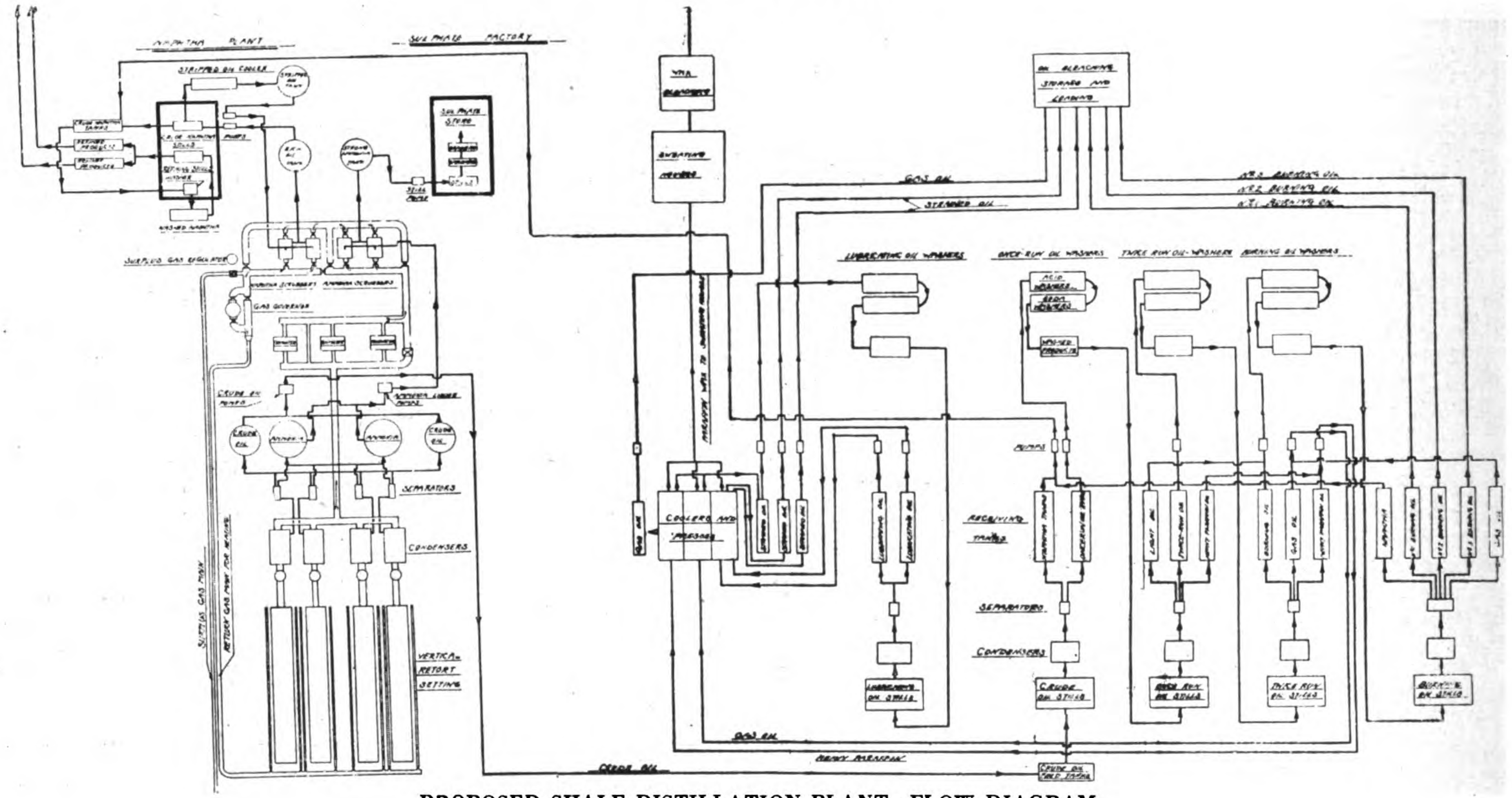
From time to time there is a demand for metal telegraph poles and electric light standards. As municipalities take up these improvements, the demand should expand. The type required is similar to those seen in Holland and Germany. The latter country would seem to have done the bulk of the supplying.

ELECTRIFICATION IN SUGAR PLANTS.

Perhaps future employers of hydro-electrical power in Java will be found in the sugar industry. At the present time this phase of the market has not been developed. A demand might be created through the installation of small electrically-driven lighting plants as auxiliary units for sugar factories during the dull season.

Description of a Shale Oil Distillation Plant

(*Continued from page 114*).



PROPOSED SHALE DISTILLATION PLANT—FLOW DIAGRAM

with acid and soda and again distilled in a set of six boiler stills giving burning oil, gas (oil) and heavy paraffin oil. The burning oil fraction is mixed with the light oil from the previous distillation then washed as before and re-distilled in boiler stills, giving naptha, the various grades of burning oil, and gas oil.

The naptha is sent to the naptha plant and the burning oil to the bleaching and loading house.

There now remains to be dealt with the gas oil from the last two distillations and the heavy oil and paraffin from the second distillation and these are dealt with in the paraffin wax plant. The gas oil being cooled and pressed to recover the paraffin scale and heavy oil similarly treated giving blue oil and paraffin scale and heavy oil similarly treated giving blue oil and paraffin scale.

The blue oil is returned to the distillery for a further washing and distillation and the fractions are cooled and pressed giving lubricating oil and paraffin wax.

The whole of the paraffin wax recovered in these processes is treated in the wax house, the oiils being cooled and the crude wax crystalized out in revolving druns cooled by liquefied ammonia.

The paraffin scale is then hydraulically pressed and melted upfordelivery to the sweating houses where it is solidified in banks of trays and the occluded oily impurities sweated out by raising the temperature of the chambers by means of steam radiators.

The sweated paraffin is then sent to the refining house where it is agitated in charcoal washers, filter pressed, paper filtered and solidified into cakes for shipment.

Power House

The power house is situated adjacent to the paraffin plant. Here are situated the generating sets and ammonia and air compressors for the refinery. Alongside the power house will be built a battery of steam boilers and superheaters for the supply of steam for the whole of the plant.

No provision is made on the lay-out for a water tower and cooler with the necessary circulating pumps.

Acid Supply

Steel receiving tanks are provided near the railway line at a low level suitable for receiving acid and soda from rail tank wagons. A compressed air line will be led to these tanks to deliver to the high level acid tanks on the various parts of the works.

British Contracts for the Far East

(By a London Correspondent)

THE uncertain aspect of affairs in China, and the somewhat troubled conditions in Japan, have been factors which have tended to keep new contracts for the Far East at a low ebb, added to which the tail end of the year is always a quiet time for placing new orders. It may, however, be said that there is a distinctly more hopeful feeling in the market generally, and prices of steel are hardening a condition of affairs which would seem to sense better times in store. Quite a number of contracts are known to be in the market awaiting placement and it is anticipated that with the turn of the year quite a number of new developments may be looked forward to with confidence.

By far the most important announcement made has been the decision of the new government to go on with the Singapore naval base. It will be remembered that the late labor government scrapped the idea, much to the disgust of the country at large, and to the twits and jeers of the Australian and New Zealand governments, to whom the scheme had been virtually promised and to whom it meant everything in the form of protection. Cable reports are to hand that the Japanese official attitude towards Singapore is expressed in the Japanese word *shikataganai* meaning: " It cannot be helped." The national attitude is distrustful and partly hostile, in spite of the official explanation that the Washington Agreement is not contravened. Referring to the scheme, the Japanese papers report Viscount Kato as having said at a dinner:—

" Personally, I am none too pleased with Great Britain's intention to construct the Singapore base. But as the Washington Agreement is not contravened we are powerless to prevent it. So Japan has no alternative but to hold her peace and await developments."

As far as can be seen from here there is no reason in the world why any country should object to the establishment of this base, any more than they should object to Great Britain's fleet traversing the oceans of the world. It is protective, not threatening, and with the peaceful and friendly associations now existing between Great Britain and all others it purely resolves itself into the question of location for housing, and the selection of Singapore was made as being the most suitable to find. It is well on the cards that in the distant future the very persons who at present are inclined to view the British motives with suspicion may be the first to feel the benefit of the scheme. However, leaving aside all political questions the contract is an important one and will materially assist in developing many interests in the Far East.

In the shipbuilding world quite a number of new launchings in which the Orient will be interested have recently taken place. It is true that some of the vessels are not constructed for any but tramp service, yet they have all been built with the idea of at some time or another, if not regularly, trading in the waters of the Far East. Some of the details may therefore be of interest.

The Canadian Pacific are having two new steamers built by John Brown & Co., at Clydebank, the *Princess Kathleen*, and the *Princess Marguerite*. The former is just completed and is undergoing her trail trips and is to be almost at once taken to the Pacific coast via Panama, by Captain Troup, manager of the British Columbia steamship service of the C.P.R. The second vessel, the *Princess Marguerite*, was launched on November 29, and will shortly follow the first named vessel. Primarily these two boats are intended for the Victoria, Seattle and Alaska run, but may at any time be transferred either as regular or additional carriers for the Oriental services of the line.

Another vessel the *Thistleros*, a motorship, was launched on December 9, by David and William Henderson & Co., Ltd., of Glasgow, built to the order of Allan Block & Co., Ltd., of Sunderland. It is the firm's first motorship and is of the following dimensions. Length between perpendiculars 400 ft. Breadth extreme 53-ft. 8-in. depth moulded 35-ft., with a gross tonnage of 4,700, has a complete shelter deck, and is built to class 100 A1 in Lloyd's Register. Electric auxiliaries are fitted throughout, including winches, windlass and steering gear. Comfortable accommodation is provided amidships for officers and engineers, and the crew are berthed in commodious quaters aft.

The propelling machinery, built and installed by Harland and Wolff, Ltd., is of their Burmeister Wain type, and consists of one single-acting Diesel engine developing a normal power of 1,850 b.h.p. when running at 90 revolutions per minute.

On Saturday, December 13, the steamer *Skegness*, built to the order of Sir William Smith & Sons, Ltd., Cardiff, by Workman, Clark & Co., Ltd., Belfast, successfully underwent a series of trails in Belfast Lough. The vessel is of the shelter-deck type, with topgallant forecastle, and has a length of 415-ft. and beam of 54-ft., with a gross tonnage of 4,570, and is constructed to the requirements of the British corporation for their highest class B.S.* " with freeboard." Special arrangements have been made for the carriage of grain and general cargoes. There are five large holds equipped with very complete loading and discharging apparatus. Water ballast or oil fuel can be carried in the double bottom, and in atdition for special voyages, a cargo hold has been constructed to serve as a deep tank for ballast or oil fuel. The accommodation for officers and crew is on a very good scale and fulfils the latest requirements of the board of trade.

The machinery, which was also constructed by Workman, Clark & Co., Ltd., consists of one set of vertical inverted, direct-acting, surface condensing, triple-expansion engines, taking steam from three large multi-tubular boilers arranged for burning of coal or oil, fuel.

The Hamburg-America line has recently placed an important contract with the Bolohm and Voss yard for a motor ship of about 9,000 tons, which is intended for the company's East Asiatic services. A similar vessel has been ordered frm the same yard by the German Australian Steamship Company. They are the first German orders for new tonnage that have been heard of for a long while. Meanwhile, the *Fulda*, 9,400 tons, the new motor ship built for the Norddeutscher Lloyd by the Aktien. Gesellschaft Weser and loaded at Hamburg has just commenced her maiden voyage.

Notable Trips

The two Dutch tugs *Willem Barendsz* and *Vlaaderen*, of the bureau Wsymuller, Rotterdam, after having safely delivered the 5,000-ton floating drydock, built by the Netherland Shipbuilding Co., Amsterdam, for the Sabang Bay, Harbor & Coal Co., at the Puluh Weh harbor received orders to proceed to Sourabaya to tow four small craft, including a small cutter suction dredger to Melbourne, the tugs and their tows having sailed from the East Java port towards the end of November. The trip which will occupy about two months will be an exceptionally difficult one to the crews on account of the fact that no experienced runners being available to man the tows, men have to be spared from the tugs' crews for this purpose. On account of the small size of the craft towed it is practically impossible to make hot meals on board, and during the greater part of the trip these men will have to live on the most simple food procurable which, together with the hard work required of them, makes the trip one of great physical endurance. After arrival at the Australian port both tugs will proceed to Adelaide to take the Ellerman liner *City of Singapore*, seriously damaged by fire and explosion, to Rotterdam, for repairs. The series of trips in which these two tugs are now engaged undoubtedly for the longest and most difficult ocean voyages ever made for this type of craft, and if fortunate enough to see the end, probably no seaman will ever have been more heartily glad of return to the home port than will be the men of these small though powerful craft.

New E. 3,000 H.P. Engine

Much interest attaches to the tests of a new North-Eastern Werkspoor engine for the motorship *Raby Castle* now building at the Caledon Yard, for the Lancashire Shipping Co., Ltd., of Liverpool. The tests were made at the works of the North-Eastern Marine Engineering Co., late in December, the power developed being absorbed and measured by a huge water brake.

The engines may be described as an 8-cylinder set of 4-stroke single-acting Diesels 730 m.m. diameter, by 1,300 m.m. stroke, developing 3,000 h.p. at 92 revolutions per minute.

The first impression that one gets is that the engine is far too big for the job ; but that is true of all direct-drive marine oil-engines. Then one realizes that there are no boilers, and that what one is looking at is the sum total of the propelling mechanism But the advantage to be gained by the adoption of the double-acting principle, especially when allied with the two-stroke cycle, is self-evident. Much less weight, much less space and an engine room far more in accord with the regulation ideas of proportion. The crank-shaft, it may be stated, although " built " is practically " solid" ; that is to say, it is constructed on the now well-known " Unity " system in which the ends of the pins and journals are fused solid into the crank webs and cannot shift ; in fact, according

to tests carried out the shaft will twist first. It is perhaps no exaggeration to say that the engine bristles with fool-proof devices. Certainly everything that the wit of man can devise to annul mistakes and facilitate handling is incorporated inro the design and the operations of starting, stopping, and manœuvring are of the simplest. On the question of accessibility and ease of overhaul it is of interest to observe that the pistons can be withdrawn without disturbing any of the top gear or lifting the cylinder covers, which are integral with the liners. The vessel will be towed from Dundee to the Tyne to receive her machinery at the North-Eastern Marine's jetty, and every care has been taken to ensure that the keelsons are sufficiently strong and stiff. This is, of course, a matter of the greatest importance in a long Diesel engine where rigidity and permanence of true alignment are extra essential.

Railway Carriages for Hongkong

It has just been announced that the Leeds Forge Co., Ltd., has received an order from the Hongkong railway for six steel carriages and has also booked a contract from the Great Indian Peninsular railway for two special steel wagons.

Contracts for Electric Light Bulbs

The British Electric Light bulb manufacturers announce very large contracts for these goods, included in which are: The Bombay Baroda, and Central India railway for 17,500 gas filled lamps. The East Indian railway 8,000 Osram lamps, while the Sydney municiapl council has placed a huge order for 100,000.

Underfeed Stokers for India

The Underfeed Stoker Company, London, have secured orders for four underfeed stokers for the United Alkali Company and also contracts for air heaters for the Lansdowne Jute Mills at Belgachia, India.

New B.I.S.N. Liner

Announcement is jusr made of a contract for a new British India Steam Navigation liner being placed with Hawthorn, Leslie & Co., Hebburn. The vessel is to be a large cargo and passenger steamer. The same firm has recently constructed three fine vessels for the same owners. In connection with this company's activities, an interesting launch, that of the *Santhia*, from the yards of Swan, Hunter and Wigham Richardson will recall memories in the East. Her predecessor in the title was a 5,000-ton cargo steamer, with accommodation for a few passengers, and was launched by Dennys, of Dumbarton, in 1901, a unit of a huge class of similar ships launched at various yards between 1895 and 1901. She was designed for the Indian and eastern trade, and it was there she spent the greater part of her career, with occasional runs down to Australia. During the war she was left to her owners when so many of her consorts were commissioned by the authorities, but that was not the only occasion when she showed very satisfactory financial results, for she was a steady dividend earner with a remarkable freedom from accident all through her career. In 1923 she was sold to Japanese owners, who kept her registered at Dairen, from which port she has been running to various Eastern ports ever since, latterly across the Pacific with supplies for the relief of the earthquake sufferers. There is every probability that the old and new *Santhia*, although rechristened, may travel in the same routes, in which case it would be exceedingly interesting to watch their respective results.

Fengtien Industrial Company

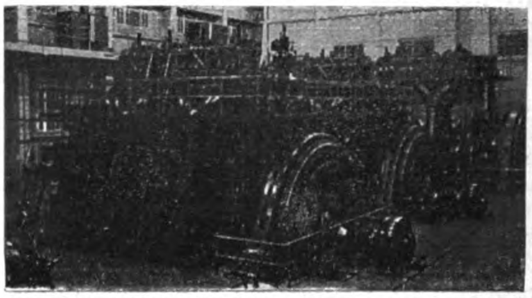
The Mukden Industrial Commissioner has been ordered by Marshal Chang Tso-lin to organize the Fengtien Industrial Company in Mukden. The company is to have six departments: paper mill, woollen factory, printing office, wood works, oil painting works and iron works. It is to be capitalised at $3,000,000, two-thirds of which are to be government shares and the remainiug one-third offerd to public subscribers. It will employ 500 workmen at the start and will have a management similar to that of the Fengtien Cotton Mill.

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE
No. 4 AVE. EDWARD VII

Power Station, French Concession, Shanghai
2 by 1,500 bhp. 2-cycle Sulzer Diesel Engines
1 by 3,600 bhp. ,, ,, ,, Engine

蘇爾壽工程事務所
上海愛多亞路四號



Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, STATIONARY AND MARINE DIESEL ENGINES, Airless Injection Diesel Engines, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

本公司常備目錄供給各界 垂詢工程事務亦竭誠酬答

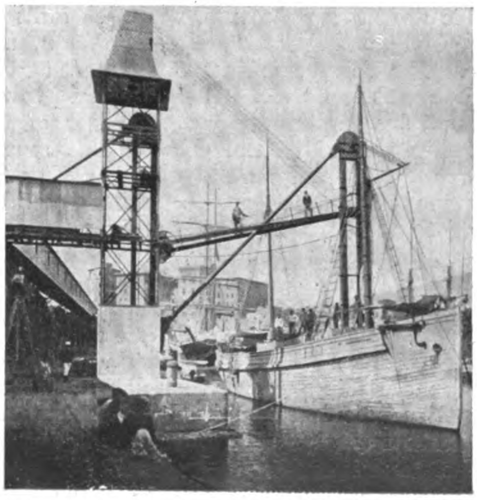
WINTERTHUR. SWITZERLAND.

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 Employees abt. 2,000



Moulin Feola & Jeandeau Drydock, Crane in Action

SPECIALITIES:
- Portland Cement Works
- Brick and Tile Making Plants
- Chocolate and Cocoa-Factories
- Breweries and Malteries
- Powder and Celluloid-Presses
- Crushing and Breaking Machinery
- Silico-Calcareous Brick Works
- Paste-Goods Factories
- Briquetting Plants
- Rice-Mills
- Roller Mills for Soap and Paint Manufacture
- "Duplex" Newspaper Printing Presses
- Conveying Plants of every kind

For particulars apply to the

Far Eastern Office: BUHLER BROTHERS

P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

GENERAL LIBRARY
UNIV. OF MICH.
MAY 22 1925

THE
FAR EASTERN REVIEW
ENGINEERING FINANCE COMMERCE

DR. JACOB GOULD SCHURMAN

JAPAN'S ALIEN LAND LAW

THE SINCLAIR OIL CONCESSION

MR. KODAMA'S ADDRESS TO THE YOKOHAMA SPECIE BANK

CHANGING FACTORS IN THE ECONOMIC LIFE OF CHINA

GREATER OSAKA

PEKING ELECTRIC TRAMS

NEW AMERICAN CLUB IN SHANGHAI

LARGE REINFORCED CONCRETE OCEAN TERMINAL AT MANILA

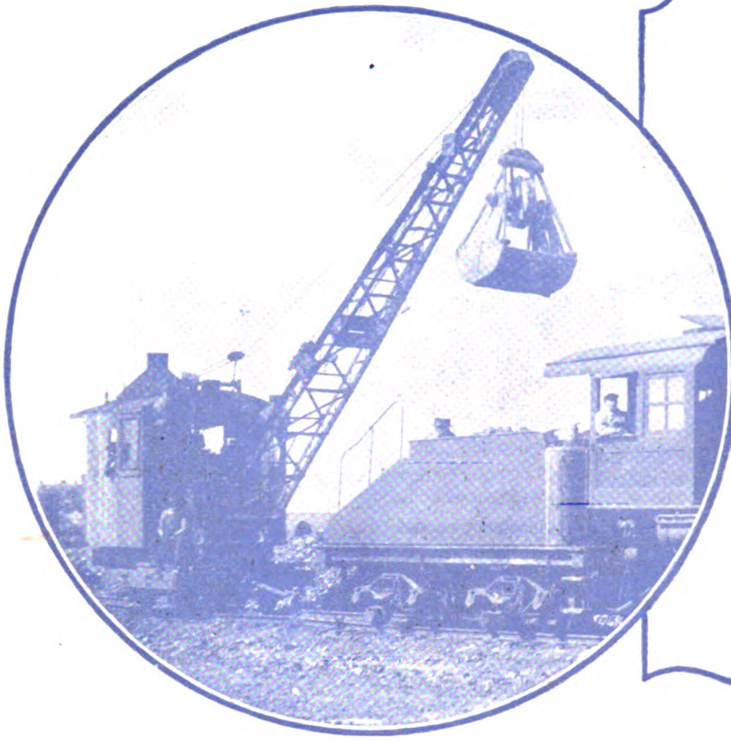
F.M.S. RAILWAY FORESIGHT

遠東時報

上海仁記路第五號

Vol. XXI April, 1925 No. 4

SHANGHAI, PEKING, TOKYO AND MANILA



Brownings Increase Production Efficiency

Maximum material-handling efficiency is vital to obtain the greatest production efficiency.

Browning Locomotive Cranes, by doing more work and faster work at lower cost over a longer period, insure the maximum in material-handling efficiency and economy.

For work requiring bucket, hook-block, dragline, magnet, wood grapple, steam shovel, or pile driver, there is no more economical, efficient, dollar-saving equipment than a Browning Locomotive Crane. Write for complete descriptive catalogue, now.

THE BROWNING COMPANY

16226 Waterloo Road

CLEVELAND, OHIO, U.S.A.

Cable Address: "Browning"

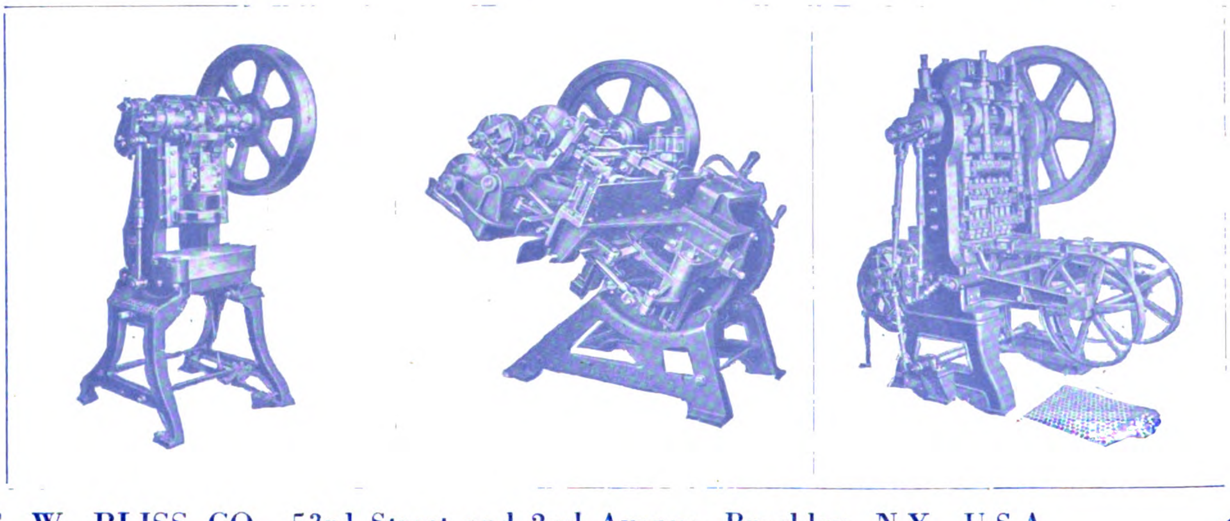
BROWNING LOCOMOTIVE CRANES

ONE OF THE MANY OUTFITS BUILT BY THE E. W. BLISS CO.

Crown Bottle Caps and Presses for their manufacture

From left to right, the Presses illustrated below will give the following productions per eight hour day: 10,000—100,000 and 500,000 respectively.

Send us Samples and state daily production required and we will be glad to give you prices and full particulars



E. W. BLISS CO., 53rd Street and 2nd Avenue, Brooklyn, N.Y., U.S.A.

BLISS

Presses, Dies and Machinery for the Sheet Metal Industry in general. Complete plants for the manufacture of Metal Boxes, Sanitary Cans of all shapes and sizes, Kitchen Utensils, Petroleum Cans, etc. Complete automatic equipment for making tin cans from tin plate in one continuous operation.

London, England—Pocock St., Blackfriars Road. **Italy—345 Via Nizza, Turin.** **Paris, France—54 Blvd. Victor Hugo, St. Ouen, Paris**

FOREIGN REPRESENTATIVES:

India—Duff Engineering Co., Ltd., D. S. Clive Building, Calcutta

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum

VOL. XXI APRIL, 1925 NO. 4

CONTENTS:

	PAGE
FRONTISPIECE—DR. JACOB GOULD SCHURMAN	
DR. JACOB GOULD SCHURMAN	147
JAPAN'S ALIEN LAND LAW	148
CHANGING FACTORS IN THE ECONOMIC LIFE OF CHINA	149
JAPAN AND CHINA	150
THE YOKOHAMA SPECIE BANK AND THE CHINA TRADE	151
FOREIGN LOAN OBLIGATION OF CHINA	152
THE SINCLAIR OIL CONCESSION CANCELLATION..	153
SULZER DIESEL ENGINES IN THE PNOM-PENH MUNICIPAL ELECTRIC WORKS, INDO-CHINA..	*153
THE AMERICAN CLUB, SHANGHAI	*154
THE PEKING ELECTRIC TRAMWAY SYSTEM ..	*156
BETTER TRADE IN THE DUTCH EAST INDIES ..	162
GREATER OSAKA	163
BEST YEAR FOR DODGE BROS.	*168
LARGE REINFORCED CONCRETE OCEAN TERMINAL NEARING COMPLETION AT PORT OF MANILA..	*169
SHANGHAI GETS DOUBLE DECKERS	*180
LANDMARKS IN THE TIN-MINING INDUSTRY ..	*181
KAPOK AND ITS USES	*185
SIAM CEMENT WORKS	*189
FORESIGHT IN RAILWAY CONSTRUCTION	*190
THE GUILLEMARD BRIDGE OVER THE KELANTAN RIVER	*192
STEEL FRAME AND BRILL 79E TRUCKS FOR SHANGHAI	*192
THE YUNGAN HYDRO-ELECTRIC LIGHT	*193

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allan, Whyte & Co., Ltd. 27
Allen & Co., Ltd., Edgar 11
American La France Fire Engine Co., Inc. 35
American Locomotive Sales Corp. 25
American Tool Works Co. 1
Associated British Locomotive Manufacturers for China 49
Attwater & Sons 48
Avery, Ltd., W. & T. 11

Babcock & Wilcox, Ltd. 36
Baldwin Locomotive Works 65
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 3
Bethlehem Steel Export Corp. 31
Bliss Co., E. W. .... Cover
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Browning Co., The .... Cover
Bucyrus Company 17
Buhler Brothers 194
Butterfield & Swire 44

Canada Carbide Co., Ltd. 70
Chambers Scott & Co., Ltd. 14
Chartered Bank of India, Australia & China 48
Chinese Eastern Railway 75
Columbia Ribbon & Carbon Mfg. Co. 70

Daido Electric Power Co., Ltd. 28
Dai-Ichi Ginko 62
Dai Nippon Brewery Co. 34
Diamond State Fibre Co. 71
Dixon Crucible Co., Joseph 70
Dodge Brothers 5

Drewry Car Co., Ltd. 15

Electricity Department, S. M. C. 6
Escher Wyss & Cie 16
Evans & Sons (Wolverhampton), Ld., Joseph 2

Fairbanks Co. 35
Fairbanks Morse & Co. 19
Fuji Gassed Spinning Co. 10

Gas & Fuel Plants, Ltd. 14
General Fireproofing Co. 41
Gleniffer Motors, Ltd. 15
Goodell-Pratt Co. 63
Goulds Manufacturing Co. 14
Graham Brothers 4
Green Island Cement Co., Ltd., The 20
Greene, Tweed & Co. 75
Greenfield Tap & Die Corp. 21

Hasler Telegraph Works 52
Heinemann, A. G., Gebr. 17
Hongkong Rope Manufacturing Co. 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co., Ld. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. 58
Ingersoll-Rand Co. 73
International Banking Corporation 55
International General Electric Co., Inc. 51

Japan Sugar Co., Ltd. 6
Jardine Engineering Corporation, Ltd., The 12

Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. 10
Kawasaki Dockyard Co., Ltd. 33
Kitchen & Wade 62
Kokusai Kisen Kaisha 45

Link-Belt Co. 63
London Directory Co., Ltd. 61
Louisiana Planter & Sugar Manufacturer, The 62

Manning, Maxwell & Moore, Inc. 14
Mather and Platt, Ltd. 2
Metropolitan Vickers Electrical Co., Ltd. 52
McConway and Torley Co. 72
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd. 38
Mitsubishi Marine & Fire Ins. Co., Ld. 38
Mitsubishi Shoji Kaisha 18
Mitsubishi Warehouse Co. 38
Mitsubishi Zosen Kaisha, Ltd. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. 18
Mitsui Bussan Kaisha 26
Motor Rail & Tram Car Co. 7
Mustard & Co. 72

Nippon Menkwa Kabushiki Kaisha 50
Nippon Yusen Kaisha 46, 47
Nipponophone Co., Ltd. 34
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. 24
One Hundredth Bank, Ltd., The 59
Osaka Shosen Kaisha 42

Redpath Brown & Co., Ltd. 15
Reyrolle & Co., Ltd., A. 7

Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 7

Sale & Frazar, Ltd. 8
Shanghai Dock & Eng. Co., Ltd. 32
Shanghai Municipal Council 6
Siemens China Co. 36
Simons & Co. Ltd., Wm 13
Smidth & Co., F. L. .... Under Index
Smith Major & Stevens, Ltd. 16
Smooth On Mfg. Co. 71
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. 71
Standard Oil Co. of N. Y. 29
Standard Underground Cable Co. 14
Sturtevant Co., B. F. 63
Sulzer Bros. 194
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd. 60
Superheater Co., The 27

Thornycroft & Co., Ltd., John I. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 17

United States Steel Products Company .... 23, 37, Back Cover

Wallace & Tiernan Co., Inc. 27
Walworth International Co. 72
Westinghouse Electric International Co. 76
Williams & Co., J. H. 3

Yarrow & Co., Ltd. 21
Yokohama Dock Co. Ltd. 34
Yokohama Specie Bank, Ltd. .... Cover

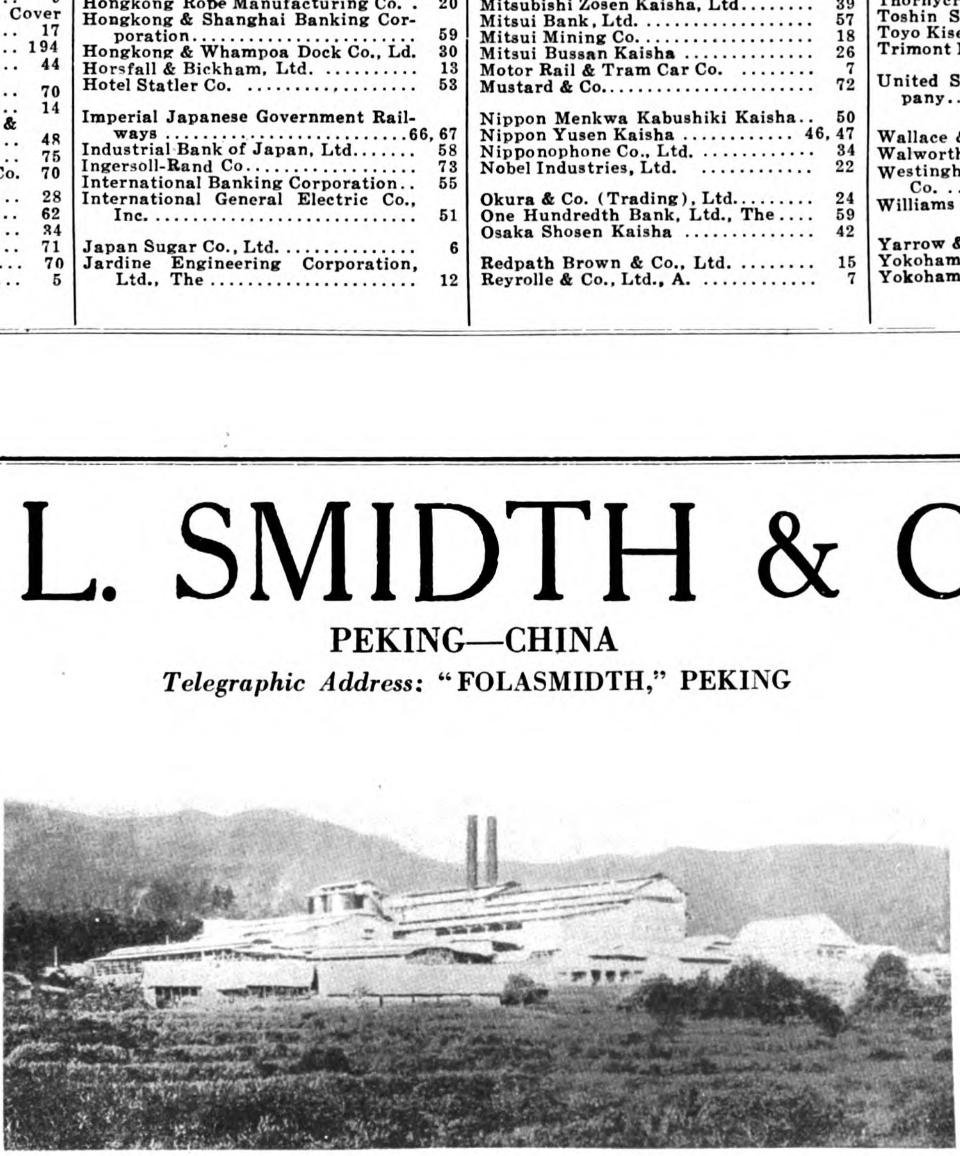
F. L. SMIDTH & Co.

PEKING—CHINA

Telegraphic Address: "FOLASMIDTH," PEKING

LONDON
SYDNEY
PARIS
RIO de JANEIRO
TURIN

NEW YORK
COPENHAGEN
33 VESTER-GADE
BIELSKO
JAPAN



The Nederlandsch-Indische Portland Cement Works at Indaroeng, West Coast of Sumatra, equipped with F. L. Smidth & Company's Cement Machinery

MACHINERY FOR CEMENT WORKS

LIME WORKS, BRICK WORKS, NODULISING PLANTS FOR IRON ORE AND VARIOUS MINING INDUSTRIES

More than 300 Rotary kilns, with a total yearly output of 60,000,000 Barrels, have been supplied and 5,000 grinding plants equipped with our Machinery

Dr. JACOB GOULD SCHURMAN
American Ambassador to Germany
From a Sketch by Juel Madsen

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, APRIL, 1925 No. 4

Dr. Jacob Gould Schurman

U. S. Minister to China Appointed Ambassador to Germany after a Laudable Career in China under the Greatest Difficulties

The American Attitude Toward China Unchanged

DR. Jacob Gould Schurman served his term as the American Minister to China during what was undoubtedly the most difficult period for a Peking diplomatic. Everything has been going wrong with China during the past three years, just as everything always goes wrong with any sick man. The fact that a man is sick, however, does not at all mean that he is dead. The capable physician diagnoses the case after a while, discovering wherein lie the dangers to the patient; what are his chances of recovery. To Dr. Schurman, apparently, China has never been without many chances of recovery. He has seen the worst and leaves the country optimistic. It is impossible to believe, in spite of all the enemies of China have to say on the subject, that a man of the training and experience of Dr. Schurman, would be altogether wrong in his analysis of the situation. He has travelled to every part of the country, to the most northern part of Manchuria, to Yunnan, to Szechuan, to interior cities and foreign trading centers ; he passed through Lincheng just after the outrage and when the captives were still on Paotzeku ; he has been through wars and changes of government ; he has seen his own country at the height of popularity ; he has witnessed the growth of an anti-foreign movement. Yet, he is an optimist. Therein, perhaps lies the importance of the man. The unscholared easily grow discouraged, for to them each situation is something absolutely new, something never heard of, never dreamed before. To a man of Dr. Schurman's scholarship, it is all more or less an old story. He has seen it all happen elsewhere, in the ancient world, in the England of the Wars of the Roses, in the Florence of Machiavelli, in the Holy Roman Empire of the Reformation. He knows that nations go through their periods of fever and depression. The strong survive, but national strength lies not in bombast and braggadocio, but in natural resources, man-power, the energy and probity of the people. These China has.

Dr. Schurman has had to face some very serious problems in China. The break-down of governmental authority, the relations between China and Russia, the imposition of illegal taxes were only a few of the many questions requiring a keen understanding of China and of the future of the United States in China. He had to undo much of the work of some of his predecessors who used the American Legation in Peking as a center of anti-Japanese and at times anti-British propaganda in China. He had to establish sincere friendly relations with all foreigners in China and at the same time maintain the prestige of the United States. He has been a difficult task but one to which Dr. Schurman was equal and which he carried through with unvaried success.

The most unfriendly criticism of Dr. Schurman came from a small but virulent group of Americans who opposed his policy with regard to the future of China. They did not reason as to whether it was a personal policy with Dr. Schurman or whether it emanated from the State Department. They were not concerned with the possibility that the policy might have been the result of an understanding between the American government and other governments interested in China. The fact remains that after the Washington Conference, Japan declared a change of policy which was finally enunciated in Shidehara's speech, parts of which were published in a recent issue of the FAR EASTERN REVIEW. It is interesting that Dr. Schurman's strongest pronouncements on extra-territoriality and China's future, synchronized with similar statements in Tokyo. In a word, the United States and Japan have both adopted a policy of helpfulness to China, of giving China every possible opportunity to end an umbrageous condition, and there can be little doubt but that Great Britain joins in such a policy. The criticism then of Dr. Schurman for his so-called pro-Chinese speeches is specious and poorly thought out. The suggestion that his speeches were scholarly but ill-timed is just so much verbose piffle. The speeches were well-timed ; they were well-planned. They clearly showed to the Chinese people that their future rests, not with Comrade Karakhan, but in the Great Power, the United States, Japan and Great Britain, whose interests in China require a healthy, peaceful China, whose hope for China ultimately is the same as the hope of the Chinese people.

Dr. Schurman leaves behind him in China a host of friends and admirers. He is a worthy successor of such a man as Rockhill. His presence put a period to appointments to Peking of men of questionable competence. His successor, Mr. MacMurray is a trained diplomatic, experienced in the China service, who for several years past has handled Far Eastern affairs in the State Department and who has been an important factor in the organization of the Washington Conference and who will therefore in Peking assist in making realizable its aims.

Japan's Alien Land Law

Legislation to Conform with the Soviet Treaty Clauses Granting Foreigners the Right to Own Land

End of a Troublesome Condition

LAND ownership in any country is a domestic affair and cannot be governed by international agreements altogether, as was evidenced in the California legislation. Public opinion changes and local conditions may develop which require a complete change of attitude on the part of any government toward the question of land-ownership. Orientals were at one time welcome on the Pacific coast, so welcome that a business arose in Canton of kidnapping Chinese for the purpose of bringing them to California. Then the situation in California changed and legislation was passed aimed at keeping Orientals out of the country. Economic conditions governed that change and in spite of every effort of the American Government, anti-Chinese and anti-Japanese legislation stands on the law-books of the Pacific Coast states. Furthermore, these states have been able to use their political influence to put through the Congress of the United States anti-Chinese and anti-Japanese legislation.

Japan naturally enjoys all the rights that the United States enjoys as a sovereign state. If California can prevent Japanese from holding land in California, Japan can pass legislation against Americans holding land in Tokyo or in any other part of Japan. What holds with one holds with the other. The protest then in many quarters against the Japanese law that foreigners may not own land in Japan is untenable, as Japan is completely within her rights to determine such question in any way she pleases. Japan may to-day pass legislation permitting such ownership, but that is no indication that Japan had no right to enact contrary legislation at any other time.

The treaty with Soviet Russia permits Japanese to own land in Russia, in accordance with the laws of that country; it also provides that Russians may own land in Japan, in accordance with the laws of Japan. But there is no Japanese law providing for such ownership. The present legislation is therefore designed to meet the terms of the treaty. But it is clear that there must be reciprocity, that Japan will not permit nationals of a country which excludes Japanese from land-ownership, to own land in Japan. Americans in Asia would like to see the reciprocal features of this treaty so written that only citizens of such states as California, which definitely exclude Japanese from land-ownership, be forbidden to hold land in Japan. But such a condition is a legal absuridity. Since when is the United States an amalgam of States and not a single nation. The Civil War was fought to determine that question and has apparently settled it. In the eyes of Japan, California is part of the United States just as Kobe is a part of Japan or Chihli is a part of China. If California offends, if the United States which offends. If Americans want to own land in Japan, they would be wise to make arrangements for Japanese to own land in California.

The whole situation is explained from a Japanese view point in the following article :—

It is explained that it is not the intention of the government to put the prohibitive provisions of this new law into operation against any American citizens, whether citzens of States having anti-alien land-ownership laws or not, although, through Imperial Rescript, such Americans could be prohibited from land-ownership in Japan.

There will be no move taken, if one be ever taken, to enforce the prohibition upon Any Americans until every opportunity has been given to States having anti-Japanese land laws to repeal these statutes.

The new land-ownership bill was introduced to the House of Peers a few days ago by Mr. Ogawa, Minister for Justice, and was referred by the House to a special investigation committee of seven composed of the following members: Count S. Terajima, Viscount T. Sakai, General K. Oshima, K. Ishihara, C. Mizukami, N. Akaike and Z. Saito.

The law denying to foreigners the right of ownership in land was enacted on January 17, 1873. Until, therefore, a law repealing that statute becomes operative a foreigner is by that law excluded from the enjoyment of full ownership in land which, in Anglo-American law, would be called fee simple (Plein droite de propriete).

Law No. 51 of 1910, which repeals that law, has not yet been put into operation.

There is no legal provision in Japan excluding foreigners from the enjoyment of leases or long leases, such as superficies and emphyteusis. The result is that ever since the whole of the Empire of Japan was opened to the commerce and residence of foreigners in 1899, upon the taking effect of Japan's new set of commercial treaties by which consular jurisdiction of foreign powers was abrogated and the inherent jurisdiction of Japanese courts over foreigners was revived, not only foreign citizens but foreign corporations, both civil and commercial, have permitted to acquire and hold rights in and to land other than full and complete right of ownership.

In Japan there are many registrations in law courts of superficies of 999 years granted to foreigners, their heirs and assignees.

Present Unenforced Law

Article 1 of Law No. 51, promulgated on April 13, 1910, which has not yet been put into operation, provides as follows:

A foreigner having domicile or residence in Japan as well as foreign corporations which have been duly registered in Japan shall be permitted to enjoy full title of ownership in land only in cases where in their own country the subjects of Japan as well as Japanese corporations are permitted to hold land by full title of ownership, provided however that in case a foreign corporation wishes to obtain full right of ownership in land, it must first obtain the permission of the Minister of State for Home Affairs.

"The provisions of the preceding paragraph only apply to the subjects or citizens and corporations of such countries only as may be named specifically in an Imperial Ordinance."

Article 2 of the same law provides:

"No foreigner or foreign corporation shall be permitted to own land by full title of ownership in the following regions:

"1. Hokkaido (which is generally known in Europe and America as Yezo, which was the old name of the Island, being the most northern of the islands forming Japan proper).

"2. Formosa.

"3. Saghalin.

"4. Limited areas necessary for the defence of the Empire.

"The area referred to in alinea 4 shall be determined by Imperial Ordinance."

Article 4 of the same law provides that the date from which this law shall be put into operation shall be determined by Imperial Ordinance and Article 5 declares that Law No. 18 of 1873 is hereby repealed.

Difficult Determination

The Law No. 51 of 1910 has never been put into operation and, in consequence, the Law of 1873, which, according to the law of 1910, is repealed, is still in force.

The reason why Japan has not been able to put the new law of 1910 into effect is found in the practical difficulty of determining what nationals shall be permitted to enjoy the benefit of the new law to the exclusion of others.

As the law regarding the ownership of land by foreigners promulgated on April 13, 1910, was not put in operation, the Imperial Ordinance denying to foreigners the right of ownership in land enacted on January 17, 1873, continued to be in force until quite recently. The Imperial Ordinance under consideration, however, is now being repealed and the following new law is in the Diet instead, to permit foreigners to enjoy the same rights as Japanese subjects in regard to ownership in land exactly on the same footing in accordance with the provision of Article 2 of the Civil Code:

New Law Pending

"Alien Land Ownership Law.

"Article 1. The identical or analogous prohibition or the identical or analogous conditions or restrictions may be imposed by Imperial Ordinance upon foreigners or foreign corporations, that belong to a country that prohibits, or imposes conditions or restrictions upon, the enjoyment of rights pertaining to land by Japanese subjects or corporations, in regard to the enjoyment of their rights pertaining to land in Japan.

"Article 2. Japanese or foreign corporations, more than half of whose partners, shareholders or executive officers, or more than half of whose capital or the majority of whose right of voting belong to the foreigners or foreign corporations specified in the preceding Article, shall be regarded as those of the same country, to which the said foreigners or foreign corporations belong, in accordance with the provision of the Imperial Ordinance, and the provision of the preceding Article shall be applied to them.

Applies to States

"Article 3. In the application of the present law, a part of a foreign country which has a special legislative authority with respect to land shall be regarded as a foreign country.

"Article 4. Prohibition of, or imposition of conditions or restrictions upon, the acquisition of rights in respect to land by foreigners or foreign corporations may be enforced in a district, when it is deemed necessary to do so in relation to the defence of the Empire, by Imperial Ordinance.

"The district provided for in the preceding clause shall be designated by Imperial Ordinance.

"Article 5. The provision of the preceding Article shall be applied to Japanese orporations, more than half of whose partners, shareholders, or executive officers, or more than half of whose capital or the majority of whose right of voting belong to foreigners or foreign corporations.

"Article 6. In case any person, who enjoys his rights in respect to land, becomes ineligible by virtue of the present Law, he shall transfer the rights to other persons within one year.

"Matters necessary for the disposition of the rights in case of the non-execution of the transference thereof specified in the preceding clause shall be determined by Imperial Ordinance.

"The provisions of the preceding two clauses shall be correspondingly applied to a case in which the heir and other general successor of any person, who has the rights pertaining to land, are unable to acquire them. In this case, the period of transference of the rights specified in Clause I shall be extend to three years.

" The period of transference of the rights provided for in Clause I and in the preceding clause shall not be permitted to exceed three years.

Annex

" Article 7. The date of the enforcement of the present Law shall be fixed by Imperial Ordinance.

" Article 8. Special regulations concerning the registration of immevable property incidental to the enforcement of the present Law be shall determined by Imperial Ordinance.

" Article 9. The Proclamation No. 18 of 1873 and the Law No. 51 of 1910 shall be repealed."

Changing Factors in the Economic Life of China

THE United States Department of Commerce has published an interesting Bulletin, (No. 312) on " Changing Factors in the Economic Life of China," by John H. Nelson, Assistant Trade Commissioner. Mr. Nelson has studied his problem very thoroughly and his report contains a large mass of material in a small compass of space on a difficult but very important subject. The conclusions reached are summed up in an introductory paragraph :

From the material presented in this bulletin three important phases of China's present-day economic status are evident : (1) China's foreign trade during the last decade has not increased appreciably in volume, as is shown by a comparative analysis of values with due allowance for price fluctuations and changes in trade channels ; (2) the Chinese are developing in a limited way as a commercial and industrial group, securing for themselves increasing participation in the country's foreign and domestic trade ; and (3) the economic status of China's rural and agricultural population, constituting about 80 per cent. of the total population, has not improved within the last decade and in many sections has materially declined.

Summing up the situation, Mr. Nelson writes :

A survey of China's Trade as a whole over a long period of time shows no great change by reason of purely domestic causes. It is true that economic development has been hampered and has even retrogressed during the last decade, but nevertheless the remarkable character of the Chinese has enabled the country to emerage from its various disturbances with little or no permanent ill effects from an economic standpoint.

In the period 1897 to 1903, covering those years immediately preceding and those following the Boxer rebellion of 1900, there was a steady and consistent increase in trade, interrupted only temporarily in the year 1900. In 1899 the exports amounted to 195,784,832 Haikwan taels, while the imports totaled 264,748,456. In 1900 the exports dropped to 158,996,752 Haikwan taels, and the imports to 211,070,422. From the period of the Boxer uprising until 1909, while the trade balance remained unfavorable, the total foreign commerce increased appreciably. This indicates favorable development during these comparatively peaceful years. The outbreak of the revolution in 1911 which made China a Republic did not seem to materially affect trade. The total foreign trade of China in 1911 amounted to 848,842,109 Haikwan taels as compared with 843,798,222 in 1910.

In 1917 there was a very serious attempt to overthrow the new Republic. This caused great internal dissension and strife, undoubtedly interfering with regular trade processes, but it is not reflected in the total trade returns of the country, imports advancing from 516,406,995 Haikwan taels in 1916 to 549,518,774 in 1917 ; and exports registering a slight decline from 481,797,366 in 1916 to 462,931,630 in 1917.

A similar situation confronts China to-day, and we might expect the same trade conditions to prevail. In spite of the greatly unsettled state of the country in 1923, the foreign trade was valued at 1,676,320,303 Haikwan taels, which represents an increase of 76,378,720 taels over the preceding year's total. The point of particular interest here is the fact that China's imports declined by about 22,000,000 taels from the previous year, while exports, which are more immediately dependent on domestic production and transportation facilities, increased by nearly 100,000,000 taels.

Such greatly distorted views of the disturbances in China are circulated abroad, and even commonly accepted in China, that the following comments made recently by the Chinese customs commissioner (British subject) at Shanghai, in his report for 1923, are of particular importance at this time.

" There has not been a time since the outbreak of the revolution in 1911 when the interior was not unsettled. Many of the years between then and the present time (1924) were good years, both from a trade and business point of view . . . . It is then a fair inference that contributory political events and disturbed conditions in China do not affect trade and business as much as supposed . . . . ; that there is room for improvement in the present conditions cannot be gainsaid, but that these conditions are the main cause of the business slump is a statement which, in the interests of business and trade alike, it would seem high time to contradict . . . . . Moreover, China is so vast a country that such impediments as civil wars, floods and famines have only a very limited effect on the entrepot trade of Shanghai, which at best taps only an infinitesimal portion of its resources."

A country larger than the United States in area, with probably four times our population, China will always possess large districts and entire Provinces where economic developments can proceed unhampered by internal disorders. A lack of confidence and a general unwillingness to make long-term investments of capital are the specific results of the continual domestic disturbances, both political and military. These disturbances, which are often aggravated by preventable natural occurrences such as floods and famines, make necessary the reallocation of trade routes and conveyances and almost invariably bring about a dislocation of trade. However, business interests in China are prone to charge all their difficulties to the domestic situation and lose sight of factors arising from worldwide conditions such as dislocation of accustomed markets in Europe and Russia, derangements of monetary system in many of these countries, and instability of foreign exchanges in general.

Foreign Trade

The method used in China, and common in most countries of the world, of gauging the course of trade by the total values of imports and exports renders it impossible under the prevailing conditions of price fluctations to judge accurately the progress of trade over a given period, since the quantities, a more reliable basis of comparison, of many commodities are not entered in the statistics.

In order to provide a more accurate foundation for a comparison of the value of China's imports during recent years with those of 1913, the following table has been prepared by the Chinese Maritime Customs, showing the declared values of imports in 1913, 1920, 1921 and 1922 and the values of imports in the three last-named years reconverted on the basis of average 1913 values :

DIRECT IMPORTS FROM FOREIGN COUNTRIES INTO CHINA
[In thousands of haikwan taels]

Groups	Values declared in— 1913	1920	1921	1922	1920 values recalculated at average 1913 values	1921 values recalculated at average 1913 values	1922 values recalculated at average 1913 values
Cotton goods	182,420	246,813	208,663	218,523	127,920	105,110	121,417
Woollen goods	4,880	4,791	7,408	8,794	2,252	2,588	4,369
Metals and minerals ...	29,156	61,572	60,077	49,928	51,199	42,271	46,431
Sundries ...	180,260	261,545	356,279	410,007	158,026	233,336	293,336
Total ...	396,716	574,721	632,427	687,252	339,397	383,305	465,553

The values entered in this table for the first three groups—cotton goods, woolen goods, and metals and minerals—represent the total value of all the items comprising these groups actually recorded in the customs returns as having been imported during the years 1913, 1920, 1921 and 1922. In the case of the fourth

group—sundries—only the values of the more important articles, aggregating some 50 per cent. have been included. The list as it stands deals with about three-fourths of the total direct foreign import trade of China, which is ample for purposes of comparison. Examination of the figures reveals some interesting facts. In the case of cotton goods, for instance, it will be seen that, while the values as declared to the customs in 1921 and 1922 show an important increase over those declared in 1913, the values in both these years, if recalculated on the basis of average 1913 values, record a serious decline and are far below the 1913 total. Values in 1922, however, show a reasonable increase over those of 1921. Recalculated values for woolen goods in 1922 indicate that this group, although not exceeding the 1913 declared values, approaches them very closely and also registers a satisfactory advance over 1921. Metals and minerals, together with sundries, present a different aspect. These two groups both show a considerable advance over the 1913 declared values, thus demonstrating clearly the progress made in these lines during recent years.

It might be well to give here a brief statement of the country's trade balance and a sketch of the background of present-day trade in China. From 1913 to 1923 China's foreign trade has increased from 970,000,000 taels to 1,600,000,000 taels, or 165 per cent. The balance of the trade during the 10 years has been against China on an average of 150,000,000 taels, or about $200,000,000 silver per annum. In 1923 the disparity between exports and imports was 170,000,000 and 305,000,000 taels. In 1919 imports exceeded exports by a margin of only 16,000,000 taels.

In addition to this unfavorable merchandise trade balance should be mentioned the foreign debt service, which for railways amounts to about $50,000,000 and for other obligations about $115,000,000. A further net import of gold and silver bullion, amounting in 1923 to some $60,000,000, adds to China's adverse trade balance. Domestic loans with accrued interest as of June 30, 1924, were $208,400,000 with adequate security and $473,000,000 without security, and the foreign loans amounted to $1,029,000,000 secured and $565,000,000 unsecured, making a total of $2,275,400,000. The combined Chinese and foreign debts, unsecured, the repayment of which is now due, is in excess of $480,000,000.

In addition to the exports, items which tend to reduce the unfavorable balance are remittances from Chinese abroad, estimated to be at least $100,000,000 a year; money required for upkeep of foreign missions, hospitals and schools in China, probably $35,000,000; expenses of foreign legations, consulates, legation guards, expeditionary forces, and naval vessels, and for maintenance and repairs to foreign shipping, about $40,000,000; money brought back by returning emigrants and that spent by tourists, provably $10,000,000. China collects no shipping or insurance profits and no interest on loans to foreign countries. Remittances from its nationals in other countries are the only returns from abroad of this nature.

Analysis of China's import and export trade over a period of years immediately preceding the Boxer rebellion of 1900, through 1923, discloses a general increase in value, volume, and variety of this trade over the entire period, but these are so obviously affected by factors beyond the influence of China's domestic affairs as to afford little more than a basis on which to expend further investigation. That China's domestic as well as foreign trade is more closely linked up with international market factors than is commonly understood, is shown, for example, in the annual report of the customs commissioner in the Hangchow district for 1923. Practically all districts in China report similar conditions with varying degrees of effectiveness. To connect the prosperity of an isolated interior country district of China with conditions in Russia and Europe may seem at first sight a little far-fetched. However, among the factors reported as most intimately affecting conditions in this district are included the closing up of the Siberian routes, the slowness in recovery of sound conditions in European markets after the World War, and the recent disastrous earthquake in Japan. The autumn floods during the previous years had been followed by famine and other forms of suffering, which naturally lessened the purchasing power of the people in this district and reduced their purchases to bare necessaries of life. The cost of living during military operations in this district rose on an average 50 per cent. During the same period conveyance of native produce to various places in the Provinces, both by river and overland, was considerably obstructed. The merchants were chary of laying in winter supplies, while considerable quantities of minerals and rice ready for transportation had to be held back. Heavier taxation and forced contributions aggravated considerably the general financial depression.

Japan and China

IN the course of an interesting article on the "Actualities of China and Her Relations with Japan," Marquis Komura referring to the relations between Japan and China in the *Japan Magazine* writes :

The unsettled political situation in the country is, however, very unhappy for it, and moreover, its economic progress and development is only a question of degree. The settlement of the political situation and the co-operation of the Government and people for the encouragement of trade and industry will quicken that progress and development. The political disturbances have badly affected things in educational, traffic and other directions. They have also had a bad effect on China's relations with foreign countries. At the Washington Conference, for instance, the powers participating in it passed a resolution in favor of the abolition of the extraterritoriality in China in future, to appoint an investigation commission preparatory for it and to convene a special tariff conference in order to effect an increase in the China Customs tariff revenue. But the carrying out of these resolutions has been retarded thus far directly and indirectly by the unsettled political situation in the country. The effect this political situation may work on the Chinese state finances is by no means light when the country is having extreme difficulty in paying the principle and interest of its foreign and domestic loans, which stand at about 2,100,000,000 yen in the aggregate. It is most important that China should be united and her political situation stabilized for the benefit of herself and also for the sake of the world's peace, and it is to be most earnestly hoped that it will be realized at the soonest possible date.

Japan is small in area but comparatively large in population, which is increasing about 650,000 a year on an average. Moreover, this is unfortunately short of a domestic supply of natural products, the yield of rice, which is her most important food, even falling under the demand by about 4,000,000 *koku* a year. In the direction of food, clothing and habitation, too, she is far from being self-supporting. In the circumstances, she has to get a large quantity of commodities from foreign lands to make up for the shortage. Her big neighbor, China, is nearly 25 times as large as Japan in area, and is rich in natural products. The best way for the future of Japan would, therefore, be to get a great variety of raw materials from that country by means of a true understanding of the Chinese Government and people, making the best use of our industrial development towards the goal of the establishment of our country on an industrial basis. The average yearly amount of Japanese products exported to China in the past three years was something like 400,000,000 yen in value, 27 per cent. of Japan's total export trade, while the average yearly volume of Chinese products imported into Japan in the same period was about 310,000,000 yen in value, sharing 15 per cent. of Japan's total import trade. From this it may be clearly understood that the two countries are in very close economic relations and must be brought into closer touch. It is regrettable, however, that while it is so important to bring about a better economic approachement between the two countries, it is felt that the two countries have not been able to sufficiently join hands in the promotion of their mutual economic interests. There are different historical and political causes for this. The Japanese people must make a point of meeting and dealing with the Chinese people with sincerity and without discrimination, with a view to benefitting themselves as well as the Chinese; and especially, those Japanese, who personally take active interest in the economic world of China, must always bear in mind that they must profit the Chinese, the owners of the land, at first and then profit themselves; otherwise it will be impossible for us to work economically in concert with China, advantageously and truly. As we must not be aggressive politically so we should not be invasive economically. We must foster a common existence and common prosperity. Essentially, the two people must thoroughly understand each other's standpoint, interests and sentiment, and respect each other.

The Yokohama Specie Bank and the China Trade

MR. Kenji Kodama, President of the Yokohama Specie Bank, in a brilliant survey of world trade in the course of his annual address on March 10, made a reference to China and Manchuria which summarizes the position of foreign trade in China and shows the effects of the country's disorders on its prosperity. We reprint from Mr. Kodama's address those parts which refer to Japan and China:

Mr. Kodama said: " In the period under review our economic world was still in what has become known as the " Readjustment Stage " and was unable to free itself completely from depression. Moreover, an adverse trade balance was reflected in foreign exchange, which recorded an unprecedented fall, and this fall, high prices and the embargo on the export of gold were the subjects of nation-wide discussion during the half-year. It was ultimately decided that the restoration of economic power by the co-operation of the whole nation was of fundamental importance if adverse factors were to be eliminated, and the government set an example by carrying out in earnest plans for readjustment and retrenchment in connection with administration and finance. Some public work was suspended or postponed, while a non-borrowing policy and enhanced import duties on luxurious goods were determined upon, and by these means the restoration of the nation's confidence was greatly assisted. The general public followed the government's example, and the spirit of thrift and of hard work became increasingly noticeable, which is a good augury for the recovery of the country's economic position.

For the purpose of comparing the chief statistical items with those of a previous corresponding half-year, it seems better to avoid using the figures for the second half of 1923, as that period was so greatly affected by the earthquake disaster, and the figures for the corresponding half of 1922 have therefore been chosen for the comparison. On the one hand, this comparison shows that the index of wholesale prices rose 8 points to 218, and that the total Bank clearings for the whole country increased by Y.2,759,000,000 to Y.38,878,000,000, an apparent indication of better times in business circles, but, on the other, that new capital issues for business enterprises decreased by Y.111,000,000 to Y.488,000,000, and that the stock of merchandise stored in the country's warehouses at the end of the half-year had decreased by 3,600,000 pieces with a total of 19,990,000, and these latter figures clearly indicate the depression in business. Money was easy during the period, to which condition the non-borrowing policy of the government, the influx of the proceeds of foreign loans and the repayment of the French Yen loan all contributed, as did also the fact that the bulk of the money realized from debenture loans, amounting to Y.400,000,000, was utilized for the liquidation of old debts. Rates showing a downward tendency, the payment of the first instalment for " destroyed silk," which had been looked forward to not without anxiety, was effected quietly. Towards the close, the Bank of Japan's advances increased until they exceeded Y.760,000,000, due to requirements for settlements at the end of the year, but even so Call Money remained easier than in the previous year.

Turning our attention to foreign trade, exports and imports for the half-year amounted to Y.999,000,000 and Y.981,000,000, respectively, showing only the small excess of Y.18,000,000 of exports over imports for a period when a much more favorable trade balance is usually expected. If the trade figures of Chosen and Taiwan be added to those of Japan proper, an adverse balance of Y.722,000,000 for the whole of 1924 is shown, or an increase of Y.115,000,000 over the previous highest adverse balance of Y.607,000,000, which occurred in 1923. Let us now examine more particularly trade conditions. By the beginning of the period, imports of emergency goods had almost ended, while exports of raw silk and cotton goods, encouraged by the fall of the Yen, had become active. August witnessed a steady improvement in trade conditions, and the excess of exports over imports gradually increased. In September, however, a sudden setback occurred, due to the disturbance which abruptly broke out in China and which greatly interfered with our trade with that country, and although our exports of raw silk increased in volume, the amount realized on them did not increase in proportion, owing to low prices. On the other hand, imports of cotton from America were of quite good amount, despite the unfavorable exchange position, and as a consequence the favorable state of trade terminated in October, and in November an adverse balance was again in evidence and remained so to the end. Our trade position was unfavorable as regards twenty-four foreign countries and favorable as against sixteen, Great Britain occupying the premier position among the former, our excess of imports from her amounting to Y.110,000,000. Then follow Germany, British India, Kwangtung Province, Dutch East Indies and Switzerland with Y.62,000,000, Y.42,000,000, Y.22,000,000, Y.22,000,000 and Y.11,000,000, respectively. America heads the list of the countries with whom we had an excess of exports, in her case to the extent of Y.218,000,000, while Hongkong, China and France follow with Y.41,000,000, Y.31,000,000 and Y.26,000,000, respectively.

Our foreign exchange, which had kept steady at the rate of 41 on America during the first half of the period, when over-exports were in evidence, became weak in October, when trade began to assume an adverse condition, and broke to under 40, dropping quickly thereafter to as low as 38½, and its maintenance at that figure even was often threatened. The beginning of November, however, saw a better position, and the rate remained at 38½ until the end of the year. Exchange on England, besides being influenced by the fall in exchange on America, was also affected by the improvement in Sterling, and experienced a steady drop from 1s./11d. at the beginning to 1s./7½d. at the end of the period. As to Silver exchanges, let us first examine the position regarding Silver itself during the half-year. It opened at 34¼d. and fluctuated within small limits with 34d. as the centre. In September, the monsoon in India was reported as satisfactory, and the subsequent increase in purchases from that country, together with a Continental demand for coinage purposes, sent the rate up until on October 9th it had reached 36$\frac{1}{16}$d., the highest price during the period. About this time, however, Continental buyers retired from the market, and although India still remained a purchaser, she could not check the influence of China, who at this time came out as a strong seller. Towards the end of October, therefore, the rate fell to 34¾d. and to 33d. in November. The recovery of Sterling was a factor in a further drop in Silver, which at the end of the period had reached 31$\frac{3}{16}$d. with a weak undertone prevailing. Exchange on Shanghai commenced at Taels 57¾, but, despite the lower price of Silver, the rate gradually dropped as the result of the fall in Japanese-English Exchange. The rise in Silver from September helped to cause a further decline, and Taels 46½ was recorded on October 10th. Any additional drop was checked by the fall in the price of Silver, and the rate eventually recovered to over Taels 49. Afterwards, the effect of any fall in the Japanese-English exchange was counterbalanced by a drop in the price of Silver, and so exchange on Shanghai continued at about Taels 49 until the end of the half-year.

" Turning our attention next to China, at the beginning of the period a good foreign trade was thought to be in prospect for that country as the result of the more stabilized political and economic condition of Europe, but this anticipation was not realized. The disastrous floods in North China, which lasted for over a month and a half; the unsettled political conditions in South China, with Canton as the centre; the war between Chekiang and Kiangsu, quickly followed by another between Fengtien and Chihli; all these troubles occurred successively and extended over about four months. Communications and transportation in the interior were thrown into disorder, which greatly hampered the movements of goods for export, and as this in turn reduced the purchasing power of the people in the affected districts, the import trade also suffered. At Shanghai, however, the exports of raw silk to Europe, India and the United States amounted in the aggregate to 51,000 bales valued at Taels 16,850,000, which figures are about two and a half times those for the corresponding period of the previous year, while the exports of cotton to Japan, due to the high price of the American product on the one hand and the delay in the movement of the Indian on the

other, also showed a large increase, the total value being Y.27,000,000 or about double that for the corresponding half of the year before. Except for these two items, exports were unsatisfactory, those of green and black teas being 20 per cent. less than in the previous year, while peanuts from Shantung and sesame seeds and beans from Hankow showed smaller shipments than a year ago. As regards imports, except for cotton from the United States and India, which totalled as much as 73,000 bales in all, there was a marked decrease in flour from America, and also in cotton goods, woollen goods and hardware from Great Britain, while wines from France continued indifferent. The imports of our cotton piece goods were, however, quite good, amounting to the satisfactory figure of 82,000 bales, valued at Y.36,000,000, or 14 per cent. more than a year ago. This good result is due no doubt to the favourable position for importing created by the depreciation of the Yen, and also to the absence of any boycott movement against our goods during the period. At Hongkong, trade with Yunnan, Tonkin and French Indo-China through Haiphon was good at the beginning, but, on the other hand, trade in Canton and district was in a depressed condition, with large quantities of all sorts of merchandise in stock. Consequently, imports by Hongkong of our cotton piece goods, which, encouraged by the fall in the Yen, had been very active at the commencement, became less lively from the middle of the period onward, while the import trade in other goods was also in a very depressed state. Exports were in general far from satisfactory, but shipments of raw silk from Canton, despite the disturbed conditions in that quarter, recorded as large a total as in 1923, and 11,000 bales and 13,700 bales were sent to France and America respectively. However, although the quantity of raw silk shipped was the same as in the previous year, the value did not correspond, being 33,770,000 Hongkong Dollars, or a decrease of 11,500,000 Hongkong Dollars.

At the commencement, money was easy, but about the middle of August, when an outbreak of war between Chekiang and Kiangsu was considered inevitable, money rapidly became tight in Shanghai and some native banks there went bankrupt, with the result that the rate was over 25 per cent. p.a. at one time. However, by the combined action of the Hongkong Bank, the Chartered Bank and our own the situation was relieved before it had become too critical, and money flowing in from outside in September provided further relief. Every precaution was taken by the banks when war between Fengtien and Chihli appeared imminent, and money became gradually easier and remained so until the demands in connection with Chinese New Year requirements commenced towards the end of the year.

Exchange fluctuated in general in agreement with Silver. For instance, take the Shanghai exchange on London, which rose from 3s./3¼d. at the beginning of July to 3s./3¾d. at the end of the month. Later, through the fall in Silver, caused by the recovery in Anglo-American exchange, it became weak, dropping as low as 3s./3d. in the middle of August. The prospect about this time of an imminent outbreak of war between Chekiang and Kiangsu again sent the rate up, and the end of August saw it at 3s./3¾d. In September it rose further to over 3s./5d., but as the Chekiang army was defeated about then and its General, Lu Yung-hsiang, fled to Shanghai, this was taken as presaging an early end to disturbances, and buyers of exchange came forward, causing the rate to fall under 3s./4d. Afterwards, owing to India's large purchases of Silver, and also to the outbreak of war between Fengtien and Chihli, the price of Silver again became firmer, pushing up the exchange in turn, so that by the end of September it was over 3s./5d. Later, it took a further upward movement, and after a slight setback reached the highest point in the period when it touched 3s./6¾d. on October 9. On October 13, however, Lu Yung-hsiang fled to Japan, and on the 21st of the same month Wu Pei-fu fled from his headquarters, and both these events were considered as indications of the cessation of the civil war in the near future. Accordingly, from the middle of October, exchange weakened very much, and at the beginning of November was quoted at 3s./4¾d. It had dropped to 3s./3 11/16d. by the end of that month, while December 18 saw a further fall to 3s./2⅛d. and by the end of the year it was 3s./1⅝d.

Finally let us investigate conditions in the Manchurian area. At the beginning of the period the financial situation in Dairen continued as depressed as before, while in Fengtien, business was very much hampered by the closure of the Native Exchange by the Chinese authorities towards the end of the first half of the year to prevent the further fall of Fengtien paper currency, and a severe stringency of money was experienced generally in that quarter. In the Harbin district, very important events were continually occurring that affected the political and financial situation, among them being the transfer of the administration of the Chinese Eastern railway to the "Reds," and the complications resulting from the disagreement over freight tariffs between the Manchurian railways on the one hand and the Chinese Eastern and Ussuri Railways on the other. As a consequence, the whole of Manchuria was thrown into a very unsettled condition, and when the Lungkow Bank suspended payment in August, which event was immediately followed by the disclosure of the very unsatisfactory position of the Money Exchange Company, the financial situation went from bad to worse. Reports of an abundant harvest somewhat relieved the acute tension, and signs of improvement were even noticeable, but at this juncture the war between Fengtien and Chihli broke out and conditions deteriorated again so much that the future looked very dark. Towards the end of October, however, General Feng Yu-hsiang suddenly changed his attitude towards his leader, Wu Pei-fu, and brought the war to an unexpectedly early termination, with the result that the financial position improved. In addition, there were fortunately the abundant crops already referred to throughout North and South Manchuria, and as about this time demands from Europe for produce began to come in on a very large scale, from October onward exports consequently showed great activity. During the half-year, exports of beans and bean-cakes recorded the exceptionally good results of 397,000 and 365,000 metric tons respectively, showing relative tonnage increases of 96,000 and 63,000 over the figures for the corresponding period of the previous year. Besides the good exports, large quantities of supplies were sold to the military, thus increasing the purchasing power of the people in the interior, and as a result of the favourable conditions, the sale of cotton piece goods, cotton yarn and sundries improved gradually, so that merchants were not only able to eventually clear off their old stocks, but had to replenish their supplies through importers, who in turn were much relieved by this development. As regards trade with Japan, this country took 40 per cent. and 78 per cent. respectively of the total exports from Manchuria of beans and bean-cakes, while as to imports, although the trade in cotton piece goods and sundries was in a very dull state during the first four months, this unfortunate condition of affairs was more than compensated for towards the latter part of the period when business revived in earnest.

"As regards our own country, what with the slow progress in readjustment on the one hand and the heavy adverse trade balance on the other, the future economic prospect looks very uncertain, and appears to be full of difficulties and obstacles against which we shall always have to make ample provision."

Foreign Loan Obligation of China

The Government Bureau of Economic Information has published a study of "Foreign Loan Obligations of China," a compendium of such secured external loan obligations of China as are provided with regular amortization tables, compiled and edited by J. R. Baylin of the Banque de L'Indo-Chine.

The design of the publishers of this compilation is to furnish those interested in the financial affairs of China in general, and in the buying and selling of China's bonds in particular, with a handy reference to those Foreign Loan Obligations of China which have been secured and provided with regular amortization tables. Hitherto the public has not had access to any such compilation, and those desiring information have been confronted with the necessity of undertaking tedious research to obtain it.

The texts of the loan agreements have not been given, the work being confined to the fiscal conditions of the various loans and the amortization tables accompanying them.

A list of payments falling due in 1925, and for which the necessary funds can be raised, has been attached.

The loans have been grouped under general, railway and telegraph loans, in that order, and easy access can be gained to any particular loan by means of the list of contents.

The matter is so arranged that the facts of each loan stand out clearly, thus making it easy for the non-specialist to get at the facts.

The Sinclair Oil Concession Cancellation

ONE of the prettiest political business deals ever to be tried in the Far East was the Sinclair Oil Concession. The facts may be stated in a few sentences: Japan (on terms of friendship with the United States), was in occupation of Saghalien. Russia (not recognized by the United States), claimed Saghalien. Russia gave a concession for the oil of Saghalien to the Sinclair Oil Company, an American corporation on condition that the United States would recognize Soviet Russia. Mr. Sinclair and Secretary Fall were supposed to have an inside track to the President and government of the United States. With the concession in their pockets, the Sinclair organization was to proceed to Washington to work for recognition. They had a vested interest in recognition. Recognition meant oil and money to them. The Soviet commissaries at the time believed that the Sinclair organization could get the American government to recognize Soviet Russia. They gave them the concession because they believed that. **They gave them the concession because they had been mis-informed about the American people and government, because they misunderstood, because they believed that if an American corporation could get money out of Saghalien, the American government would go to war with Japan to drive the Japanese out of Saghalien.**

They were fooled. The American government did not go to war with Japan to drive Japan out of Saghalien. The American government paid no attention to the Sinclair contract. The American government ignored the Sinclair arguments. To this day, the Amerian government has not recognized Soviet Russia, but Japan has. And therein lies the rub, for not only has Japan recognized Russia, but Russia has given Japan an oil Concession in Saghalien by solemn treaty between the two governments. *In a word, the little Sinclair plot has failed to bring about trouble between Japan and the United States, and by a sort of poetic justice, it has helped Japan.*

That the Sinclair people knew what they were up to and what Soviet Russia wanted is obvious from the remarks of the Soviet lawyers at the Moscow trial to cancel the concession. The lawyers said :

The Counsel for the plaintiff asked the court to declare the contract null and void, and demanded that the Company pay a fine for breach of contract and compensation for the alleged loss resulting from the fact that the Company had not begun to develop the concession within the contracted period of one year, nor within the supplementary period granted by the Soviet government.

The Counsel further declared that the concessionaires at the time of the conclusion of the contract, were aware of the Japanese occupation of Saghalien, and that consequently the company's plea of force majeure was invalid. Moreover, he declared that the Soviet authorities, and particularly the Soviet Ambassador in China, had given every possible assistance to the Company's expedition for the exploration of Saghalien.

He endeavored to prove that the Company, knowing of the presence of the Japanese troops, incurred the risks involved.

For the defence, the Counsel denied these assertions, gnd insisted that the Company took all possible measures to ensure developments but were frustrated by external interference.

They admitted knowledge of the presence of the troops, but declared that they did not realize to what extent the Japanese would resist the entry of the expedition into the territory of the concession.

The Soviet Concessions Committee Chairman, Gregory Pyatkoff further made the point that the Soviet government had been prodding the Sinclair Oil Company to live up to its agreement. An Associated Press Despatch from Moscow dated February 22, reads :

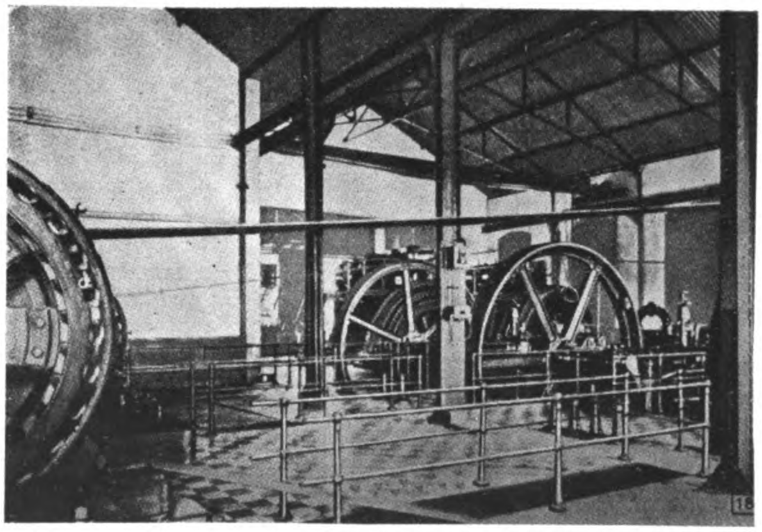
Pyatkoff declares that long before the Russo-Japanese treaty was concluded the Soviet government warned the Sinclair company that non-fulfillment of the agreement would force the government to refer the matter to the courts. He says that in 1924 he gave the company six months in which to comply with the terms of the contract. Evidently referring to the failure of an alleged attempt by the Sinclair company to induce the American government to recognize Russia, Pyatkoff says :

"The Soviet government is convinced that the Sinclair company is unable to carry out certain obligations enumerated in the contract because it over-estimated its own weight and importance in political matters and has not received and support from its own government."

Nothing can be more clear. The concession was granted in return for the Sinclair organization working for recognition of Soviet Russia by the United States. That was the Soviet understanding. That was undoubtedly what Sinclair agents told the Soviet government they could do. Soviet Russia would have given its right eye to be recognized by the United States, and what are oil wells in Saghalien compared with that ? Had the United States become a party to the plot, had the American government recognized Soviet Russia, had it supported the Sinclair Concession, what would Japan have done ? What would have been the relations between the United States and Japan had the United States recognized the Sinclair Consession ? Would the United States have gone to war to drive the Japanese troops out of Saghalien ? Would the United States have gone to war with Japan to support concessionaires against every sane interest in the country. That is what might have happened if this deal had gone through as planned. That is what Americans operating carelessly in the Far East might have brought upon their country. Fortunately, wise State Department saved the world from such a calamity.

Sulzer Diesel Engines in the Pnom-Penh Municipal Electric Works, Indo-China

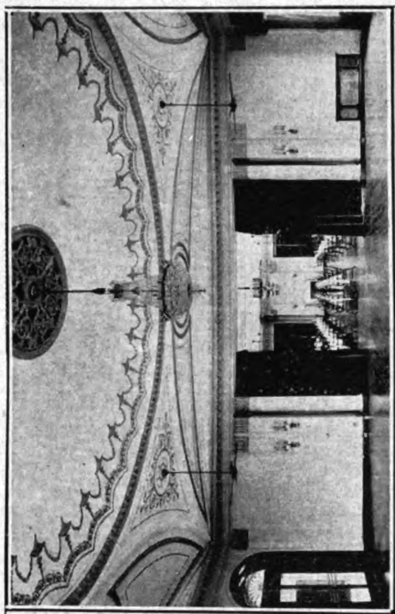
Sulzer Bros. have installed two 270-b.h.p. Diesel engines in the Municipal Electric Station at Pnom-Penh for supplying light and power to the town. The station is located in the middle of a marsh on a peninsula at the confluence of the rivers Me-kong and Toule-sap, about half a mile from Pnom-Penh. About two-thirds of the energy generated by the Diesel sets is used for street

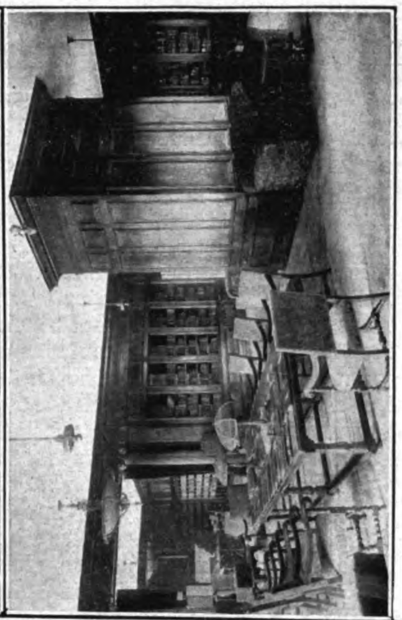


Municipal Electric Works, Pnom-Penh, Indo-China, Equipped with Two 270-b.h.p. SulzerDiesel Engines

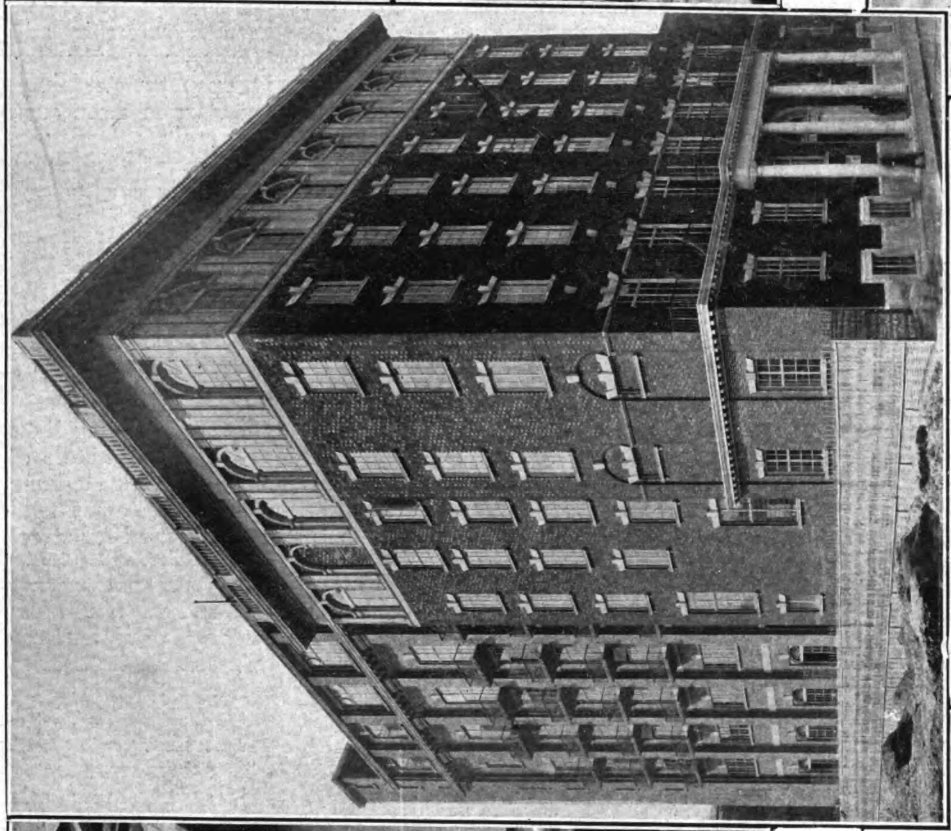
lighting and the remainder for working the pumps at the municipal waterworks and for driving various small motors and fans. In addition to the Diesel engines there are also four small steam engine sets which are put into service when required. The Diesel engines run about 600 hours monthly, and the steam engines about 200 hours, the total amount of electric current generated daily amounting to about 8,500 units. The Sulzer Diesel engines are of the four-cylinder four-cycle type, running at 187 revs. per min. and coupled to 225-k.v.a. 4,200-volt flywheel type generators supplied by Brown Boveri & Co., Baden, Switzerland.

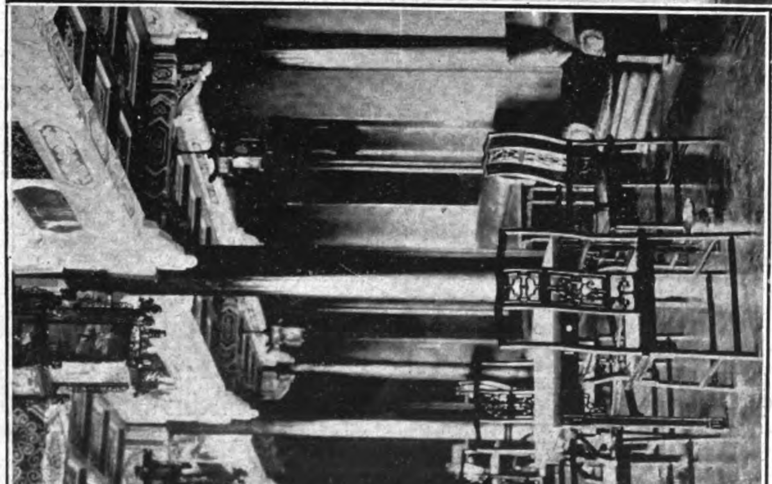
The American Club, Shanghai



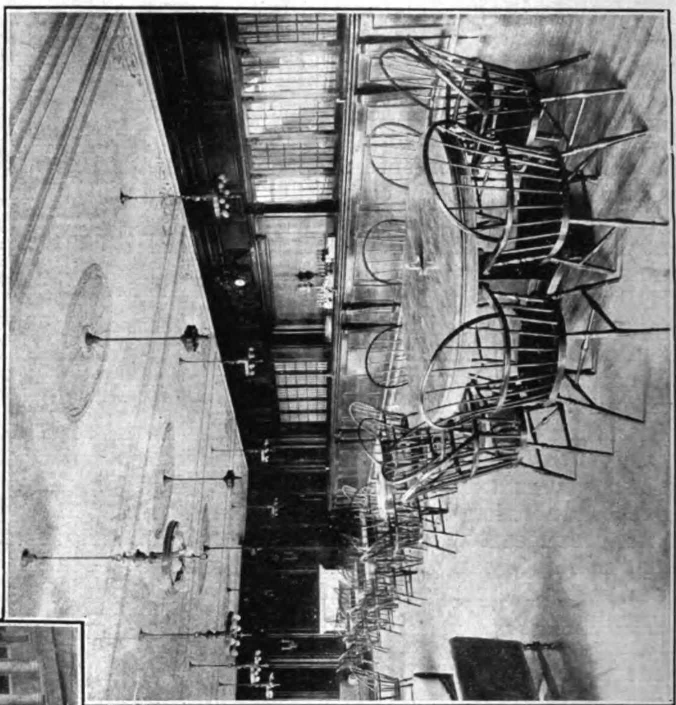


Library

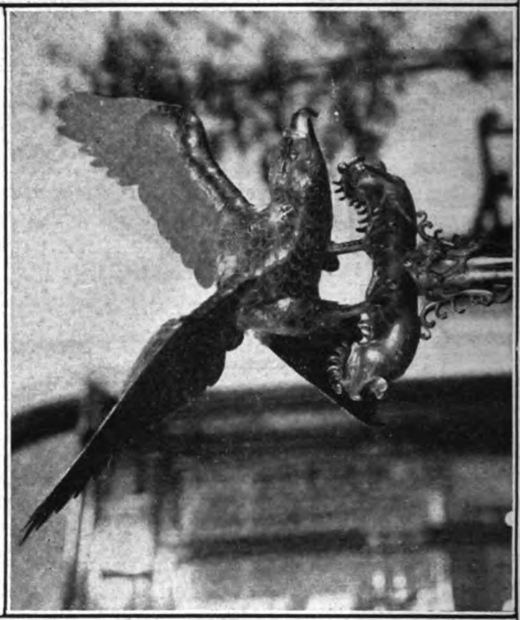




The Mah Jong Room

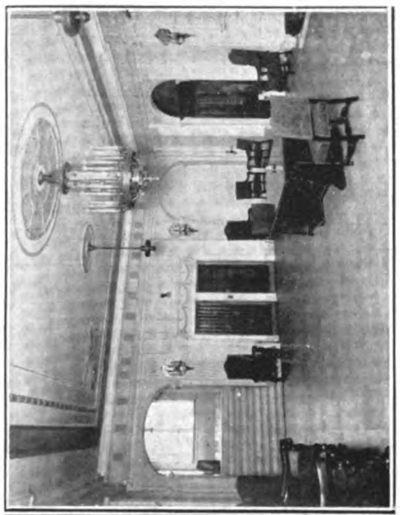


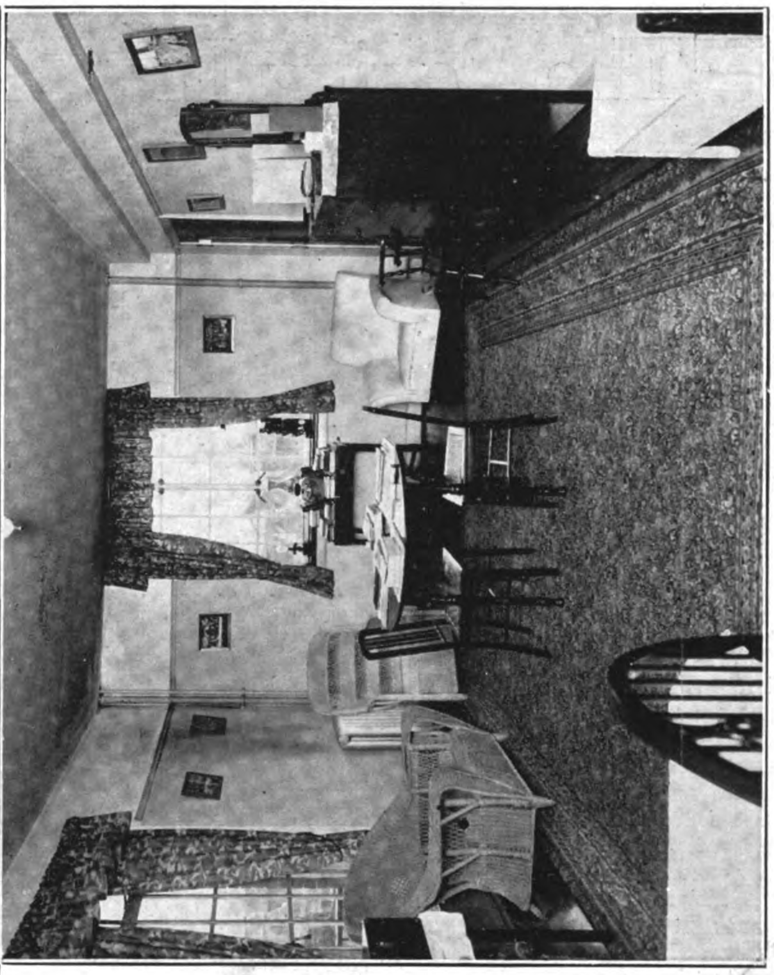
The Bar



The American Eagle in the Lobby

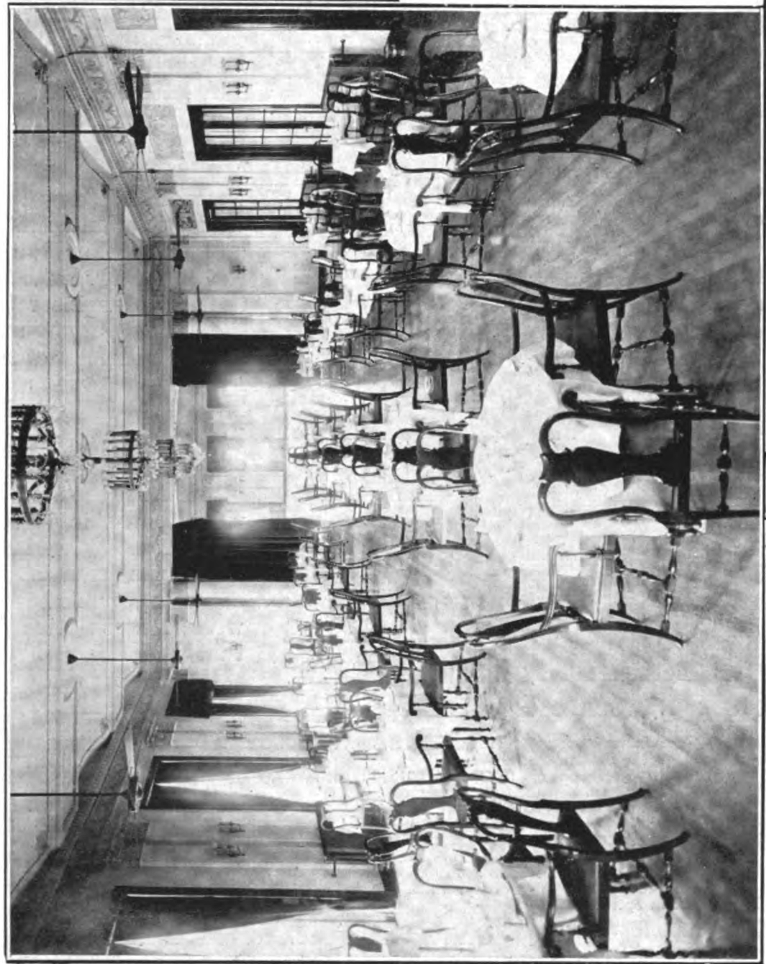
The Card Room

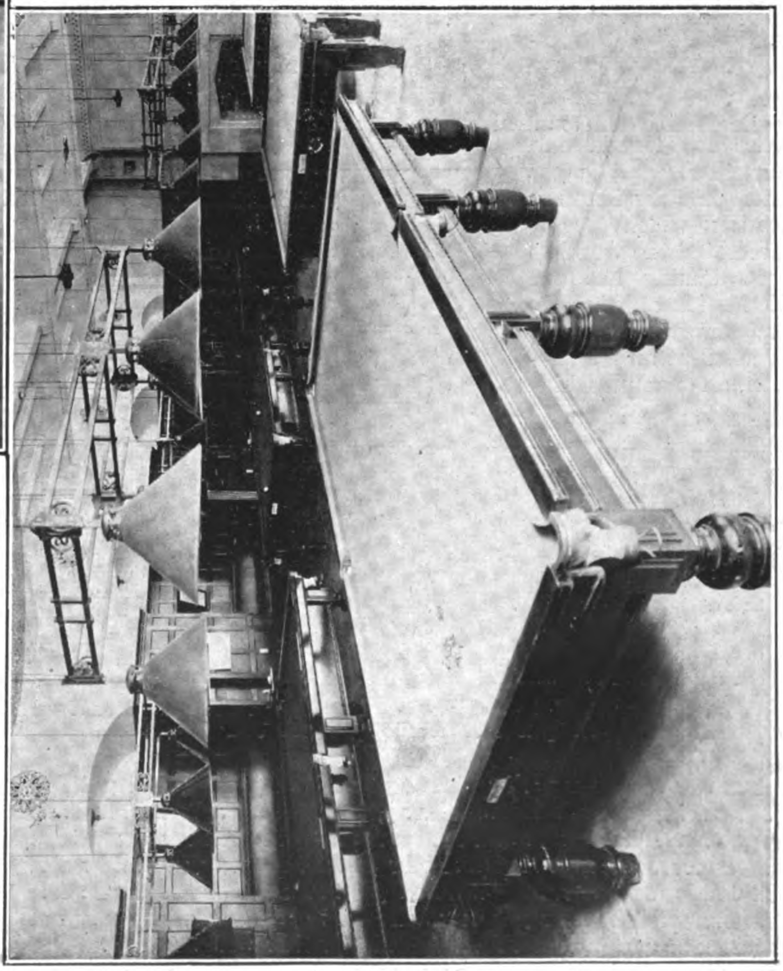




A Corner of the Lobby *(top)*

Bedroom *(bottom)*





Library *(top)*

Dining Room *(centre)*

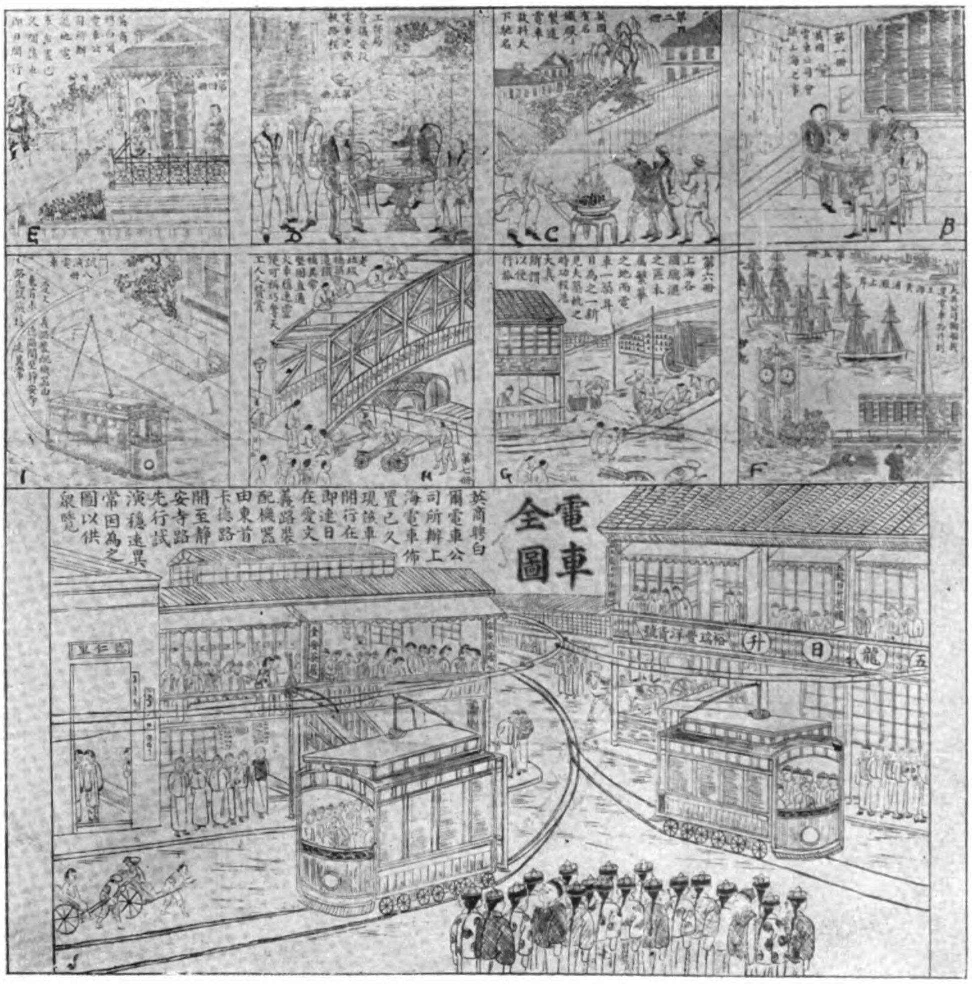
Billiard Room *(bottom)*

The Peking Electric Tramway System

By Lawrence Impey

AFTER overcoming many difficulties and encountering much opposition on the part of both the press and various official organizations, the electric tramways of Peking have been constructed and the working of them commenced. For those who know something of the mediaeval condition which exist in many parts of China and who comprehend in some measure the innate aversion of the Chinese to any startling innovation, this tramway scheme, apparently insignificant, assumes an evolutionary characteristic of the greatest importance.

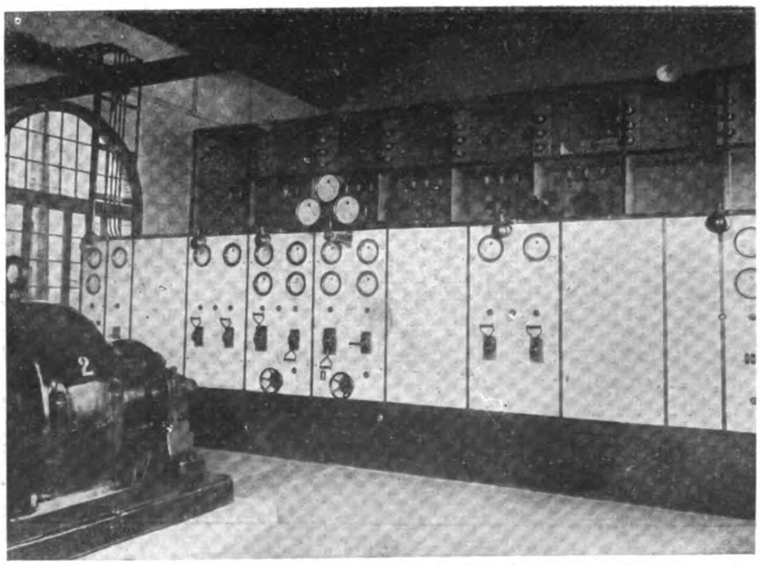
Up to date the only places which possessed an electric tramway system were the British colony of Hongkong and the Chinese cities of Tientsin and Shanghai, and these latter had foreign concessions which greatly facilitated the work, so that Peking has the distinction of being the first purely Chinese city to attempt an installation, an example which will probably be speedily imitated elsewhere should it prove successful. In considering the working of the Peking system the writer does not intend to dwell at length on the financial and administrative organization of the company, which was described by him in some detail in the FAR EASTERN REVIEW for June, 1924, but at the same time it may not be out of place to pay a tribute here to the work of Mr. Tang, that energetic administrator and able diplomat, and the skill of Mr. Laforest, the chief engineer for the company and formerly director of the French tramways in Shanghai, in bringing the scheme to a successful culmination.



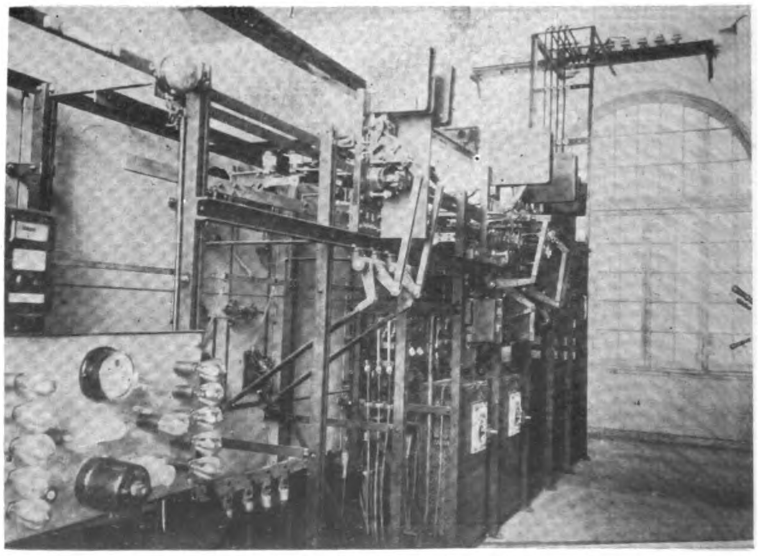
REPRODUCTION OF CHINESE NEWSPAPER 1908

(*b*) Meeting of the Board of Directors of the Shanghai Tramway Co. held in England.
(*c*) The British foundries constructing the rails, these foundries are the most famous in the world.
(*d*) A Meeting of the Shanghai Municipal Council decides on the installation of the tramways.
(*e*) The office of the contractors, Messrs Peebles & Co.
(*f*) The materials for the tramways arrive at Shanghai and pass the Customs.
(*g*) The famous port of Shanghai undertaking the laying of the tramways.
(*h*) The iron bridge at North Chekiang Road is such a work of art that the trams can cross it, every-one should see this wonder.
(*i*) The tramway service from Avenue Road into Carter Road is placid in the extreme.
(*j*) General view of the tramway system. This picture is drawn in order to accustom our readers to the sight of this novelty, which will shortly be in operation.

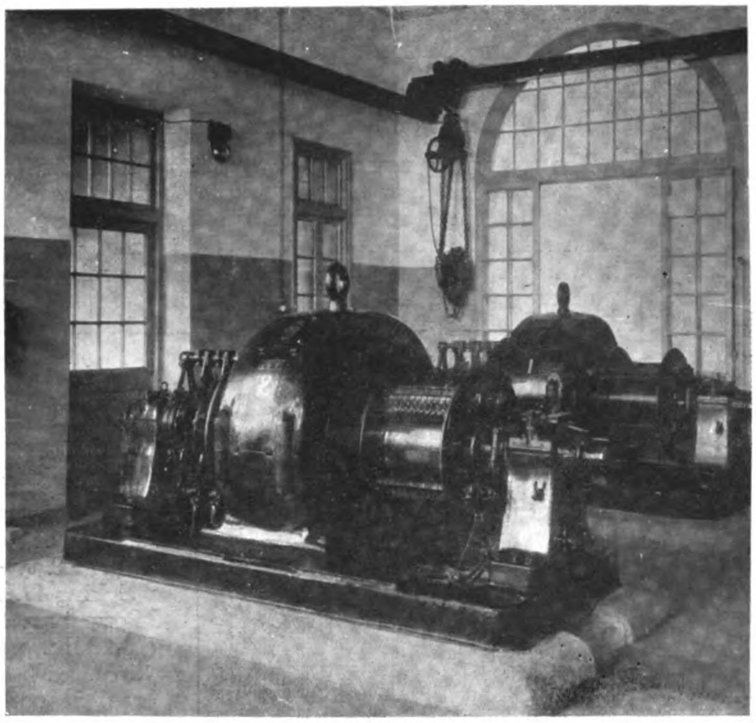
During the months prior to the inauguration ceremony and even when the trams had actually commenced to work, it was noticeable that there was a considerable campaign in the press against them on the grounds that they would compete with the rickshaw traffic and thereby throw many coolies out of work. Whether this will prove to be the



Sub-Station Switch Boards



Sub-Station Switch Boards



Rotary Convertors

case in Peking only time can show, but deductions which can be made from the following statistics gathered in Tientsin and Shanghai appear to show that this dimunition in the number of rickshaws need not necessarily take place.

SHANGHAI MUNICIPAL COUNCIL

Average number of licences issued to vehicles annually.

Years		Rickshaws	Carriages	Motors	Wheel-barrows	Chairs	Carts
1907	..	13,829	1,635	96	7,386	661	1,090
*1908	..	12,892	1,511	119	7,060	619	1,046
1909	..	12,740	1,414	133	6,020	501	993
1910	..	12,498	1,366	151	5,804	331	982
1911	..	11,111	1,277	217	6,310	199	958
1912	..	13,252	1,269	268	5,790	94	1,003
1913	..	13,777	1,278	342	6,437	46	1,230
1914	..	13,867	1,190	443	6,938	35	1,400
1915	..	13,816	1,053	539	6,777	28	1,425
1916	..	12,855	1,015	673	7,460	25	1,546
1917	..	13,691	941	819	8,404	27	1,718
1918	..	14,209	886	1,061	8,117	17	1,821
1919	..	14,726	831	1,378	8,667	16	2,141

N.B.—The tramways were introduced in 1908, and the following is an extract from the Shanghai Municipal Council Report for that year, the subject being Public Rickshaws : " It was anticipated that with the advent of tramcars these vehicles would show a considerable reduction in number, but this has not been the case. There was, however, a slight falling off during the summer months, but for the last three months the number has recovered and in now fully up to the average for the preceding year (in 1906—12,594 rickshaws)."

TIENTSIN FRENCH CONCESSION.

Annual licence fee receipts in taels.

Years		Rickshaws	Carriages and Motors	Wheel-barrows	Carts	
1905	..	20,290	230	5,431	9,524	
1906	..	20,522	323	5,920	10,977	—Tramways started
1907	..	20,753	349	5,894	8,979	
1908	..	21,122	284	5,129	5,607	
1909	..	21,682	261	5,196	4,876	
1910	..	21,651	242	5,804	4,760	
1911	..	16,345	333	6,152	4,463	—Prohibition of houses of prostitution.
1912	..	18,718	607	7,118	4,981	
1913	..	17,471	1,420	8,314	5,961	
1914	..	16,753	1,431	11,364	8,334	
1915	..	14,801	1,503	11,494	8,215	
1916	..	15,437	1,984	12,128	8,857	
1917	..	17,004	2,670	12,808	9,466	
1918	..	19,130	3,505	13,587	9,771	
1919	..	20,383	4,337	14,587	10,374	
1920	..	25,464	7,179	15,222	11,327	
1921	..	30,281	9,058	15,714	12,423	
1922	..	32,079	10,337	18,338	14,393	

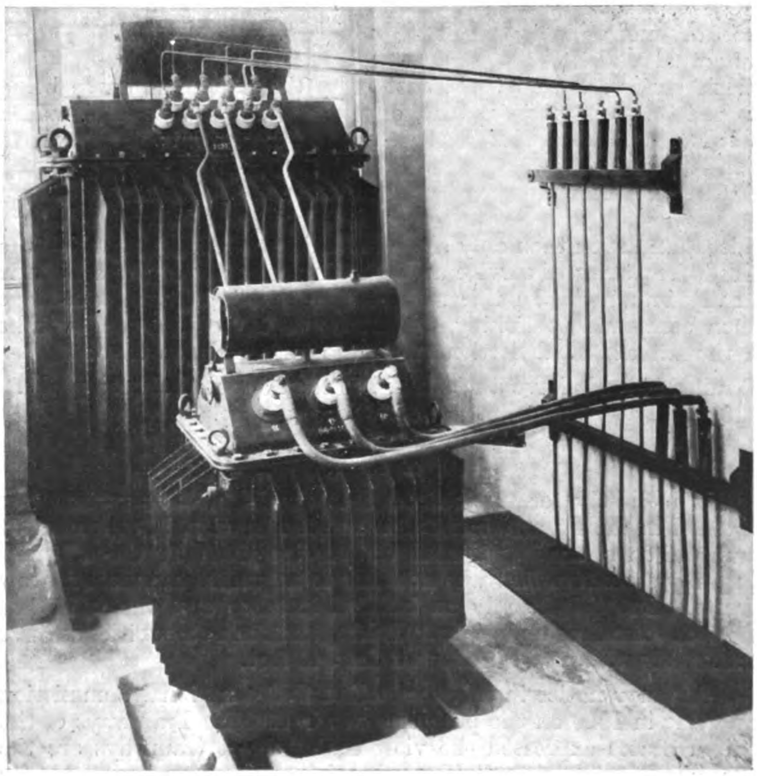
How can one best explain this increase in vehicular traffic in the face of keen competition on the part of the trams ?

In the opinion of the writer the most important argument which can be advanced, is the statement that increased facilities for travel of any kind encourages all classes of the people to take journeys, hence the larger aggregate of passengers for the rickshaws in spite of the tram traffic. The same argument may be used in regard to the use of carts, for while it is obvious that the railway system must take over the bulk of the passenger and freight trade for any distance over a few miles, it appears that the transportation of these same passengers and goods to and from the stations has actually led to an increase in the number of carts in use in many provincial towns in China.

One of the principal objections presented in the vernacular press and elsewhere as to the use of electric trams in Peking is based on the idea that these vehicles cannot but increase the congestion in the traffic on the main roads. Here the writer's experience as an engineer leads him to admit that there may be some grounds for the suggestion, for the same point has been frequently discussed abroad when the relative merits of trams and motor vehicles were being considered, one party arguing that with the trams that were restricted to a certain definite area it was easier to control the remainder of the traffic, while the opposition pointed out that the motors had freedom of movement and could therefore go round obstacles and avoid any crowding of the streets.

But the consideration in Peking is not so much the relative merits of trams and motors as an agent on traffic, as a question as to whether the tramways or the other vehicular traffic cause the greater congestion. In this regard one may consider the following figures as an approximate comparison of road space occupied by rickshaws and trams respectively :

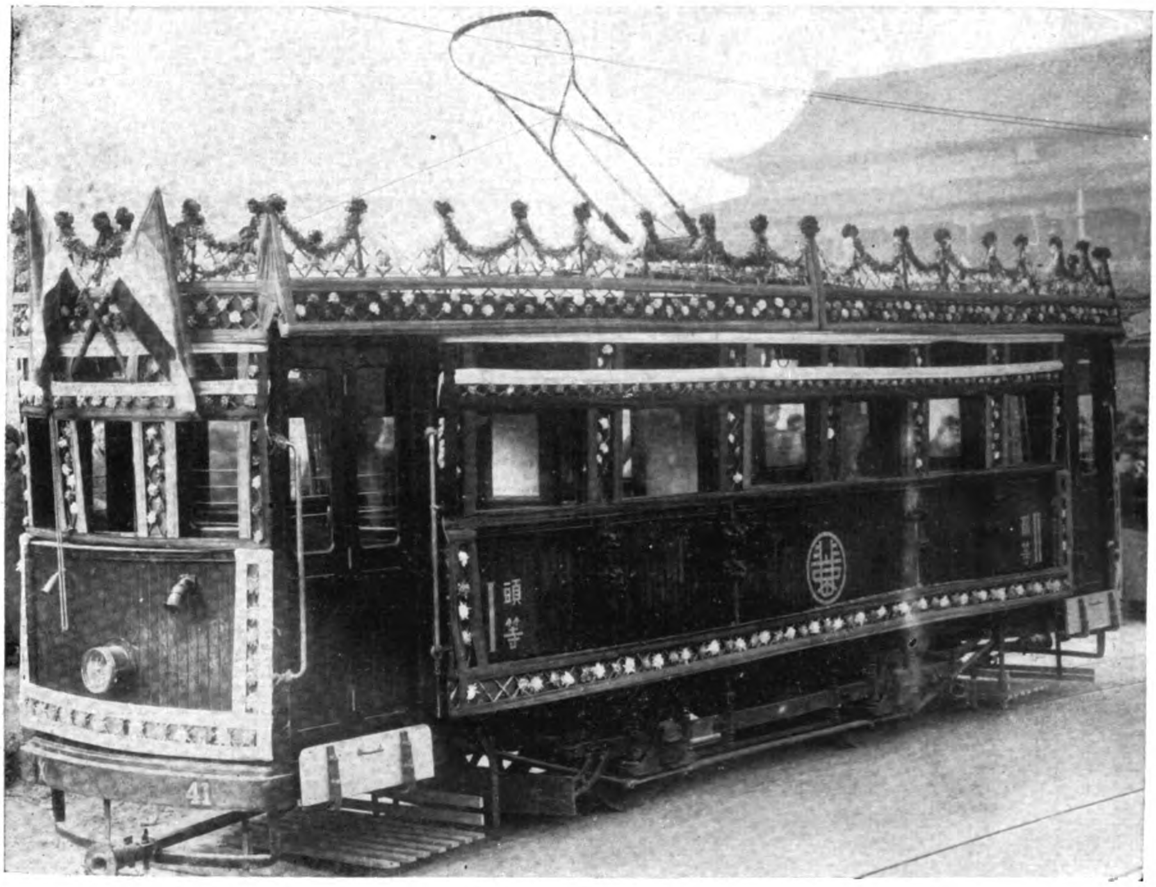
	Trams.	Rickshaws.
(*a*) Number of passengers carried per vehicle	50	1
(*b*) Miles per hour (including stops) ..	8.8	6



Sub-Station Transformer and Reactance

(*c*) Travelling m.p.h. (C=A×B) ..	440	6
(*d*) Area occupied by each vehicle in square feet	200 s.f.	25 s.f.
(*e*) Practical traffic area occupied by each in s.f.	200	71½
N.B.—35 rickshaws massed wheel to wheel were found to occupy 2,500 square feet.		
(*f*) Road space occupied by 50 travellers therefore	200 s.f.	5,220 s.f.

From these statistics one may deduce therefore that (*a*) A tramcar will effect the same transportation as 73 rickshaws, and (*b*) A tramcar is occupying only 1/26th of the road surface required by the 73 rickshaws. It is evident that one of the most important factors bearing upon the establishment of an electric tramway system is the width and nature of the roads which are available. In this respect Peking is at present at a considerable disadvantage as compared to cities in Europe or America, for while the total width between building frontages on the main streets in Peking is probably 150 feet or more, the actual road width varies from 40 to 50 feet only, the remaining space being wasted to a very large extent, owing to the annoying habit which the Chinese people possess of walking in the road in preference to using the sidewalk.



The Inaugural Car

In estimating the road area necessary for a tramway system it may be said that a width of 30 feet is the absolute minimun required, and even then only a single track can be laid, by which the speed, frequency of service and carrying capacity of the system is greatly impaired. In this respect Shanghai is at a disadvantage when compared to Peking, for an inspection of the road widths in the International Settlement of the former shows that:

60 miles of roads have a width of less than 30 feet between paths.
12.3 „ „ „ of 30 feet average.
7 „ „ „ of 40 „ „
2 „ „ „ of 50 „ „

It is chiefly for this reason that the Electrobus system was installed in the French Concession and International Settlement at Shanghai in order to augment the service given by the ordinary tramway system, which was not able to negotiate the most narrow streets. But this is only an isolated instance and one which, as has been said, does not apply to Peking and such other cities as have main roads with a width of more than 40 feet.

One may notice in this connection that a national Commission reporting in 1920 on the problems of the Electric Tramways of the United States expressed the view that "street tramways are the most nearly adequate reliable and satisfactory system available for transporting the maximum number of people through the streets of our cities. Where roads are straight and wide as in most cities of the United States, tramways have every advantage as an efficient means of transport."

The Installation of the Peking Tramways

Routes.—The accompanying map will give the reader some idea of the tramway system as it now exists and how it serves the needs of the different parts of the Tartar and Chinese cities of Peking.

Length of route laid with double track, 10.35 miles; length of route laid with single track (partly in use), 5.25 miles; car tracks at depot and sheds, 1.82 miles; length of single track to be completed, 2.62 miles; total length of track laid (one metre gauge) 30.39 miles.

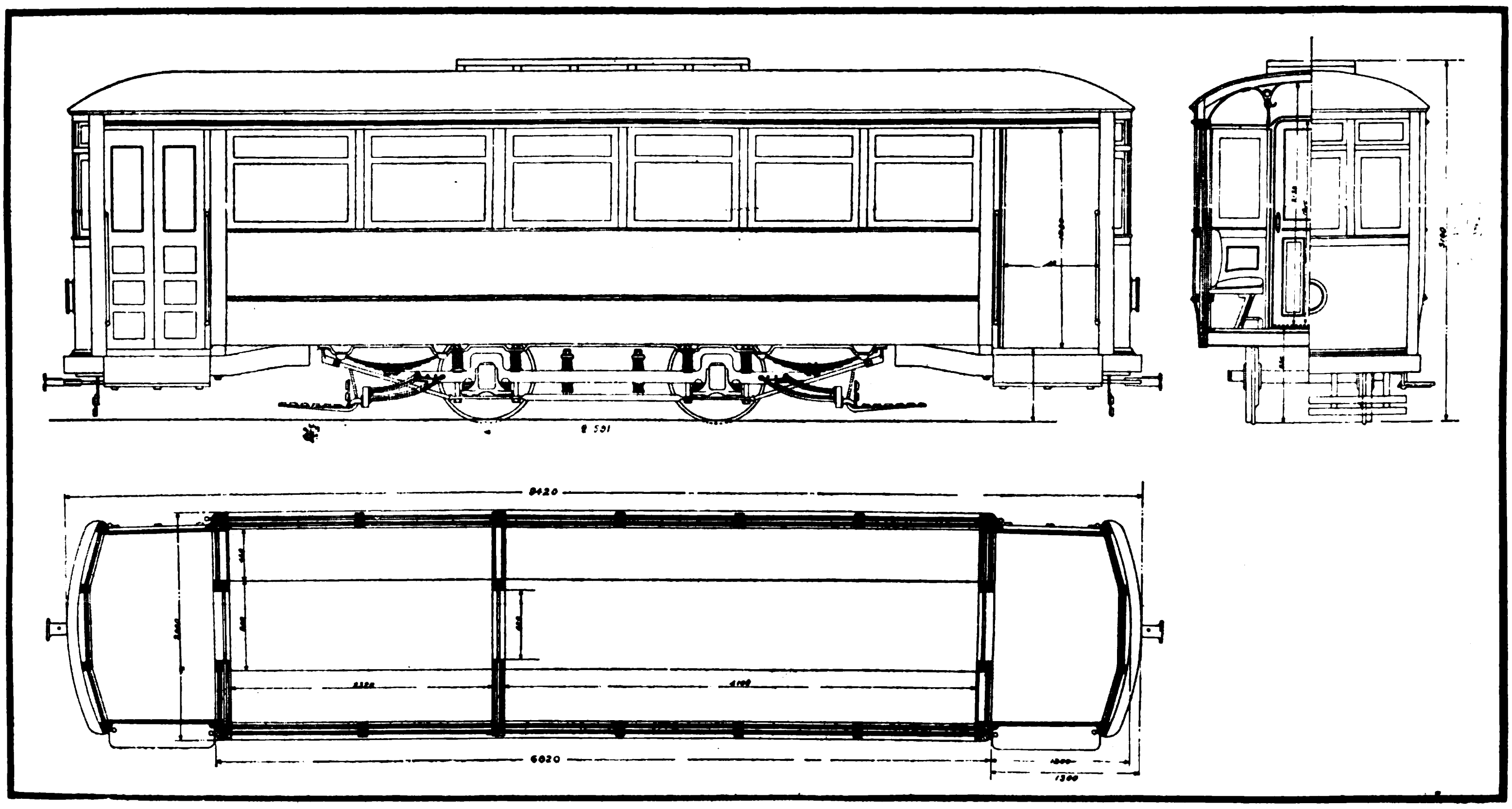
Rails.—The rails are supplied by the French foundries of Longwy, and are of the U V F III type weighing 47.77 kilos per metre (96.25-lbs. per yard). These are laid on a foundation of hard broken stone placed in parallel trenches and embedded in the ordinary road material. The minimum radius of curve on the route is 25 metres. For the depot and shed tracks Tignole rails of 20 kilos per metre (40.2-lbs. per yard) have been employed, these also coming from French workshops.

Overhead Equipment.—The standards are of reinforced concrete and were manufactured in Peking by the firm of Brossard Mopin, being placed either between the tracks or to the side of them as best suits the locality. The live wire, which is carried either by brackets or suspension cables has a section of 63 millimetres (about No 00 S.W.G.) The other overhead equipment comprises the lines for the alternating and high tension current, the supply lines for the continuous current, and the signal cables, etc. The repairs to all the overhead street wiring are carried out by means of the usual repair tower mounted on a Delahaye truck for portability.

Rolling Stock.—This comprises 96 cars, of which 66 are equipped with motors and 30 are trailers. Of the 66 first named 4 are used for the transportation of material and 2 as watering cars. The chassis of all there vehicles comes from French factories, being of the standard Brill 21 E type, while the superstructure was manufactured in China under contract. The width of the cars varies from 8-ft. 6-in. for the motor equipped to 7-ft. 6-in. for the trailers.

The electrical equipment for the cars is supplied by the Societe des Constructions Electriques de France and is of the standard Dick Kerr type. The current is tapped from the overhead wire by means of a bow pattern feeder and not by a trolley wheel, which is not now considered so efficacious as the bow pattern.

Each car is fitted with two motors of 30 h.p. capable of developing 55 h.p. for a brief period if required, thus giving a total of 110 h.p. in emergencies. The traction pull is approximately 3 tons at the tyres of the wheels. The total weight of a car, that is chassis and body, is 9.6 tons, while that of the trailer is 5.8 tons.



Plan of Tram Car Used in Peking System

The cars have 1st and 2nd class compartments which are entered from the extremities, while the trailers have only the 2nd class and are fitted with central doors of admittance of passengers. As a matter of observation the writer would say that differentiation of class was of no great utility in Peking at the present time, for the bulk of the soldiers and police students appear to ride without paying their fare, thus leading to disputes with the tramway employees on several occasions and greatly inconveniencing the general public which desires to travel in peace and comfort. In this question the tramway company deserve some sympathy, for without the fullest support from the authorities, which they are scarcely likely to obtain, it is difficult to see what they can do to remedy matters short of closing down the system for a time until the weight of public opinion compels the government of Peking to support them.

The car bodies are built very much on the lines of a railway carriage on the Chinese railways, being of varnished wood, it being expected that this will prove more satisfactory than metal frames, which are both hot in summer and cold in winter. At the same time there is an installation of electric radiators in the cars which enables them to be heated during the winter months, when the bitterest cold is to be experienced.

Depot and Repair Shops.—These buildings are situated in the southern part of the Chinese city not far from the Temple of Heaven, are fully equipped for all necessary repair work, and are constructed in reinforced concrete.

The car sheds cover an area of 4,556 square yards and contain 12 lines of rails fitted with repair pits, so that more than one hundred cars can be accommodated thereon at the time. The workshops lie to the north of the Sheds, which have doors opening at both their extremities, and a turntable is fitted between them so as to allow of any necessary handling.

The workshops cover an area of 3,000 square yards, and comprise the following departments :

Carpenter's Shop and Joinery.—Area of 720 square yards and fitted with :

1 Circular saw
1 Band saw
1 Grinder
1 planing and jointing machine.

Turning, Fitting and Winding Shop.—Area of 1,615 square yards and equipped with :

1 Wheet Lathe
1 Lathe, bench length 7-ft. 0-in. and working radius 8½-in.
1 Lathe, bench length 11-ft. 0-in. and working radius 8½-in.
1 „ „ „ 11-ft. 0-in. „ „ „ 10-in.
1 Milling Machine
1 Punch and Shear
1 36-in. pillar sensitive drilling machine
1 26-in. „ „ „ „
1 Grinder
1 Emery Wheel
1 Shaper
1 Planer
3 Winding Benches
1 Impregnating Boiler and Machine complete.

Painting Shop.—Area of 420 square yards.
Blacksmith's Shop.—Area of 120 square yards.
Office and Storeroom.—Area of 120 square yards.

All these above buildings are fitted with steam heating, and the water supply for them is derived from two artesian wells equipped with the necessary pumps and water towers. The lighting system for the shops is supplied, alternating current, by a transformer of 100 k.v.a. The site also contains various buildings for the personnel, together with store sheds, etc., which have not been considered in the foregoing, but which cover a considerable area.

Sub-Stations and Transformers.—The continuous current of 600 volts for the system is supplied by two convertor stations which transform the triphase alternating current 5,000 volts 50 period into continuous current. The material for these two sub-stations was supplied by the Societe Siemens China.

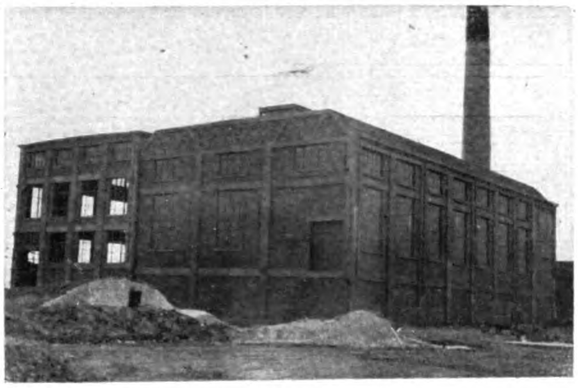
The North Sub-Station contains :

2 Triphase static transformers of 240 k.v.a. (5,000/470 volts)
2 Threephase static reactances of 45 k.v.a.
2 Rotary convertors (hexaphase compound) of 225 k.v.a. (615 v./370 amperes)
1 High tension switchboard with cells.
1 Switchboard for continuous current.

The South Sub-Station contains :

2 Threephase transformers of 400 k.v.a. (5,000/470 volts)
2 Reactances of 65 k.v.a.
2 Convertors (hexaphase compound) 375 k.v.a. (615 v. 600 amp.)
1 High tension switchboard with cells.
1 Switchboard for continuous current.

Car Shed



Tungchow Power Station

Exterior of Car Shed

The Central Power Station.—It is most unfortunate that there is not in Peking or its immediate vicinity any water supply of a volume and character suitable to the needs of an electrical power station of any capacity. To the west of the capital, at a distance of some twelve miles, there is the Yung Ting river, but its current is extremely raid and very muddy in the flood season and almost non-existant during the drought, so that it was impossible to consider it as a source of supply. To the east of Peking at about the same distance runs the Pei Ho, a river whose current is more equable, and it was therefore decided that a power station should be erected on its banks close to the Chinese town of Tungchow, a place of some 30,000 inhabitants. The coal supply is brought on the Peking-Mukden branch railway as far as Tungchow itself, and thence a branch canal of a mile and a quarter supplied by the Pei Ho serves for transportation to the power plant.

The buildings of the latter include:

A boiler room, dimension 67-ft. 0-in. wide 130-ft. 0-in. long and 48-ft. 0-in. high.

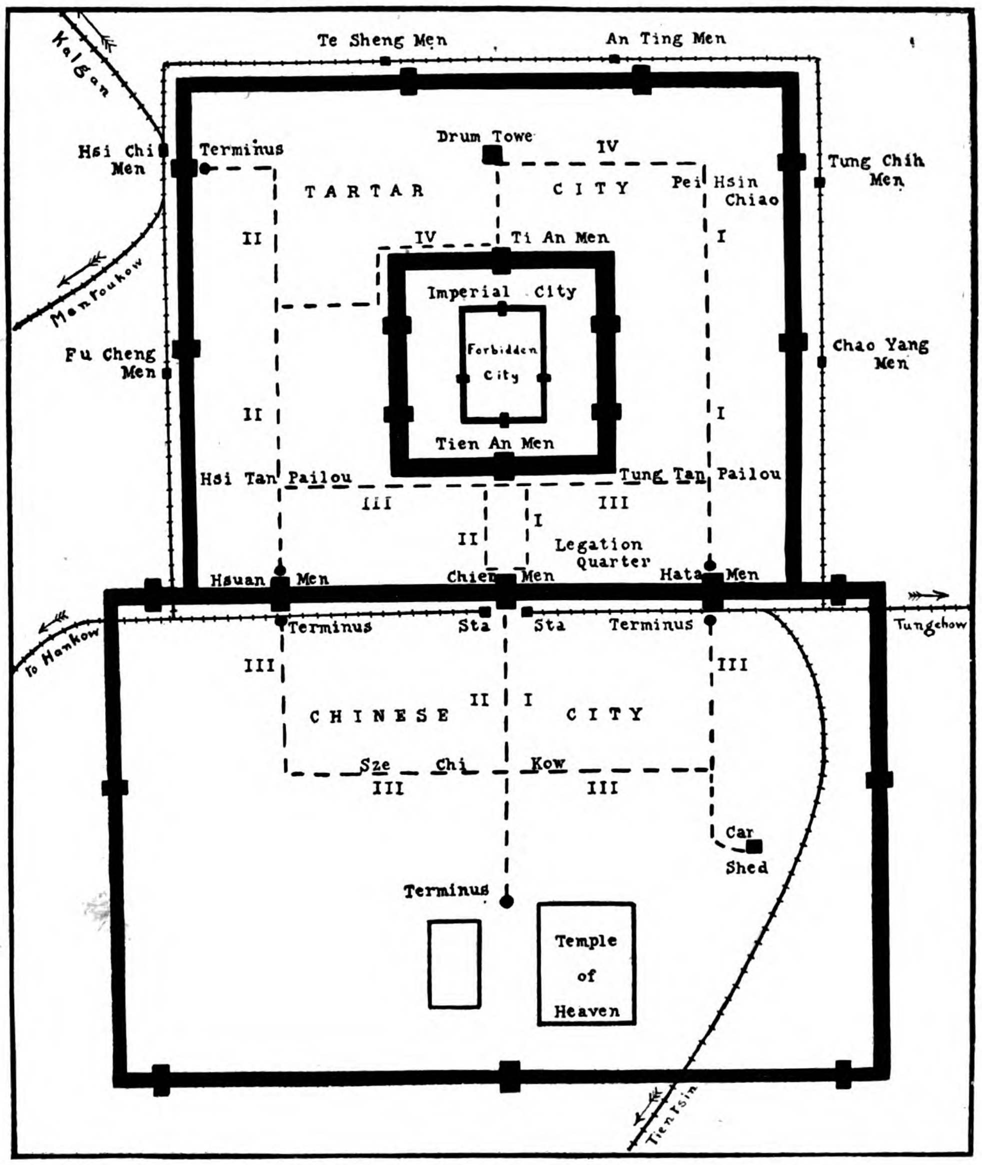
Turbine and switchboard room 40-ft. 0-in. wide 150-ft. 0-in. long and 48-ft. 0-in. high.

Chimney stack 175-ft. 0-in. high and 6-ft. 6-in. diameter at the top.

To these must be added the pumping station, the transformer room, the filter plant, engineer's house, offices, storesheds and workshops, etc., the construction of the majority of these being almost completed at the time of writing.

The boiler house contains three Babcock and Wilcox boilers of 4,400 sq. ft. heating surface, each fitted with superheater of 1,210 sq. ft. heating surface, and having a grate surface of 100 sq. ft. per boiler. Babcock automatic fuelers are fitted, and each boiler has a green economiser of 1,720 sq. ft. heating surface. The superheated steam is supplied at a pressure of 14 atmospheres.

In addition to this, foundations are already in place for three more boilers of similar nature, which will thus complete the installation of six as originally planned.



Map of Peking Tramway System

Firing can be either ordinary or draft, by means of a ventilator of 62-in. diameter.

Besides the two feed pumps for the engine room the plant is also fitted with a distilling plant for drinking water.

The Engine Room contains:

1 set if turbo-alternators brown boveri of 120 k.v.a. for auxiliary services.
2 sets of turbo-alternators brown boveri of 900 k.v.a. for the tramway system.
1 set of turbo-alternators brown boveri of 1,800 k.v.a. for the tramway system.

In addition to this the foundations are in place for a further set of 3,600 k.v.a. while the recent installation of a 30 ton bridge crane has greatly improved the facilities for handling the machinery.

The current produced is an alternating threephase of 5,000 volts 50 periods, and the switchboard system, which covers three stages, has been calculated to permit of considerable future extensions.

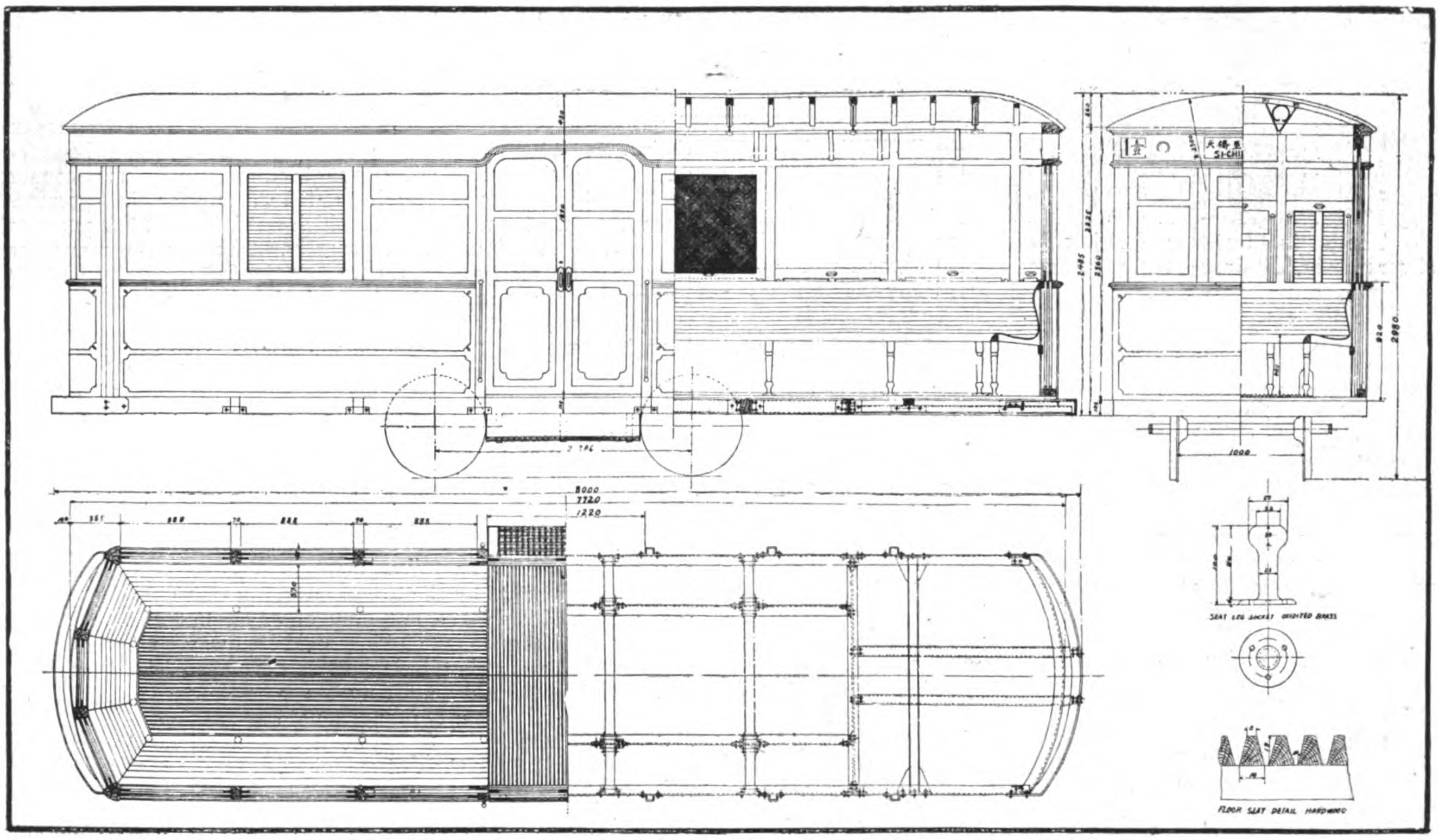
The adjoining transformer room contains two threephase transformers of 2,725 k.v.a. which enable the current to be stepped up from 5,000 volts to 33,000 volts for transmission to Peking.

The pumping station contains three sets of motors, one delivering 100,000 gallons per hour and the other two 200,000 per hour, while additional space has been provided for the installation of further plant to deliver 400,000 gallons per hour. These are all supplied by the firm of Sulzer.

The workshops comprise blacksmith's equipment, two lathes, drilling machine, one 12-in. shaper, grinder, etc.

Transmission Equipment.—The high tension current of 33,000 volts is carried by two lines in parellel of 6 copper conductors No. 3 S.W.G. total length of 15.6 miles.

The system also includes one steel ground cable $\frac{7}{11}$ b.w.g. and signal line of $\frac{7}{13}$ b.s.



Plan of Trailer

The supply line from Tungchow to Peking follows the route of the railway, and is carried on reinforced concrete standards supplied by Brossard Mopin of Peking. On arrival at the transformer station close to Hatamen Gate the current is again stepped down from 33,000 volts to 5,000 volts, by a similar equipment to that installed at Tungchow, viz: 2 transformers of 2,725 k.v.a. supplied by the Swiss firm of brown boveri.

It is expected that the central power station thus outlined will be in full working order by the end of 1925, and in the meanwhile the current required for the tramway system is being supplied by the Peking Electric Light Co. in the form of a threephase current of 5,000 volt 50 periods.

Inauguration of the tramway service, December 17, 1924.—This interesting ceremony took place in the presence of a large gathering of Chinese officials, governmental representatives, merchants, etc., and an auspicious start was made by the demonstration cars, which were immediately inundated by an enthusiastic public looking for free rides. After the first few days of trial trips the service settled down to regular business, and as the other traffic on the streets became accustomed to the sight the speed was gradually increased, in the hope that thereby any serious accidents might be avoided. It was obvious that a certain time would be required in order to educate the various kinds of traffic encountered on the streets of Peking to the changing conditions, for not only have the obstacles presented by camels, rickshaws, mules, funeral processions, pedestrians, etc., to be dealt with, but the inertia of the police and the the military has also to be overcome, for these latter seemed at first not to comprehend that a tramcar is a moving mass which is indifferent to the obstruction caused by a coolie in uniform, however important he may feel himself to be. It was really extraordinary to notice how, for the first week or two, a policeman or a soldier would step into the middle of the track and apparently expect the tram to go round him; the subsequent unfortunate results being in the nature of a painful surprise.

In spite of several adverse conditions, however, the results of the first months of working compare very favorably with those in Shanghai when the trams were inaugurated there in 1908-1909.

Average of Monthly Running Reports.

	Peking 1925	Shanghai 1909
Passengers carried	930,000	981,000
Car miles (net)	82,000	165,000
Passengers per car mile ..	11	5.95
Number of trams in service ..	30	55
Average payment per passenger	4.25 cts	3.86 cts.

As a general rule the receipts on the tramway systems in Chinese currency are in coppers, and the conversion of these into silver

The Old and the New

dollars occasions a very considerable loss, as the following figures will show:—

Loss on Exchange.

Year	Shanghai.	Peking.
1908	20%	
1910	24%	
1915	27%	
1920	26%	
1925	53.5%	64.2%

The original tariffs on the Shanghai tramways were reckoned in silver money, but during their development the conversion to copper occurred, no one apparently having foreseen the possible fluctuations in the currency which have since taken place. It is worth noticing here that this cheapening of the copper coinage is mainly due to a simultaneous debasement of the metal and lightening of the weight; and that as the expenses of the tramway companies of Shanghai and Tientsin are chiefly in silver currency it became necessary for them to raise their transportation charges in order to keep pace with the depreciation in the receipts. With this in mind the Peking Tramway Company has fixed its charges in silver cents, but at the same time it has prepared a table of conversion rates for coppers into silver and this is affixed to all the the cars on the system.

It may not be out of place to present to the reader at this point some statistics with regard to tramways in operation in Europe, America and China, for purposes of comparison.

Number of Passengers carried per Mile of Route per Annum.

Glasgow	5,100,000
Manchester	2,570,000
Liverpool	2,900,000
Philadelphia	2,000,000
Chicago	2,460,000
Paris	2,200,000
Shanghai (S.M.C.)	7,000,000
Peking (from Dec. 18, 1924 to Feb. 18, 1925)..	1,080,000

Car Miles run per mile of Route per Annum.

Glasgow	267,000
Manchester	170,000
Liverpool	197,000
Philadelphia	180,000
Chicago	217,000
Paris	194,000
Shanghai	300,000
Peking (since commencement Dec. 17) ..	100,000

Number of Journeys in Public Vehicles Per Head of Population per annum.

Glasgow .. .. .. Population	1,200,000	404 journeys
London	7,300,000	413 ,,
Philadelphia	1,825,000	466 ,,
Chicago	2,700,000	482
Paris	3,000,000	517
Shanghai (International Settlement) ..	800,000	145
Shanghai (All Settlements and Chinesecity)	1,700,000	100
Peking (since commencement Dec. 17)	1,181,000	9.44

Length of Route Public Vehicles per 100,000 of population.

Glasgow	8.08 miles
Manchester	10.10 ,,
Liverpool	8.83 ,,
Philadelphia	22.22 ,,
Chicago	21.20 ,,
Paris	21.30 ,,
Shanghai (International Settlement only)	2.43 ,,
Shanghai (Including Chinese city, etc.)	1.86 ,,
Peking	1.69 ,,

These figures serve to show that in China the number of travellers in proportion to the population is much less than in Europe or America, but at the same time it must be recognized that trams as a means of locomotion are only just beginning in the Orient, and in the course of a few years it may be confidently predicted that the use of public vehicles will make immense strides.

In support of this argument one may quote finally some figures which show the progress made in Shanghai.

	Length of Route		*Rolling Stock*		*Passengers Carried.*	
Year	1909	1921	1909	1921	1909	1921
Intor. Set.... ...	16.3 miles	17.8	65 cars	182	11,000,000	120,000,000
French Con. ...	9.12 ,,	9.87	32 ,,	49	7,000,000	33,000,000
Chinese City ... (opened in 1913)	—	6.00	—	42	—	30,000,000

Better Trade in the Dutch East Indies

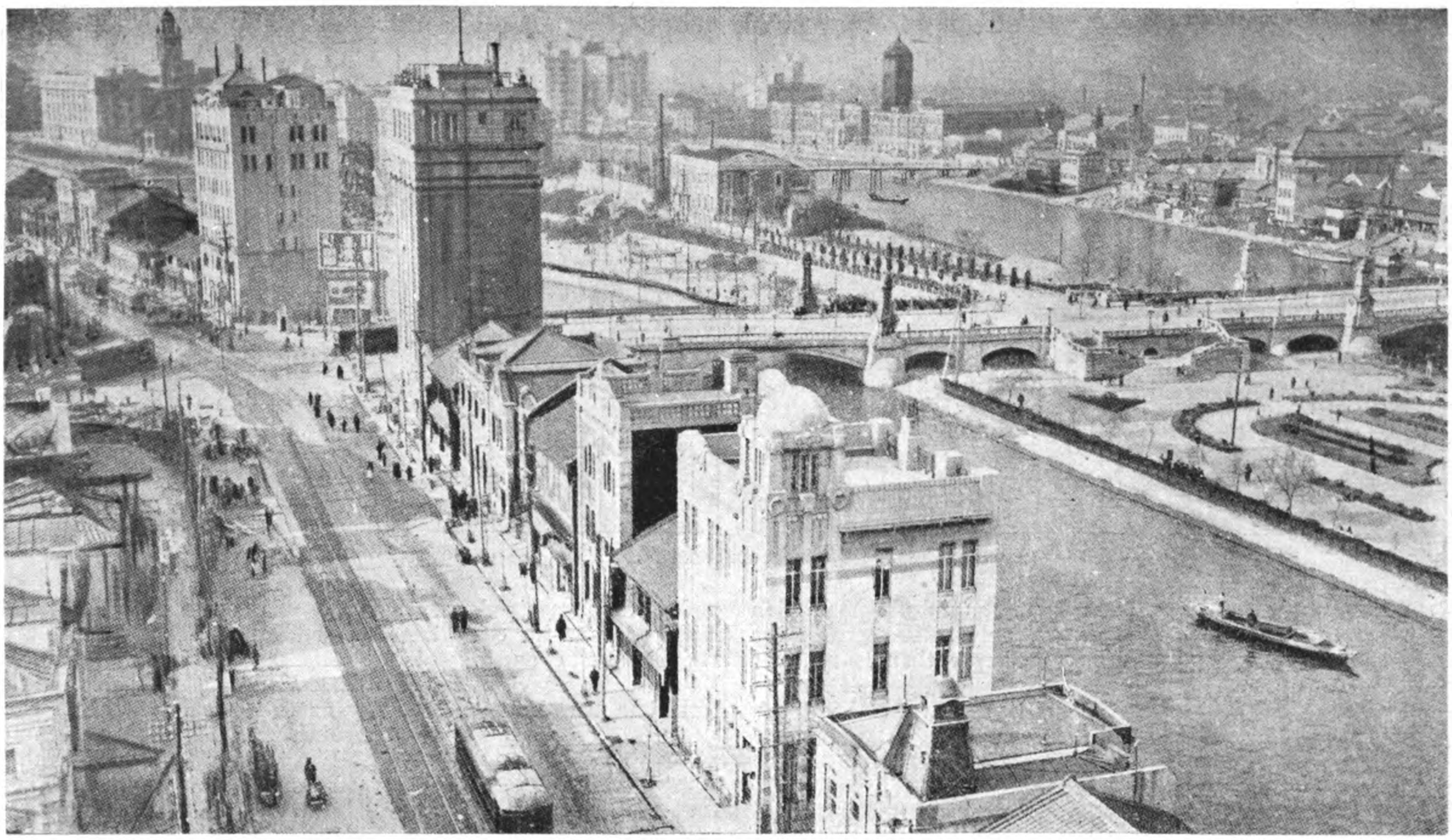
Only so short a time ago as last May the Governor-General of the Dutch East Indies, in opening the Volksraad Session, was deploring that the Government were still obliged to moderate their activities owing to the unsatisfactory condition of the market, and although he was able to see a slight improvement in the economic position, he expressed himself as still waiting for that permanent recovery of the financial balance which was before all things essential to renewed and invigorated progress. Things have moved with unexpected rapidity since then. For the first time since 1916 the Budget has shown a surplus instead of a deficit; there has been a record crop of sugar; rubber prospects are better than they have been for some time; an actual boom has occurred in tea and coffee; and the tobacco sales have yielded results far in excess of any in the past. The results of these developments are shown in the fact that produce companies are paying good dividends, and that there is an improvement in the import trade.

Probably the most encouraging feature of recent months has been the revived interest in agricultural industries as a result of the more favorable prices obtained. There has been a general extension of tea and sugar plantations, and in the cultivation of agave fibre, while the Government have considerably assisted in these developments by the irrigation works which they have undertaken. All this is true not only of Java, but also of Sumatra, where agriculture is now making rapid headway, and what is being done in the larger, but hitherto less developed island, suggests a future which will add materially to the aggregate prosperity of the group and will mean a proportionate expansion in both import and export activities. Only the fear of taxation holds back the necessary capital for the full exploitation of the enormous natural resources of Sumatra.

Relatively little attention has so far been given to manufacturing industries in the Dutch East Indies, except those that are the direct offshoots of the natural products of the islands, as, for example, alcohol and arrack distillation, oil and petroleum refining, tin smelting, etc., but these are steadily advancing in importance and output, and are every day becoming larger purchasers of industrial plant. Here again the Government has come to the aid of enterprise by making available the water-power resources of the various districts. Apart from New Guinea, the water-power of which is still an unknown quantity, there is an available horse-power in the water courses of about 5,500,000, of which 3,000,000 are in Sumatra. 2,000,000 in Borneo, 1,000,000 in Celebes, and 500,000 in Java. At present something over 100,000 k.w. are generated at the power stations erected.

It is hardly necessary to point out that the improved conditions in the Dutch East Indies market are likely to renew the demand for better quality goods than have been purchased in recent years. The slump in regard to many of the products of the islands seriously affected the buying power of the population, and this showed itself particularly in the case of textiles, the demand for which, as a result of reduced circumstances, was directed almost exclusively to the cheaper grades, such as those offered by Japan. The last-named country, indeed, became the principal source of imports into Java of grey, printed, and dyed cotton piece goods. It may be expected that increased purchasing power will cause many of the importers to renew relations with British and American firms, and thus improve their stocks not only in quantity but in quality. Of course, many of these relations have never been severed, most of the leading import houses being closely in touch with British firms, not only as a result of business transactions extending over many years, but in some cases as a result of capital investments.

Great Britain's direct share in the import trade of the Dutch East Indies is relatively small, being in 1923, the last year for which statistics of this character are available, only 14.7 per cent. of the total. But in addition 16 per cent. of the imports came from the Straits Settlements and the Federated Malay States, and it may be safely ventured that a large proportion of trade *via* Singapore was of United Kingdom origin. Besides this, 4.3 per cent. of the purchases came from Australia and New Zealand, so that altogether 35 per cent. of the total imports of the Dutch East Indies was derived either from Great Britain or from the British Empire. The 14.7 per cent. representing the direct imports from the United Kingdom amounted to a value of over £9,000,000, and the figures for the nine months of 1924 encourage the expectation that the full trade for the past year will considerably exceed that amount.



Bird's-eye View of the Business Centre of Greater Osaka

GREATER OSAKA

GREATER Osaka celebrated its prosperity with an exposition which was opened on March 18. In the course of his address, President Motoyama said :

"The metropolis is the cradle of a country's culture. I am confident that people of Osaka will live up to the expectation of the rest of people in their contributions to the development of the national wealth, realizing the heavy responsibilities placed upon their shoulders in carrying out the plans and ideals of Greater Osaka.

"The opening day of the Exposition, under the auspices of the *Osaka Mainichi*, should therefore be congratulated not only by the people of Osaka but also by the nation itself. May the *Osaka Mainichi* always be at the call of the city, and of the nation, encouraging, promoting, and developing industry and commerce and the nation's prosperity."

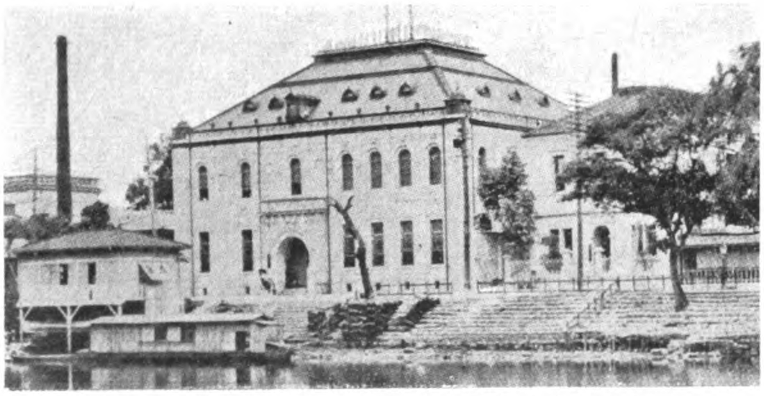
"The greatness of a municipality should not be measured merely by its population nor by its area. It must be judged by the quality and perfection of all its civic enterprises and institutions. The *Osaka Mainichi* has heretofore contributed greatly to these requirements, and, what is more, has now collected important data, showing all the activities of the city scientifically presented in the Exposition."

Mr. Takahashi, Minister of Agriculture and Commerce, sent a message to the following effect :—

"The destiny of a nation is chiefly dependent on the prosperity of its industries. Hence, it is most fitting and proper for the nation that an influential newspaper like the *Osaka Mainichi* should undertake this civic enterprise, pointing the direction in which the people, not only of Osaka, but of Japan, should go.

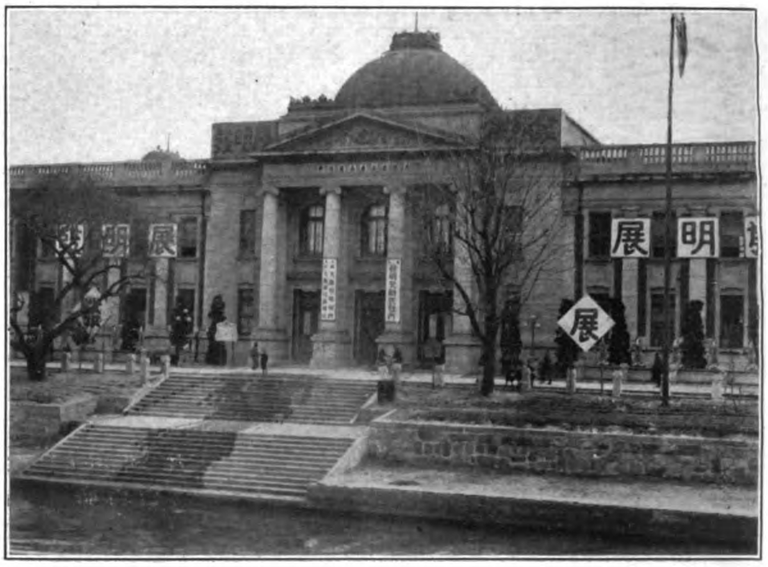
"The Greater Osaka Exposition, surely, will contribute immensely to the encouraging of the industries and business of the nation. On this account, I take great pleasure in expressing congratulations on the opening day of the Exposition."

Osaka, known as the Manchester of the Orient, because of its popularity as the cotton manufacturing centre of Japan and the Orient, has become the largest city in the Orient and fifth in rank among the cities of the world in point of area. By annexing the two adjoining "gun," Higashinari and Nishinari, the total area



Head Office of the Nippon Menkwa Kabushiki Kaisha

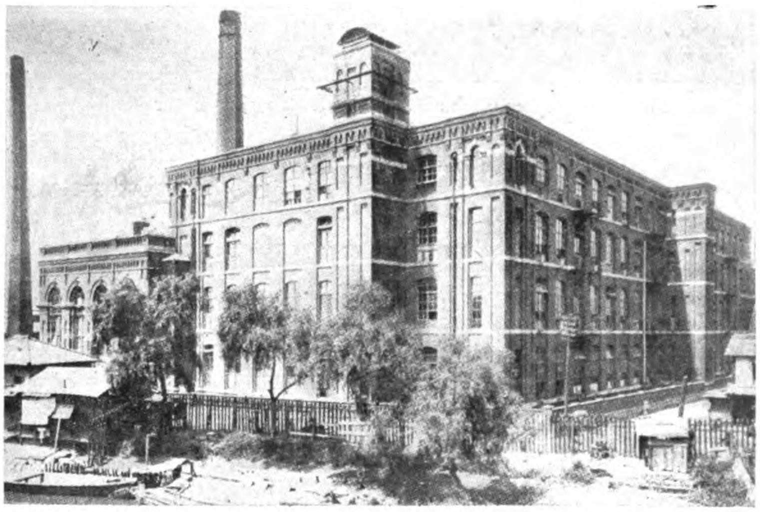
Harbor Construction-Jetty, Osaka



The Osaka Commercial Museum

of Greater Osaka becomes 65.75 square miles, and the population 2,030,000. Formerly the city's area was only 20.82 square miles and its population 1,390,000. Osaka is larger than Manchester now.

Higashinari and Nishinari guns comprise 44 towns and villages, covering a total area of 42.93 square miles and possessing a population of 642,000. By far the greater part of the area which was consolidated into Greater Osaka is at present devoted to farming. Therein lies the significance of the consolidation, for the Manchester of the Orient keenly feels the need of open space to build factories, and the two guns which have afforded space for that purpose in the past will do so in future, with modern improvements added by the efforts of the municipality of Greater Osaka.



Osaka Cotton Spinning Company. One of the Typical Factory Buildings in Osaka

The city of Osaka was formerly divided into four wards: Kita, Higashi, Nishi, and Minami; or North, East, West and South. But in Greater Osaka, these four wards have been subdivided, creating in all eight wards, namely: Kita, Konohana, Higashi, Nishi, Minato, Tennoji, Minami and Naniwa.

In addition to the foregoing wards, five new ones have been created in the area consolidated into Greater Osaka, namely Higashinari and Nishinari. The five new wards are known as: Nishiyodogawa, Higashiyodogawa, Higashinari, Sumiyoshi and Nishinari. Nishiyodogawa-ku comprises Dembo, Sagisu, Utajima, Chibune, Hiejima Fuku and Kawakita. Higashiyodogawa-ku comprises Nakatsu, Toyosaki, Nishi-Nakajima, Toyosato, Omi-chi, Shinjo, Nakajima, Kita-Nakajima and Kamitsu. Higashinari-ku comprises Ikuno, Tsuru-hashi, Nakamoto, Kamiji, Shoji, Joto, Enomoto, Namazue, Enami, Johoku, Furuichi and Shimizu. Sumiyoshi-ku comprises Tennoji, Hirano, Kizure, Kita-kudara, Tanabe, Yosami, Nagai Sumiyoshi, Sumince, Anryu and Shikitsu. Nishinari-ku comprises Imamiya, Tamade, Kohama, Tsumori.

From the point of view of what used to be Osaka City, there are two reasons for which the consolidation of the outlying districts into Greater Osaka was considered absolutely necessary; readjustment of the streets and sanitary improvement of outlying districts to prevent disease. These two problems are not easy to solve, as their solution will require a considerable outlay of funds and a deal of inconvenience spread over a long period of operations. Nevertheless, they must be solved, for, should the irregular development of the outlying districts continue, Osaka City will be literally choked by menacing diseases and by inconvenience in communications. As an organic community, Osaka must break through these walls

The Osaka Municipal City Office

The Osaka Branch Bank of Japan

to preserve its health. These considerations led to the plan of consolidation.

As for the districts consolidated into Greater Osaka, they will naturally get the benefit of the municipal improvements extended to them. These self-governing communities were requested by the Home Office, through the Osaka Prefectural Government, to reply as to whether they cared to be consolidated into Greater Osaka and on what conditions they would join. Very little dissension was forthcoming.

As soon as these districts made their reply, the Home Office gave formal consent to the plan of consolidation and preparations for creating Greater Osaka was made at once. And from April, 1925, Osaka announced its expansion into Greater Osaka.

There are several interesting facts which should be noted in connection with the creation of Greater Osaka. Greater Osaka has within its limits 5,132 *chobu* (a *chobu* is equal to 2.45 acres) of rice fields and 1,912 *chobu* of track gardens. The city is not only a manufacturing and commercial centre, but an agricultural city as well. About 86,000 *koku* (a *koku* is equal to about 40 bushels) of rice and 9,000 *koku* of wheat will be produced. Being adjacent to Osaka City, the outlying districts produce a considerable amount of vegetables, chickens, eggs and other farm produce.

There are 6,600 families engaged in chicken raising, with 240,000 chickens, yielding annually 6,430,000 yen. These farming districts will be converted, in a space of five or ten years, into city streets or manufacturing sites, according to how fast Greater Osaka develops.

MAP OF GREATER OSAKA

According to the plans in the minds of the promoters of Greater Osaka, purely agricultural districts in the highlands, east of Osaka City, are sites for future residence districts, as a way of relieving the present crowded and unsanitary condition of residence houses in the city.

The regions along the Yodo and Kizu Rivers have been specially selected as sites for big and special factories, which will be removed from their present sites within the former city limits, thereby increasing the efficiency of the factories and at the same time safeguard the lives of the people of the city, who are at present tormented by the smoke, noise and malodours of the factories.

The improvement of sanitary conditions in the city was one of the objects for which Greater Osaka was planned. Osaka's death rate is beyond description. Its rate of 22.-32 per thousand of the people of Osaka is the highest of the six largest cities in Japan, except Nagoya. The rates in some of the outlying districts are extraordinary. In Ikuno-mura, it is 57.03, in Toyosaki Machi, 33, and in Imamiya Machi, over 38.

An example of improvement is shown by Imamiya, where the rate in the part of Imamiya which was incorporated into the former Osaka City some years ago is smaller by 11 than that of Imamiya Machi, which was left behind, but which is now consolidated into Greater Osaka. In Tennoji, the difference is 1.4. By rates similar to these examples, the sanitary and health conditions of the outlying districts will be improved.

All these and other improvements which may be enumerated can be brought about only if the people of the city and of the districts incorporated into Greater Osaka address themselves seriously to the great task before them. The increase of area alone will not make for a great city. There must be modern civic improvements carried out in order to make Greater Osaka worthy of its name.

Side by side with the proposed plan of Greater Osaka, the city has a plan to construct broad streets which will run in four directions, in order to relieve the present congestion of traffic.

The narrowness of the streets in Osaka, as in other cities in Japan, has been an obstruction to the proper development of modern enterprises in industry as well as in other lines of human activity. Moreover, if a natural accident, such as an earthquake which would shake the city from its foundations should visit the city followed by a big fire (Osaka is famous for fires), the present condition of the streets is entirely unsatisfactory in affording the people sufficient right of way to escape to places of safety.

Already plans have been mapped out by the city authorities for the construction of wide streets, which will be carried out as soon as the needed funds are secured.

With the wealth and latent economic and financial strength of the city, there is no reason why the plans mapped out cannot be carried out, if the people address themselves seriously to the problem.

There is also a plan of constructing rapid-transit means of travel in the city, either elevated or underground, in order to relieve the present street car congestion. The suburban electric car lines, such as the Hanshin, Hankyu, Nankai, Keihan and others in existence, as well as those planned, are contemplating improving their service by reconstructing the lines in the city.

Their plans have not progressed very fast as yet, due to legislative difficulties presented by the municipal assembly, but as soon as these and other natural impediments are overcome, means of locomotion to and from Osaka will be greatly improved.

Last, but not least, is the fact that the Imperial Railway Office is now carrying out a plan for rebuilding Osaka Station at Umeda into the finest railway station in the Orient. Acres of

property adjoining the present station at Umeda have been purchased, the buildings standing thereon are being demolished, and engineering work is fast progressing. Within a few years Osaka's front will be decorated with a first-class railway station worthy of the largest city in the Orient.

History of Osaka

Nozomu Nakagawa, the Greater Osaka Governor

Osaka, known in ancient times as Naniwa, is the largest city of Japan, and it has taken the foremost rank as an industrial and commercial centre from very early times, now having a population of about 2,030,000.

On the west the city looks out upon Osaka Bay, and on the east it is walled in by the mountain ranges of Ikoma. The city covers 65 square miles, and is easily reached from Kyoto, the former Capital, which is 27 miles north-east and also from Kobe, one of the leading sea-ports in the Empire, which is 20 miles west.

The development of Osaka may be said to have originated in the River Yodo, which rising in Lake Biwa, empties its water into Osaka Bay traversing the heart of Osaka. At the mouth of this river the busiest scenes are presented by the thousands of coastwise vessels and junks, coming and going from and to all parts of the country, and laden with an endless variety of domestic products. The river is connected with numerous canals extending to a total length of 40 miles, and affords great convenience and exceptional commercial advantages.

Hajime Seki, Mayor

It was here that the first historically recorded Emperor of Japan, Jinmu Tenno stayed on his way to Yamato, and the place was called Naniwano-Saki. This, according to Japanese Chronology, was over 2,580 year ago.

In those dim and semi-mythical times Osaka, or Naniwa, as it was then called, began its career as the centre of communication and transportation and it has never lost its chief characteristics as a commercial city.

Nintoku, the 16th Emperor (A.D. 313-399), made the city his capital, and constructed many public roads leading to different points and also opened new canals with the sole desire to develop and prosper the city. Many beautiful stories are told of this benevolent Monarch.

Buddhism was introduced soon after, and the Shitennoji Temple, an old edifice to be associated in fame with the Horyuji Temple of Yamato was built at Osaka by Prince Shotoku (593 A.D.). Through the introduction of this new religion Japan came into closer relationship with China and Korea, and Osaka was made the port for passengers from those countries, and it was at this time that a reception hall named the "Korokan" was built for the purpose of entertaining diplomats and ambassadors from China and Korea.

The real foundation for the present prosperity and importance of Osaka, however, must be ascribed to the personality of that great hero, Toyotomi Hideyoshi (1536-1598 A.D.). He was born in the midst of a feudal period. After fighting many battles he at last became active ruler of the Empire, and built in this city the famous Osaka Castle (1585 A.D.), making it his permanent base, and the city begun to prosper as the leading city of Japan.

Later the distinguished hero was succeeded by Tokugawa Ieyasu, the remotest ancestor of Prince Tokugawa Iesato. Ieyasu selected Edo, the present Tokyo, as his base; and consequently the centre of military affairs and administration was removed to Edo, but commerce and industry continued to prosper in Osaka.

In those days the Daimyos (feudal lords) sent to Osaka the products of their districts to be disposed of, or raised money on their products from prominent merchants of the city. For this reason even the Daimyos were obliged to bend their knees before the Osaka merchants. The city thus developed as an independent, economical centre and kept aloff from Feudalism. This historical fact is a source of great pride to the City of Osaka.

As to arts and learning, Osaka produced not a few great persons during this era. During the Restoration (1868), in the China-Japan War and Russo-Japan War, Osaka performed its great mission both economically and politically. With the advancement of time, Osaka has continued to develop in every respect as shown by its present prosperity.

Here are all the industries needed to supply China, Korea, the South Sea Islands—in all those regions where the goods of Osaka find a market because of their goodness and cheapness.

One of the officials of Osaka, who has been of the greatest service to the city, is Dr. Hajime Seki, present Major, who succeeded Mr. Shiro Ikegami last year. Mayor Seki was formerly an official of the Education Office, but his great administrative ability forced him to forsake the educational field and cast in his lot with the municipal administration of Osaka.

For a time he was long a Deputy Mayor under former Mayor Ikegami, and his services for the municipalization of the Osaka Electric Light Company are still fresh in the memory of Osaka citizens. Since he became Mayor last year, he has been endeavoring to make the city the centre of the nation's life, by perfecting various municipal establishments and by persuading the Central Government officials to grant autonomy to the various phases of Osaka's administration.

Greater Osaka, now completed, certainly bear testimony, to our gratitude, to the administrative ability of this tireless civil servant—this scholar and statesman—Mayor Seki.

Osaka Harbor

The Oriental trade of our country is chiefly carried out through Osaka harbor. The Municipality is improving and enlarging the harbor and when all the quays, docks and landing facilities, now planned are completed it will meet all the requirements of modern trade, and place Osaka, in another decade, in the forefront of Japanese ports. The inception of Osaka Harbor dates back to 1872, though the work did not really begin until 1897.

Beginning with entrance from the sea the visitor should inspect the Harbor which cost over fifty million yen. This harbor gives Osaka the equipment of a first-class port and it places her in a position to deal directly with the markets on the continent of Asia and elsewhere, where goods manufactured in the city are exported.

The number of foreign ships putting to Osaka harbor is gradually increasing, According to investigations by the Osaka Customs House the total number of foreign bottoms entering Osaka harbor last full year was 18,012 and the gross tonnage 4,533,314 tons, an increase of twice in number and over three and a half times in tonnage, in comparison with 1920. The total tonnage of foreign goods was 1,983,131 tons an increase by over three and a half times, compared with 1920.

Katsutaro Inabata, President of the Osaka Chamber of Commerce

Another boost to the expansion of Osaka is an announcement just made that Osaka port will have, in 1926, two new gigantic piers, with a combined capacity for the accommodation of eight 10,000-ton steamers.

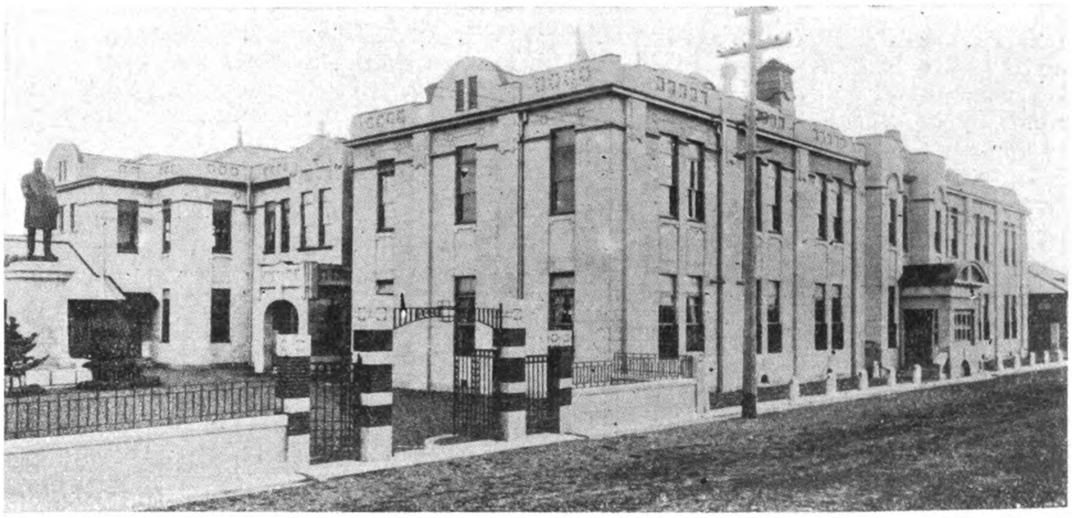
The announcement further states that the piers, when completed, will have up-to-date loading and discharging facilities; special attention is to be paid to railway yarding and trunk line connections. In all, Osaka will have, in 1926, one of the best port facilities in Japan.

The work on the piers has been going on ever since 1918, when 1,575,000 yen was appropriated for improvements to Osaka harbor. Progress at first was slow on account of changes in plans, but the rough foundation work is finished and the piers can now be clearly

seen, rising from the water. With the first stage of the construction work finished, those in charge are now positive that the whole job will be finished in 1926.

During the past 38 years, since the Osaka Electric Light Co. was first established, the number of electric lights has increased from 150 to 2,150,000 in and around Osaka. This is surely big progress, although there are so many needed things in the service yet to be accomplished.

There are ten Telephone Exchanges in the city of Osaka, *viz.*, Honkyoku, Higashi, Nishi, Minami, Kita, Tosabori, Shimmachi, Sakuragawa, Ebisu and Semba. There are more than 50,000 telephones, and automatic telephone boxes everywhere in the city.



7 Offices of the Osaka Iron Works, Limited, at Osaka

The waterworks of Osaka were first built to supply a population of eight hundred thousand, but when the population had increased to over nine hundred thousand, an enlargement of the works was found necessary.

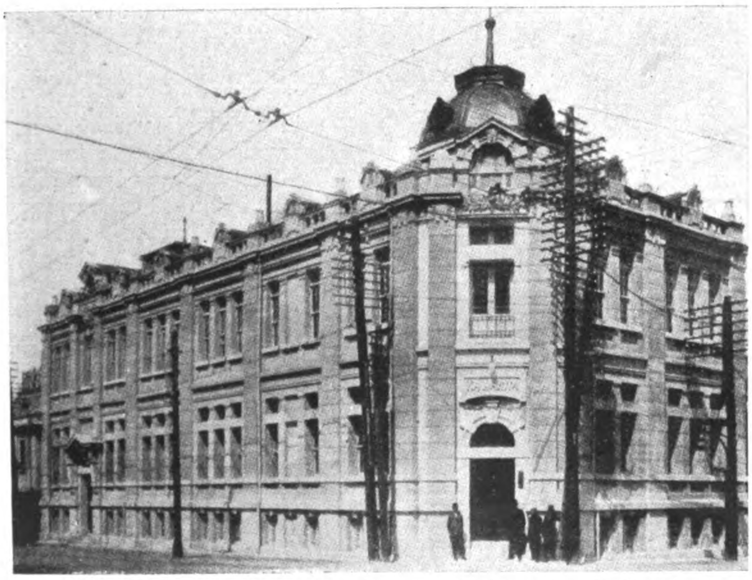
After that the Municipality entered upon a big undertaking, with a scheme to supply a population of a million and a half with 3.5 cubic feet of water daily. The estimated expenditure for the enlargement was ten and a half millions.

The Yotsubashi (Bridge), Osaka

The best machinery in the world imported from England is now in use at Osaka Waterworks, and the city is more favorably situated in regard to water supply than any other in the country. Visitors desiring to inspect the reservoirs and works must apply to the city office for permission.

With a population that is steadily increasing at the rate of fifty thousand a year, it is not difficult to predict the future of Osaka as a distributing centre. Had the city been contented with its old accommodation as a port it would have probably still continued to occupy the important place it has always occupied as a centre of distribution for the domestic trade, seeing that its advantage lies in its central geographical position and in its admirable service of waterways and other communications. But the enterprise of the citizens in equipping themselves at great expense with a modern port ought to be rewarded by a commensurate expansion of the foreign trade. The great market for Osaka goods lies on the Asiatic mainland and in the South Sea Islands, although of late years there has been a steady development in trade with North and South America and Europe.

But Osaka's future clearly lies in supplying the immense Asiatic population across the sea with cheap goods, and to do a direct trade between Osaka and the ports of the mainland is the aim of its citizens and the object for which the port was built.



The Office Building of the Kawakita Denki-Kigyosha, Osaka, Japan

Contract from Karachi Port Trust

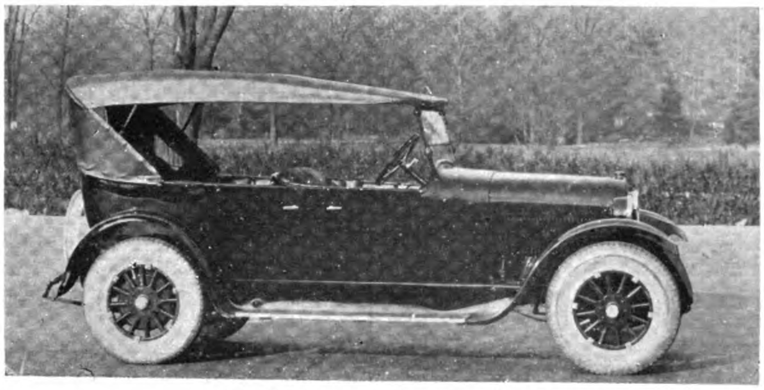
A powerful shore discharge two pump plant, boilers, and engines have been ordered from Messrs. Lobnitz & Company, shipbuilders, of Renfrew, Scotland, by the Karachi Port Trust.

New Seaplane for Dutch East Indies

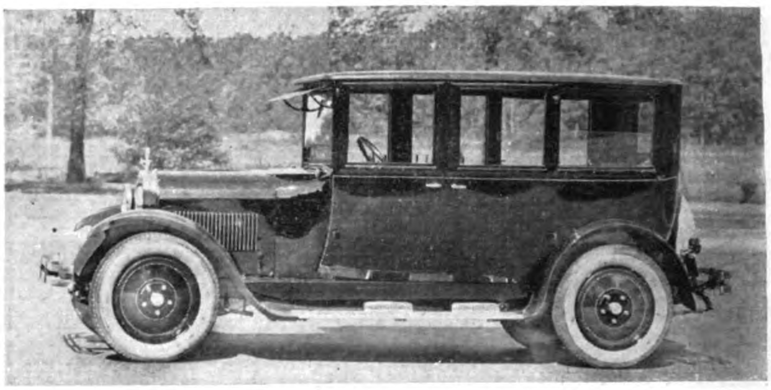
The Fairey Aviation Company have just received an important seaplane contract from the Dutch Government for machines required for use in the Dutch East Indies. The contract was obtained in competition with the whole world, including the Fokker Company of Holland.

New Post Office for Singapore

The new General Post Office at Singapore, which is being constructed of concrete, will be another outstanding feature in the history of construction in the Orient. A fine plaster model of this new building was exhibited in the Malayan Pavilion of the recent Empire Exhibition at Wembley. The building will, it is estimated, cost approximately £1,000,000, will stand on two acres of land, and will, when completed, be one of the finest buildings in the Far East. It will not only be the home of the Post Office but will also house the Singapore Club, and a large number of palatial business offices. The principal facade is 446-ft. long with a maximun width of 204-ft., the total height being 138-ft. In order to distribute the load so as not to exceed one ton per foot super, the foundations of the building comprise a rectangular reinforced concrete raft. Architectural features are receiving special attention, and external facings are of a special synthetic stone, made from granite chippings and white cement.



Dodge Brothers Touring Car



Dodge Brothers Special Type B Sedan

Best Year For Dodge Brothers

Gain 35.6 Per Cent. Over 1923 in Face of General Decrease: General Sales Manager Nichols Credits President Haynes for Progressive Policies

THE year 1924 was the most successful in the history of Dodge Brothers, according to company executives.

While the automobile industry as a whole showed a production decrease of 8 per cent. for the first ten months of the year, compared with the same period for 1923, Dodge Brothers increased their production and sales 35.6 per cent.

The figures for the remaining two months of the year will show about the same percentage of gain, according to John A. Nichols, Jr., general sales manager.

" It will be recalled that 1923 was the banner year of the industry," Mr. Nichols added. " Prior to 1924, it was also Dodge Brothers best year and in view of this, our large increase last year is especially noteworthy.

" It is not exceptional for a small company, or one that is just getting under way in business, to make such an increase. But for Dodge Brothers, who stand among the three or four largest motor car manufacturers in the world, to advance so sharply over an extra good previous year, is conceded by all authorities to be actually remarkable.

" Bear in mind that every year of their history has been a good year for Dodge Brothers. There have been no ups and downs—only consistent gains. These facts contribute to the unusualness of the achievement.

" Our 1924 shipments to dealers aggregated 225,104 cars, of which 193,861 were of the passenger type and 31,243 commercial.

" Practically this entire total represents retail sales, as dealers stocks at the close of the year were unusually low.

" Dodge Brothers ended their tenth year with a total of 1,250,000 cars built and sold. Registration records show that more than one million of this number are still in daily service, giving some idea of the materials and methods employed in building the car.

" Public confidence in Dodge Brothers product was never greater. Respect and admiration for the car's long life, dependable performance and comfortable riding qualities are universal.

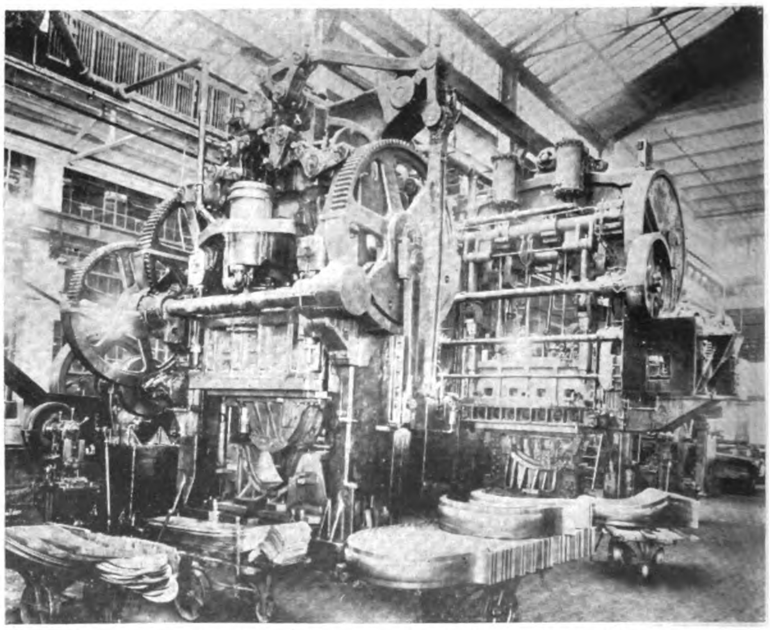
" It is this public confidence, coupled with constant, diligent improvements in the car, that accounts for Dodge Brothers increased business in the face of a general decrease.

" Chief credit for this gratifying showing belongs to Dodge Brothers president and general manager, Mr. Frederick J. Haynes. There has been a steady, healthy growth in production every year during his administration. The factory has been greatly enlarged, much new equipment has been installed and many better methods of manufacture have been adopted.

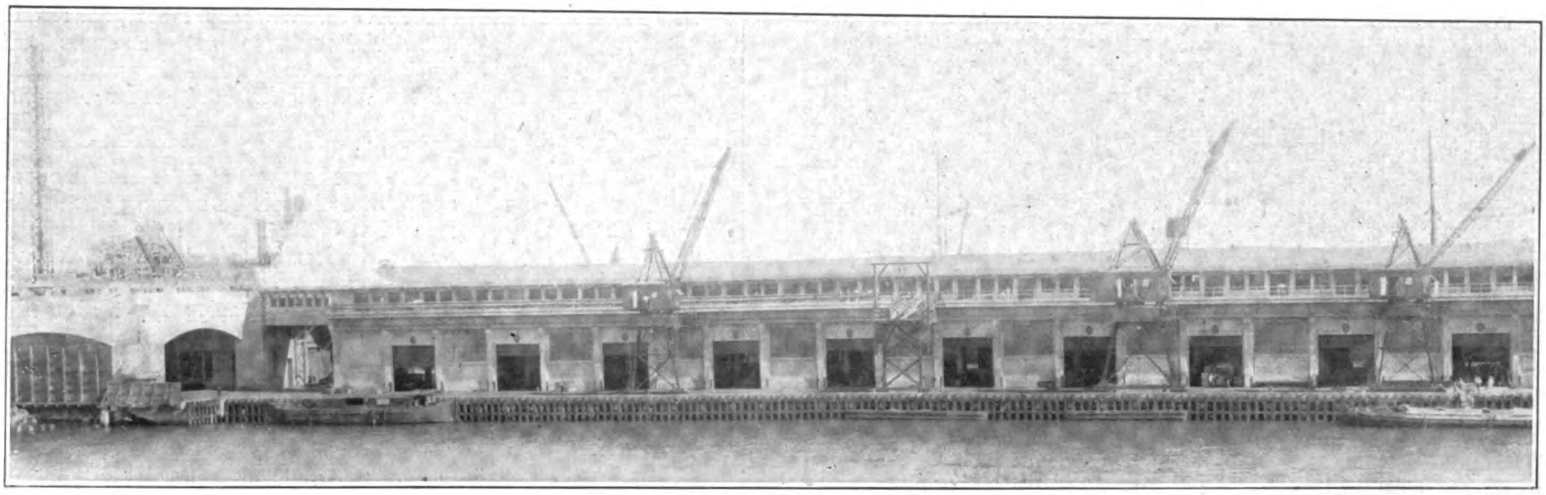
" In addition, pronounced impovements have been made in the appearance and riding qualities of the car, adding greatly to the appeal of a well-built product.

(Continued on page 184.)

Machining Dodge Brothers Cylinder Blocks. Careful, Accurate Machining of the Dense, Close Grained, Strong Cylinder Castings Contributes to the Unusual Life for which Dodge Brothers Engine has always been so well-known



Making Dodge Brothers Fenders. Each Formed in a Giand Press from a Single Piece of Heavy Gauge Steel



Partial Side View of Pier No. 7

Large Reinforced Concrete Ocean Terminal Nearing Completion at Port of Manila

Driving of Concrete Piles 24 Inches Square and 110-ft. Long, Involves Construction of Worlds Largest and Most Powerful Floating Driver of Special Design

By E. C. Earle, Chief Designing and Port Works Engineer, Bureau of Public Works, Manila
Vice Chairman, Manila Harbor Board

NOTABLE FEATURES OF CONSTRUCTION.—Concrete piles 24 inches square, 110 feet long, driven to sustain 110 ton loads. Largest and most powerful floating pile driver ever constructed required to drive the piles.

Special field equipment used for casting, lifting and transporting piles.

FEATURES OF DESIGN.—Novel features for caring for passenger traffic embodied in structure.

Special interior and exterior electric cargo handling equipment.

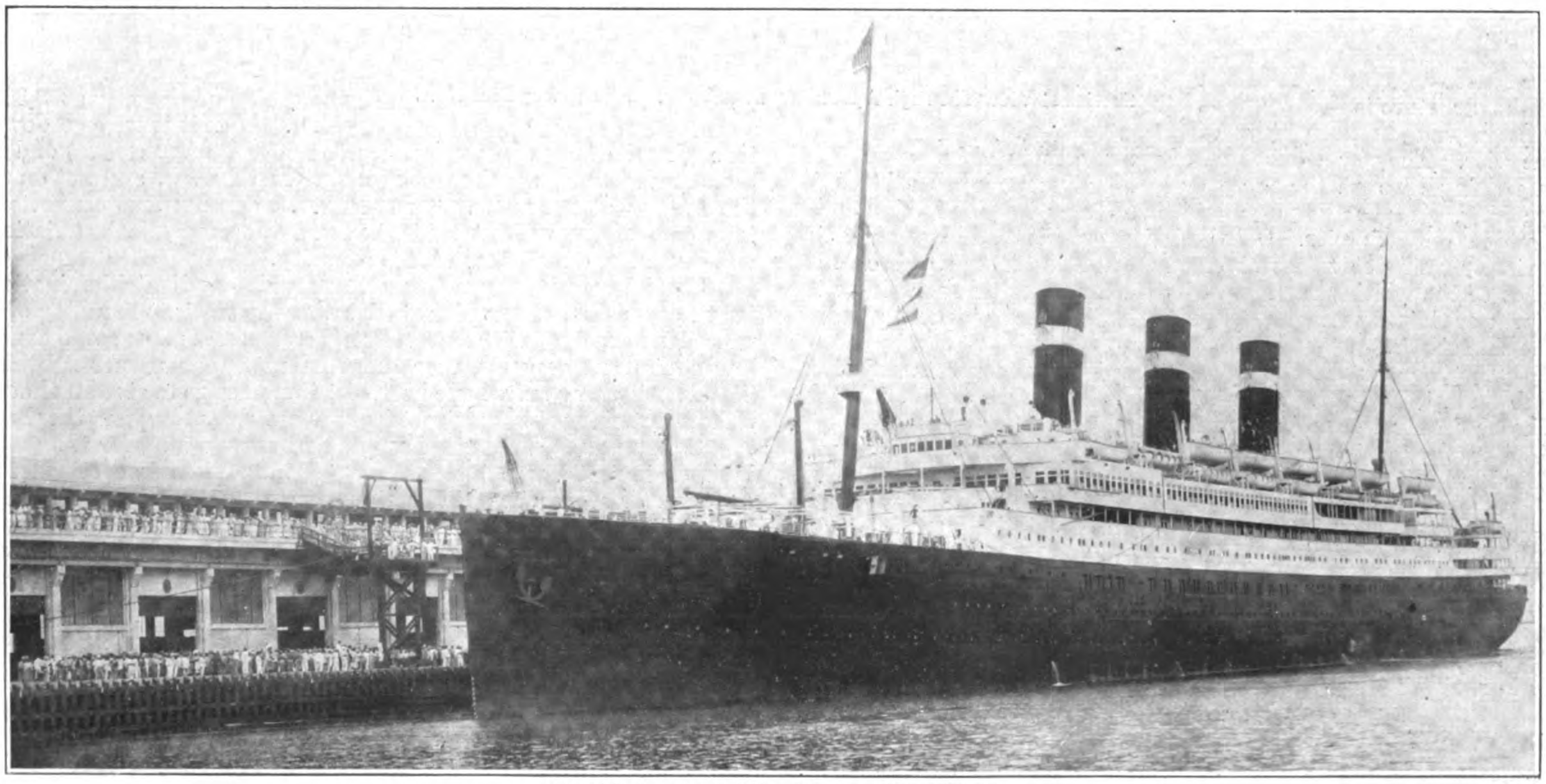
Roof trusses of long span designed to carry interior cargo handling cranes from suspended runway—maintaining large clear floor space on cargo deck of pier.

Wide aprons provided to handle cargo over.

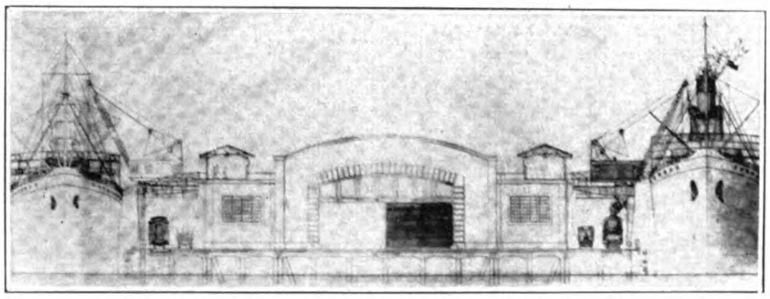
Unique fender system equipped with heavy buffer springs.

A large reinforced concrete pier now under construction at the Port of Manila, Philippine Islands is nearing completion. One half of the structure was commissioned July 7, 1924 and it is plained to open the entire structure about the latter part of this year. About 2,600 large concrete piles are being driven on this project.

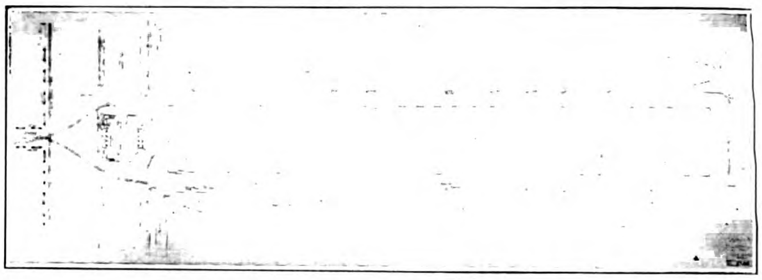
The outstanding features of interest of the project are the use of exceptionally long heavy reinforced concrete piles—24 inch square by 110 feet long, weighing 32 tons—and the special equipment being utilized in handling and driving the piles; each pile being driven to safely support a load of 90 to 110 tons.



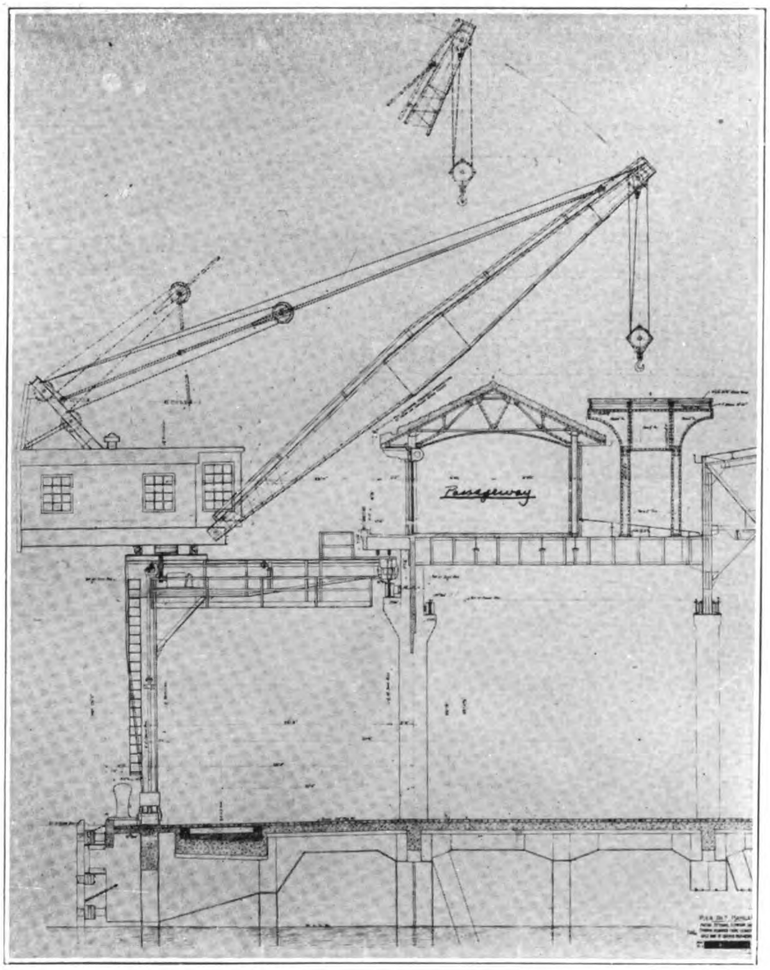
S.S. "Belgenland" Berthing at Pier No. 7



Sectional View of Pier No. 7 (Behind Pier head)



General Layout of Cargo Deck, Pier No. 7



Sectional View Through Apron and Passenger. Passageway Pier No. 7

Port Improvements to Cost $20,000,000.—The construction of the new pier (Pier 7) at Manila is the first of several projects which the Insular Government plans to carry out in connection with the proposed program for the improvement of the Port of Manila, including the construction of two new modern piers, the reconstruction and enlargement of existing piers, the construction of marginal wharves, cargo sheds, and oil and coal depot, the extension of the breakwater, etc., including the deepening of the harbor to 40 feet in the South Port District.

General Description of Pier.—The new terminal structure is 234 feet wide and its length when completed will be 1,400 feet. It is equipped throughout with modern mechanical facilities for the rapid handling of a miscellaneous cargo. The pier shed proper is 160 feet wide and 1,253 feet long. Aprons, 36 feet wide extend out on each side to the fender system. Railway tracks are being provided on each apron.

A novel feature which has been incorporated in the design of the structure is the overhead passage-way on both sides of the pier. The usual exposure of passengers to risks encountered in passing through the more or less dangerous areas utilized for trucking, and the storage and handling of cargo is completely avoided on this pier. Ships decks are reached by ascending stairs or using elevators situated within the Pier Head on both sides of the waiting room, and by then passing through either the North or South passage-way and over the connecting and plank to the ships deck.

The floor system throughout the pier is of concrete and of the slab and girder type. All walls and columns are also of concrete. The roof over the main shed is of galvanized iron—supported by steel trusses, while the roof over the passage-ways at the second floor level is of tile on steel trusses.

The shed is well ventilated and lighted by continuous top hung movable steel sash running the entire length of the structure and electrically operated, while fixed steel sash lights every alternate panels of the shed wall. Steel rolling doors 18 by 20-ft., both electrically and manually operated have been installed in alternate panels, of the shed wall, with provision for inside and outside controll.

The fender system, built entirely of mountain dungon which is highly resistive to the ravages of marine borers of these waters, is supported by and slides on heavily reinforced concrete brackets. Large spring pots, each fitted with two heavy double coil springs capable of resisting 50 tons per set when fully compressed, are located above and below each bracket.

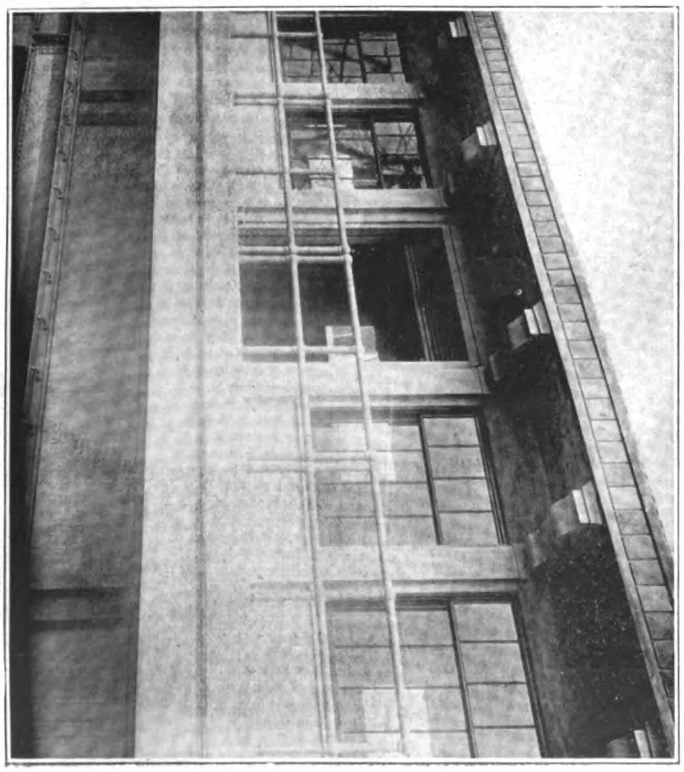
The pier head consists of a three floor central building and two entrance wings; the latter simply forming a covered connection between the pier shed, the pier head and the adjacent cargo sheds or latterals. Waiting rooms, baggage room, Customs and other offices are located in the central portion of this building.

Cargo Handling Facilities.—The mechanical equipment for the rapid handling of cargo on the pier will consist of 16 electric travelling semi-portal gantry cranes of the jib type, (14-2 ton and 2-15 ton) 8 being situated on each side of the pier; a flexible system of 48 interior 2 and 3 ton overhead electric cranes; a fleet of industrial tractors, trailers and elevating trucks, and other usual auxiliary equipment such as portable conveyors, stackers, etc. Six gantry and 24 interior cranes have already been installed.

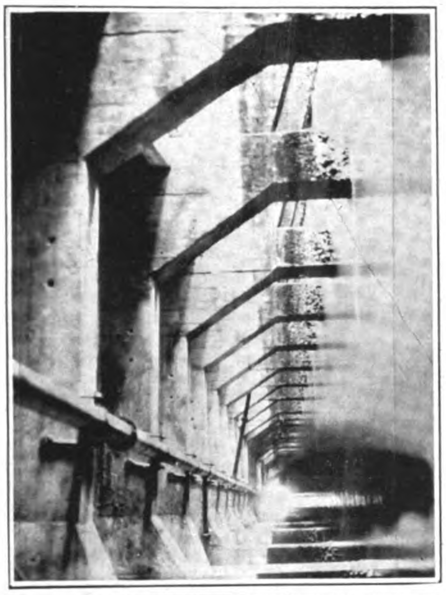
Substation — Illumination.—Current for the operation of all cranes and other cargo handling machinery as well as for illumination is brought to the substation at the centre of the pier at 3,300 volts. Here it is stepped down through a battery of transformers to 160 volts (for cranes) and is then converted by synchronous converters to D. C. and put on to the feeders at 260 volts. Two 350 k.v.a. synchronous converters take care of the present loads, however the complete installation will consist of 4 machines of this capacity.

Special care has been taken to provide excellent illumination for the operation of the pier at night, as the efficient handling of a miscellaneous cargo with rapid electric cranes and other cargo handling equipment depends, to a great extent, upon proper lighting. Standard lighting units have been distributed so as to give an almost uniform intensity of approximately 2¾-ft. candles throughout the shed.

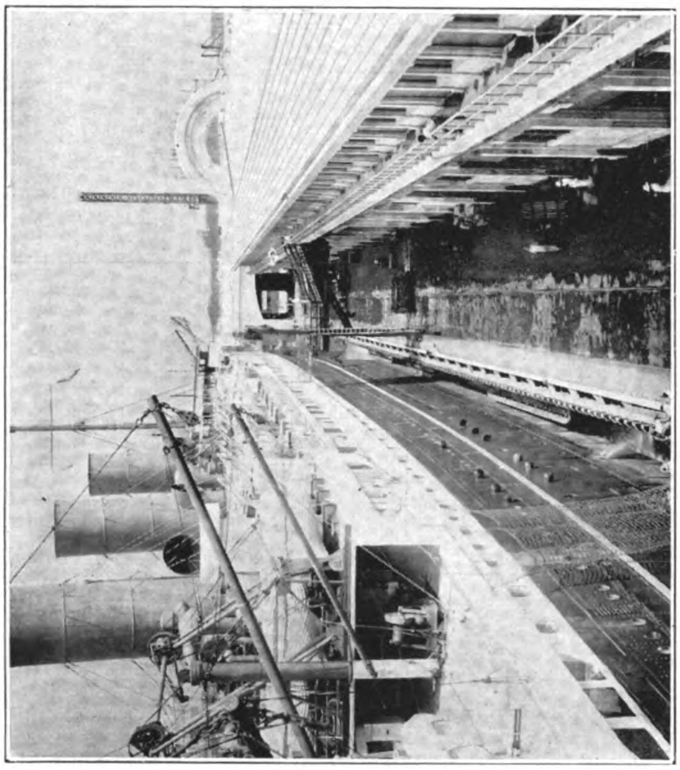
Condition Governing Design of Pier.—As by far the great bulk of import cargo handled over Manila piers is destined for godowns or warehouses in various parts of the city not served by direct rail or water connection, such cargo must pass over the apron and into the pier shed, whence a large percentage is removed by industrial tractors and trailers to the adjacent cargo sheds or latterals for classification and delivery. In view of this and the fact eight per cent. of all export cargo is loaded aboard ship directly from barges alongside, it was deemed advisable to avoid depressed trackage and rails have accordingly been set flush with the apron block surface. Greater latitude was thus obtained for the disposition of each draft of cargo upon the apron whence it is rapidly removed by stevedores hand trucks or directly deposited upon industrial trailers or elevating platform trucks.



General View of Passenger Passageway—Pier No. 7

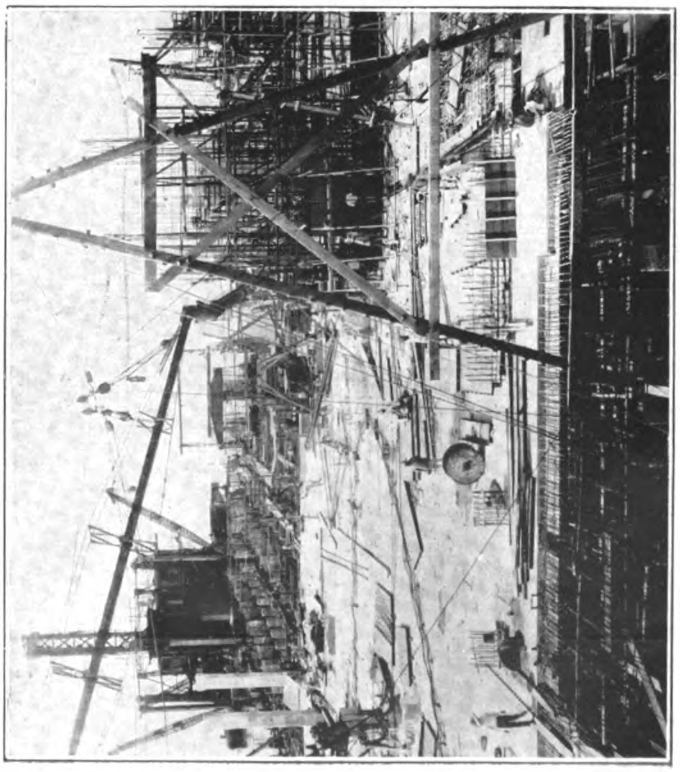


View of Underside of Floor System—Pier 7

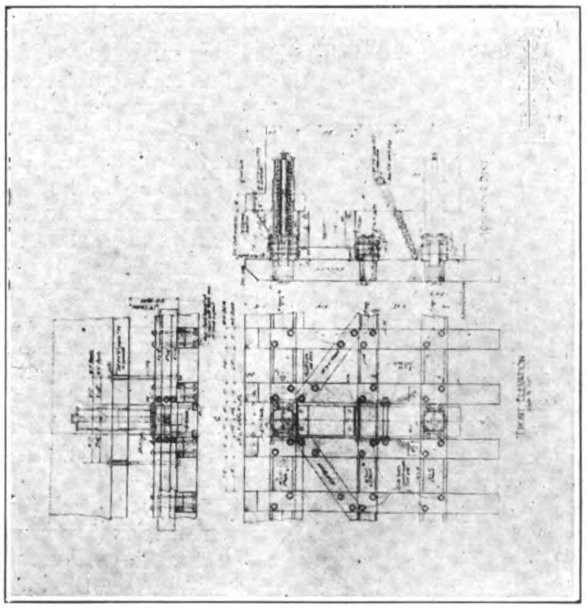


S.S. "Empress of Canada" at Pier 7. These View Shows Passenger Passageway, Travelling Landing Stage and Cradled Gang Plank

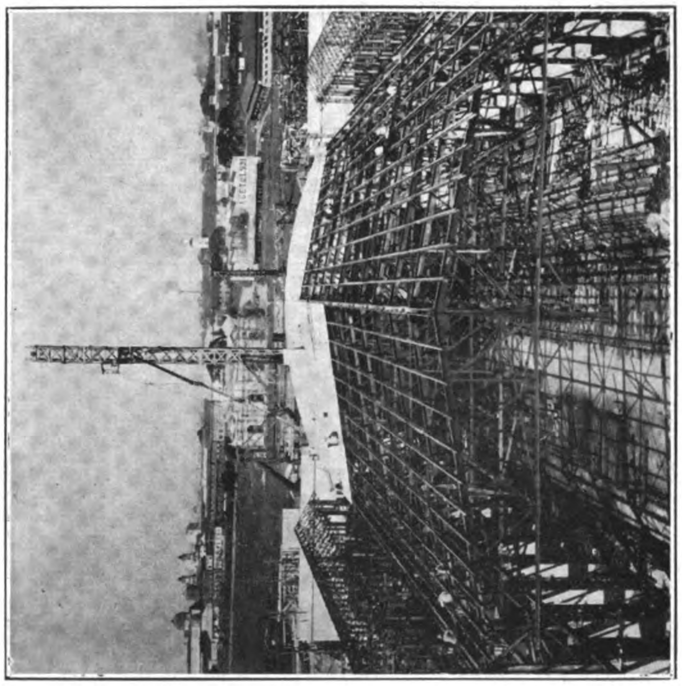
Pier 7, Manila, the most modern Docking Facility in the Far East.



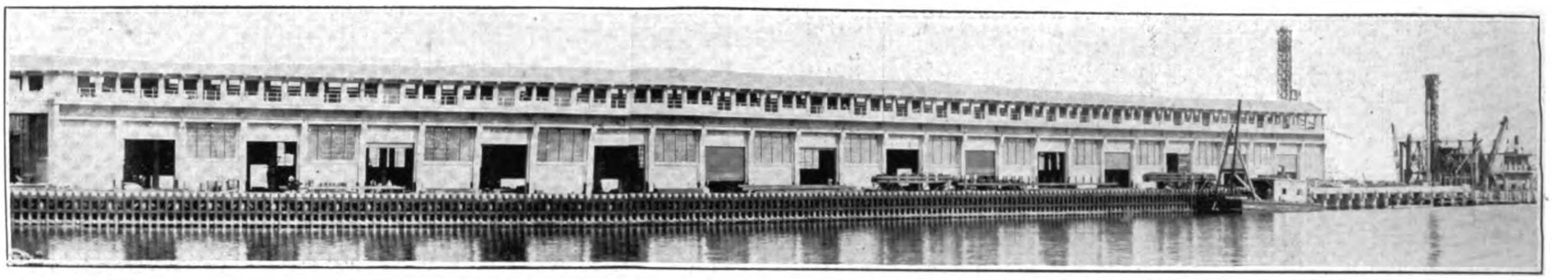
Construction View of Cargo Deck—Pier 7



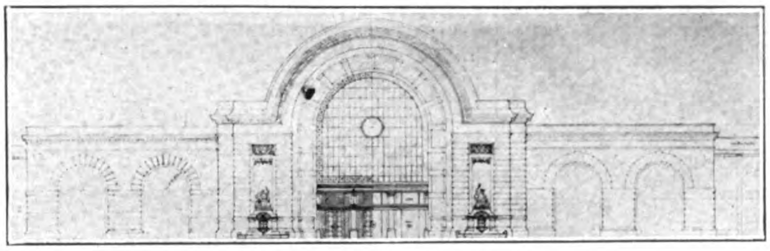
Typical Fender System Details—Pier 7



Construction View of Roof and Roof Trusses—Pier 7
(*Note:*—Suspenders Crane Runway)



Construction View of Pier 7 (This View Shows Fender System Partially Installed)



Front Elevation—Pier 7

The large quantities of hardware such as wire, spikes, galvanized roofing sheets, steel plate and other heavy materials like paint and print paper, arriving at the Port of Manila, led to the decision to design for rather heavy live loads to obtain maximum service from the structure. One thousand pounds per square foot was accordingly used in designing the floor system within the shed and 750 pounds per square foot for the aprons. Special provision was made in the design of the apron to care for the heavy reactions of the gantry cranes and freight locomotives.

Within the shed a special effort was made to avoid obstructing the cargo deck with numerous columns and to this end long span trusses (96-ft.) were designed to support suspended crane runway girders, thus doing away with a line of columns down the centre of the pier. Aside from the columns in the shed walls there are but two other lines of columns supporting the shed, all spaced on 22-ft. centres. This arrangement offers the maximum unobstructed floor space and at the same time permits of the very convenient division of the shed structure into four crane bays.

Design and Arrangement of Piled Substructure.—The design of the substructure was based upon the results of a thorough exploration and study of the underlying material of the harbor bottom, and upon results obtained by driving test piles at intervals over the area of the pier site. A two-inch Calyx-Core-Drill, motor driven, was used in making borings. The materials encountered varied considerably throughout the site. About 20-ft. of stiff blue mud overlaid the several other strata.

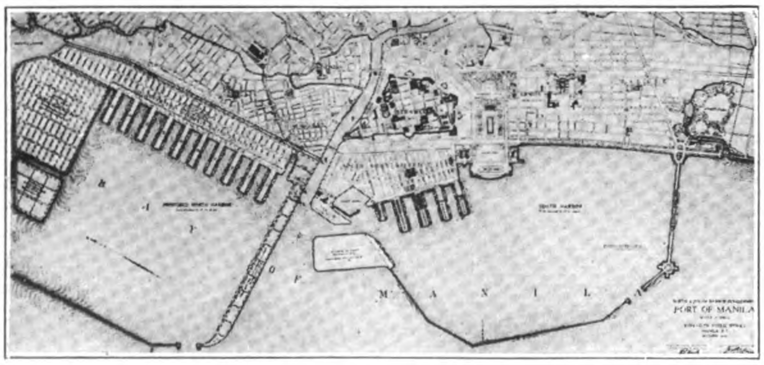
Permanency and resulting rigidity considered together with the possibilities of faster operation were the main factors dictating the use of concrete piles instead of concrete cylinders or in place of the usual concrete filled steel casings supported on timber pile clusters; the latter system being formerly used in the construction of the earlier Insular Government Piers at the Port of Manila.

Crane and locomotive reactions on the aprons, door and column spacings and the live loads noted above indicated the general arrangement of the piles and the loads to be sustained by each.

Transverse pile bents and fender brackets are spaced on 11-ft. centres throughout the main structure, while the longitudinal lines of piles are spaced on 16-ft. centres under the shed and on 13 and 18-ft. centres under the aprons. The outermost row of piles in each transverse bent are driven in pairs as they must sustain very heavy loads from the front legs of the gantry cranes. Under each shed and wall column a pair of vertical piles and one batter pile have been driven. This arrangement requires 25 piles in each transverse bent under the columns and 17 piles in all other bents. The load sustained by an individual pile varies from 90 to 108 tons. These loads necessitated the use of piles having a cross section 24-in. square.

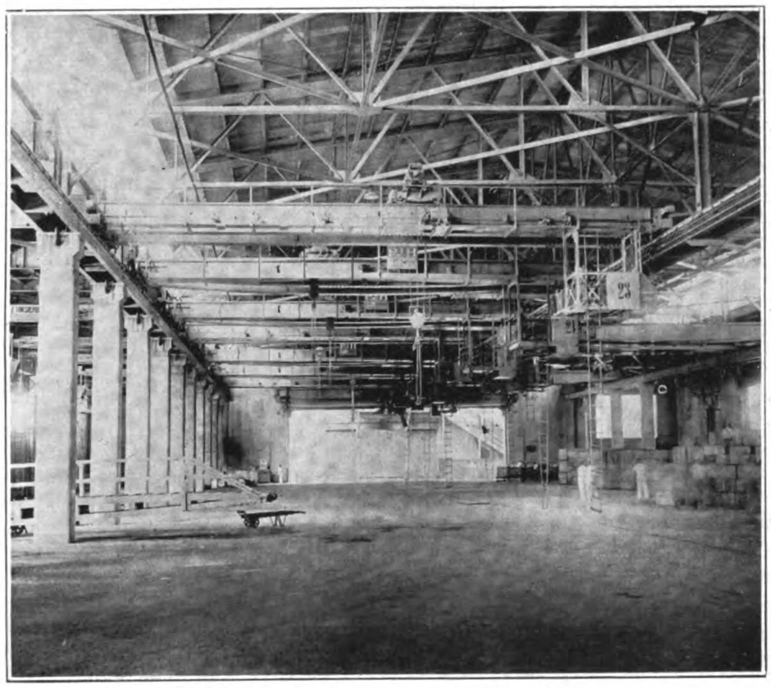
Piles of a considerable variation in length were required; the longest or 110-ft. piles being driven on the inshore end of the pier and as far out as 400-ft. From this point on to a distance of 800-ft. from shore 90 and 100-ft. piles were driven to grade. The longer piles (110-ft.) were used for the remaining length of the structure, but at a distance of approximately 300-ft. from the offshore end they were driven from 10 to 30-ft. below grade with a follower. Pre-cast pile sections, belled out at the bottom, were set over these piles and grouted in place under air pressure. The very peculiar condition of the harbor bottom at the extreme offshore end of the pier necessitated a greater penetration of piling than was required over any other portion of the site. This was due to the fact that the several thicker strata of harder materials covering most of the area and which offered fairly good frictional resistance, pinched out at the end to relatively thin layers offering fair lateral support but insufficient frictional resistance. Accordingly the pilling had to be driven further and into harder materials existing at greater depths.

General Layout of Construction Plant.—A provisional wharf and convenient land plant was constructed adjacent to the pier site, for casting piles and for building the floating equip-



Port of Manila

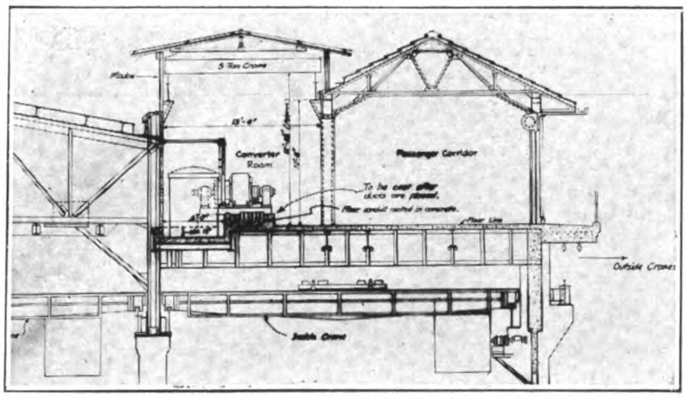
Semi-portal—Revolving Gantry Gib Cranes—Pier 7, Manila



Interior Electric Overhead, Cranes—Pier 7, Manila (*Note:*—Suspended Crane Runways in Centre)

View of Pile Field and Ladder Track System—Pier 7, Manila (*Note:*—Field Filled with Piles Seasoning)

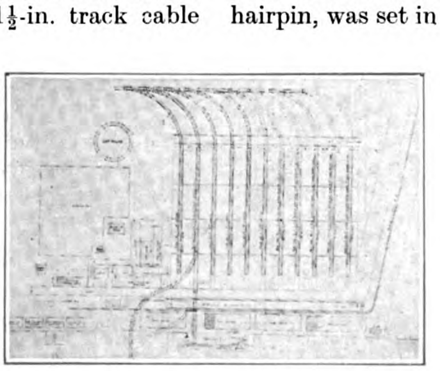
ment consisting of a mammoth pile driver, 8,150 ton material barges, a 500 ton pile barge, 2-test barges and other pieces of floating equipment such as derricks. The general layout of the pile field, storage yards, sheds, shop, provisional wharf and launching ways is shown in the figure at the bottom of this page. A 16 ton derrick was erected on the south end of the wharf and two elevated material bins of 200 yards capacity were put up adjacent to the wharf and within reach of the derrick boom. Sand and crushed rock was handled from scows to the bins by 1½ yard grab bucket and this aggregate was moved in dump cars to large storage piles situated to the rear of the Head Tower of the cableway pile-casting plant by means of an elevated track which passed under the two bins.



Sub-station Arrangement

The pile field was so laid out as to permit of casting the piles with an aerial cableway and for moving them from the field to the pile barge with a locomotive crane operating over a ladder track. The entire field accommodates 1,584 piles of various lengths.

Aerial Cableway Pile Casting Plant Used.—Various methods of casting the piles were studied with a view to assuring the deposit of well mixed batches of dense concrete in the pile forms. The cableway type of plant best suited local conditions and was built. A pair of standard gauge tracks were put down at each end of the pile field approximately 550-ft. apart. Over each pair of tracks a timber tower was mounted on six standard railway trucks. Both towers were weighted with heavy concrete blocks forming the anchorage for the track cable. A 1½-in. track cable was suspended between the two towers and carried a steel carriage (hauled by an endless cable) from which a bottom dumping bucket for concreting was suspended. Mixers were centrally mounted on the Head Tower platform. This tower also carried the hoisting and haulage machinery consisting of a h.p. double drum contractors hoisting engine and swinging gear; the latter rigged to drive the haulage line. One drum was used for hoisting the filled buckets to the latching carriage hock and the second drum for hoisting the aggregate to the hopper, while the shaft of the swinging gear was fitted with a large improvised driving pulley which drove the endless haulage line. The Tail Tower carried a two ton floating counter-weight to maintain the proper tension in the endless jaulage cable.



General Layout of Plant and Pile Field.—Pier 7, Manila

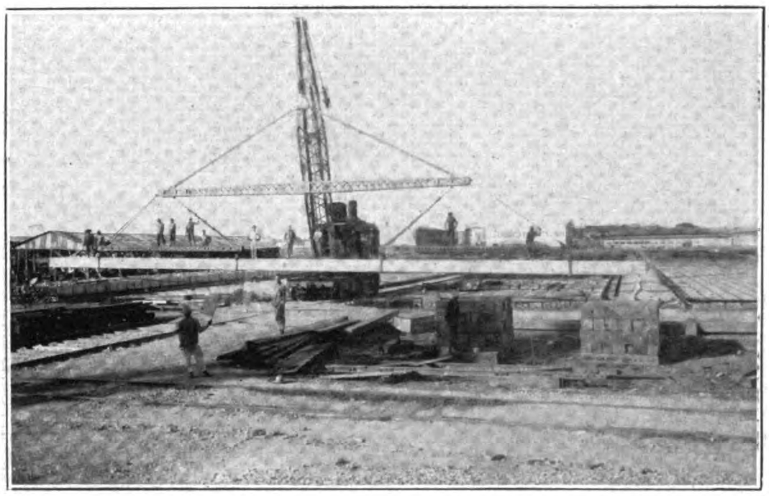
The 1:½:3 mixture used in the plies was well graded, thoroughly mixed and unusually well placed. Tests showed the concrete to be dense and strong, cubes breaking at average values of 3,600 to 5,300 pounds per square inch after seasoning 28 to 40 days.

Approximately 230 yards of concrete were handled daily with the plant when operating to capacity, 14 piles being cast.

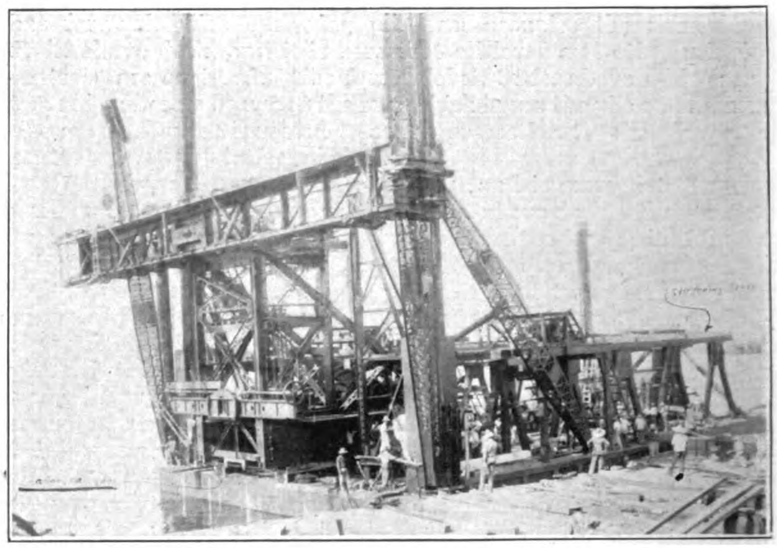
The use of this type of plant instead of a spouting plant made it possible to deposit the aggregate in almost the same state it left the mixer, at the same time leaving the area occupied by the pile forms entirely clear of platforms and other obstructions.

Reinforced Concrete Pile Make-up.—The piles are reinforced with eight one inch corrugated bars with centre of steel 2½-in. from the surface. Hoops of ¼-in. rods were used with a spacing of 1½-in. at head of pile for a distance of 3-ft. then 3, 6 and 9-in. centreings over a distance of one, two and three feet. Twelve inch spacing was satisfactory for the rest of the length of the pile except near the point of the pile where the hoops were spaced on 3-in. centres for a distance of 3-ft. All bars were allowed to project three feet above the head of the pile for the purpose of rigidly connecting the deck girders to pile, while at the points the bars were bent inward to better reinforce that part. A 1½-in. rod bent in the shape of a hairpin, was set in the head of each pile to receive the shackle of the pile line used in suspending the pile in the leads of the driver. Cambered piles were cast for use as batter or brace piles and were reinforced as noted for the straight piles except considerably heavier in the plane of camber. The camber in the longest batter pile amounted to approximately 5½-in.

Fabrication of Pile Reinforcement Units.—The reinforcement units for the piles were fabricated under cover in the make-up shed in sets of three. When a set of three units were completed, bridge timbers are swung down; racks pushed back and the units moved out on to the storage supports whence the locomotive crane removed them to the field for storage



50-Ton Locomotive Crane Carries 110-foot Pile from Field to Barge—Pier 7



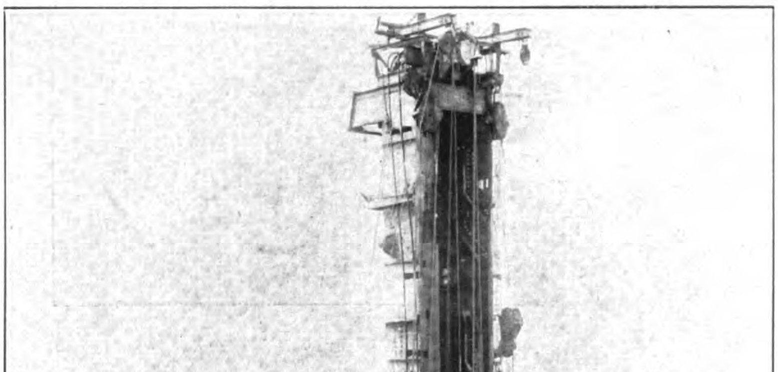
Pile-driver Mammoth under Constructions

until needed or set them into pile forms. Nine units were fabricated daily, working a nine hour shift.

HANDLING PILES FROM FIELD TO PILE BARGE.—Piles seasoned 60 days or longer are removed from the field to the pile barge, when needed, by a 50 ton locomotive crane mounted on specied 10-ft. gauge trucks. The lifting rig which is suspended from the crane boom was designed especially to avoid inducing severe stresses in the piles. Essentially the rig consists of a long upper spreading strut of latticed structural steel, spreading two flat woven wire cables which hang from the crane hook. A pair of equilizing sheave located near each end of this strut carry a pair of cables which support the two shorter latticed struts below. To each of the two lower struts are attached a pair of hinged steel pendants and a bottom bar. When piles are to be removed the rig is lowered over the pile and the arms of the pendants are raised on the near or open side of the pile while the bottom bars are inserted through tin covered slots left in the forms for this purpose.

MAMMOTH PILE DRIVER CONSTRUCTED.—The successful handling and driving of these extra large piles, which are of record size—110-ft. long by 24-in. square—and which weigh 64,000 pounds, required the construction of what is perhaps the largest and most powerful floating pile driver ever built, of a type especially adapted to the needs of the project, equipped with long steel movable leads a powerful steam hammer, a pair of 40 ton steel derrick with 60-ft. booms : powerful hoisting engines ; a battery of both steam and electric high pressure jet pumps, and much other machinery required for the efficient functioning of the driver.

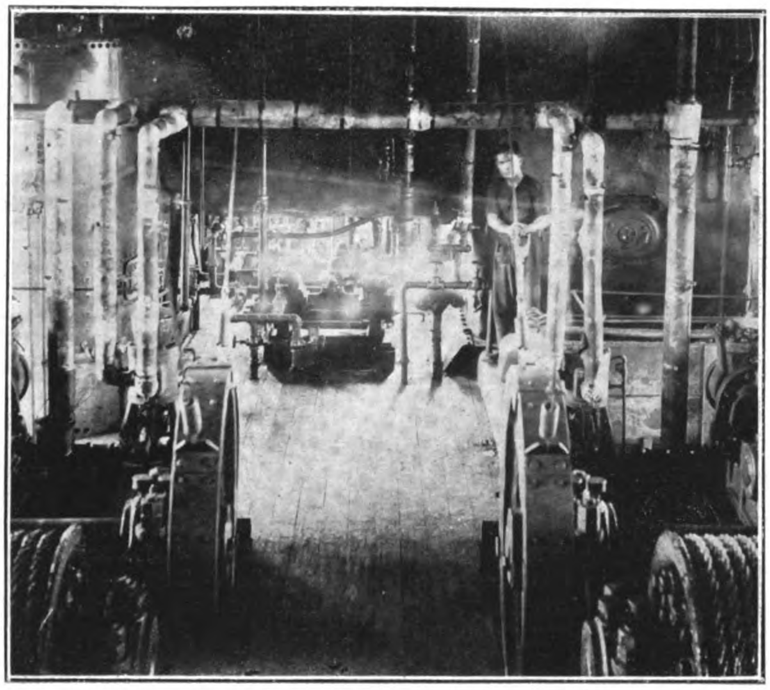
HULL.—To obtain ample stability under all conditions of operation and to provide sufficient space for the installation of all machinery, a staunch wooden hull 110-ft. long, 55-ft. wide with a depth forward of 15-ft. 6-in. and 7-ft. 6-in. by the stern, was designed to float with a free-board of about 5-ft. with deck level, displacement approximately 1,200 tons. Due to the necessity for concentrating the bulk of the machinery at the bow end of the hull, the bottom was sloped downward from the stern to the bow to secure the needed additional bouyancy there. The make-up of the hull consists of a series of cross frames and transverse and longitudinal bulkheads of heavy Oregon pine timbers, forming twelve watertight compart ments, each equipped with a 4-in. bilge syphon. The sides and bottom are planked with 6-in. lumber. Two heavy stiffening trusses were framed into the hull to prevent hogging. Especially heavy bulkhead construction was necessary near the centre of the bow and immediately under the steel carriage.



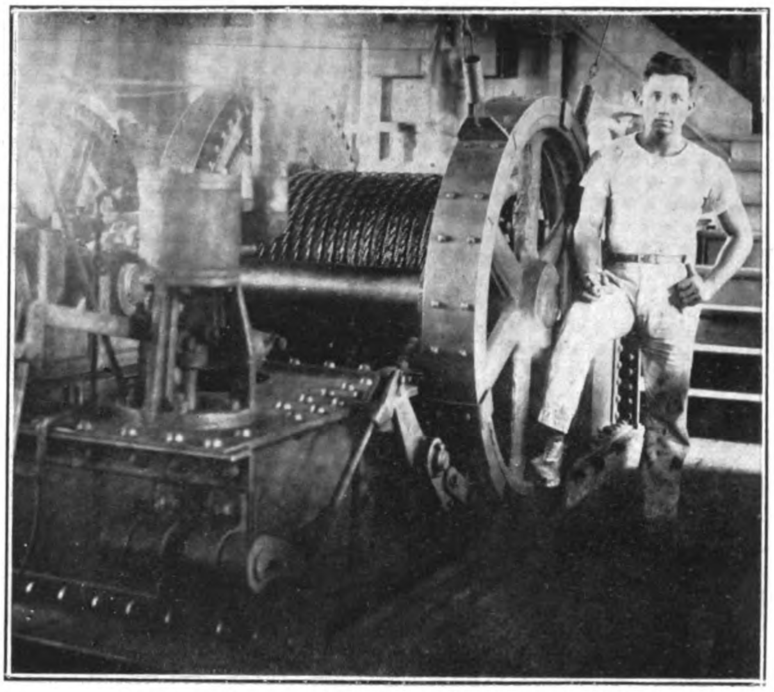
Mammoth Pile-driver

GENERAL ARRANGEMENT OF DRIVER.—The main machinery is carried on the several levels of the leader carriage which is centrally located at the extreme forward end of the driver. All other machinery and plant is fixed to or founded on the main deck with the exception of the Port and Starboard derrick engines carried on the upper deck and the captan engines below deck. The boiler room, situated on the after part of the main deck, houses the power plant and the forward spud engines. Boiler feed-water tanks of ample capacity were built into the hull below deck. An 8 by 8-in. double cylinder compound geared anchor windlass with two gypsis is fixed to the deck at the stern end of the driver aft of the boiler room, and carries two 5,000 pound anchors.

Open deck space running fore and aft on both sides of boiler room is utilized for deck fittings such as line spools, mooring bitts, steam and dummy capstans for the handling of lines when man-



Boiler Room, Pile-driver "Mammoth"



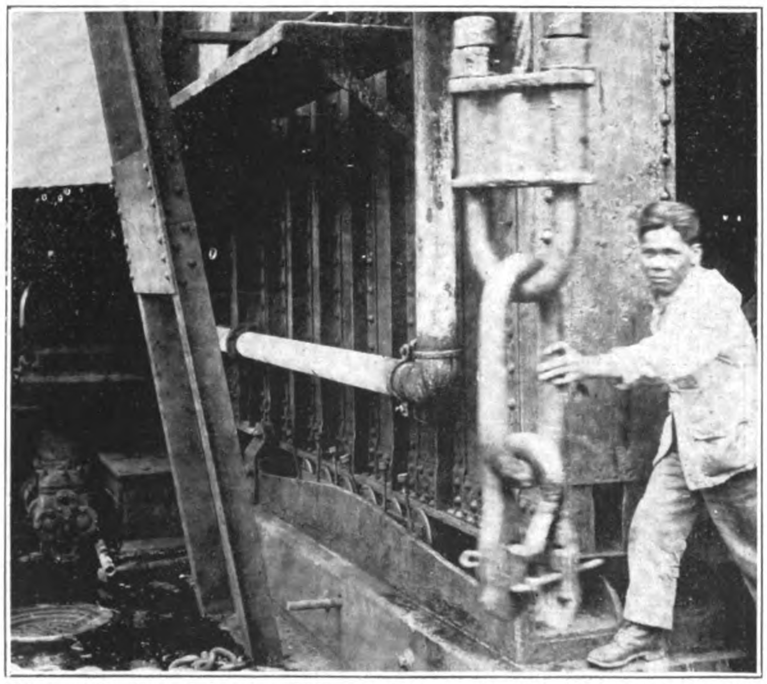
Forward Spud Engines, Pile-driver "Mammoth"

euvering. Two steel derricks of 40 tons capacity are bracketed to the forward corners of the driver. Living quarters for the Driver Superintendent and engineman are provided on the aft part of the upper deck. The crew are provided with folding bunks and lockers in the boiler room.

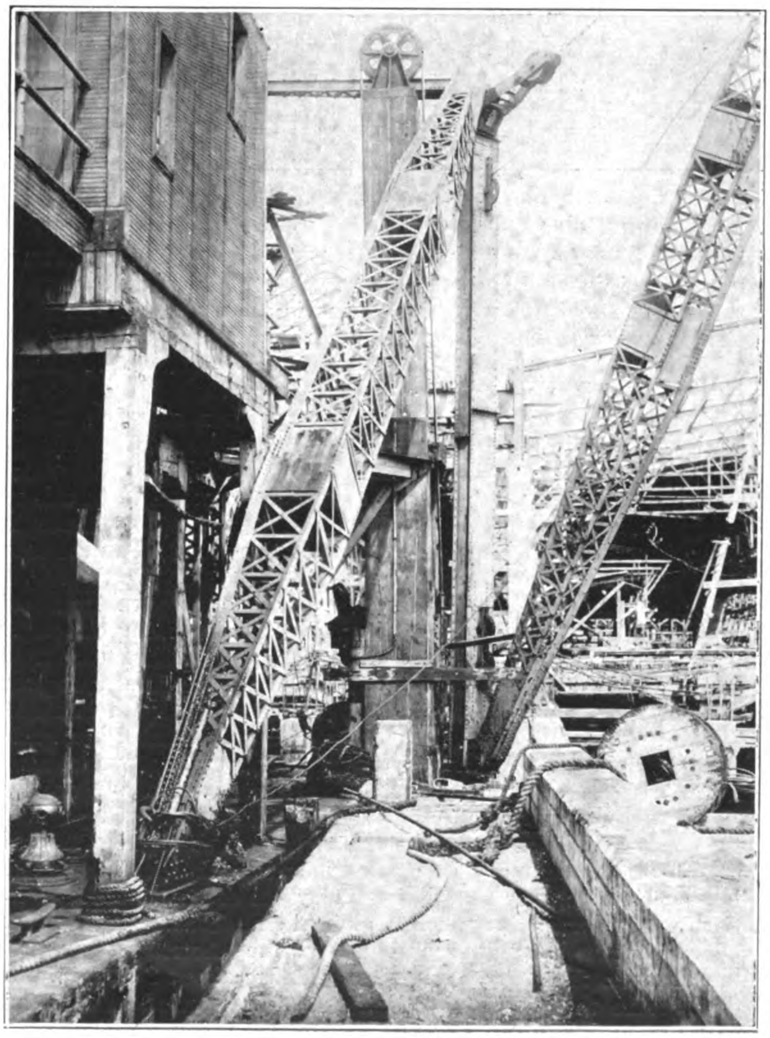
PONDEROUS SPUDS.—For the purpose of adequately anchoring the hull in position when driving and to further stabilize the driver during all operations, by pinning up, the hull was equipped forward with two ponderous spuds, each 36 inches square and 96-ft. in length, weighing approximately 20 tons each, while aft a single spud 24-in. square and of the same length was provided to hold the driver against swinging. The forward spuds were made up from 20 by 20-in. timbers, securely fastened with clinch bolts. All spuds were equipped with cast steel shoes, slightly tappered; those for the forward spuds weighing approximately 6,000 pounds each. The top of each forward spud carried a 42-in. cast steel sheaved and a similar sheave, housed, was fitted in each spud just above the shoe.

Heavy timbers bolted to the sides of the hull form the spud wells and guides. An upper spud keeper and a lower spud gate of cast steel are fastened across the outer face of each pair of spud guides.

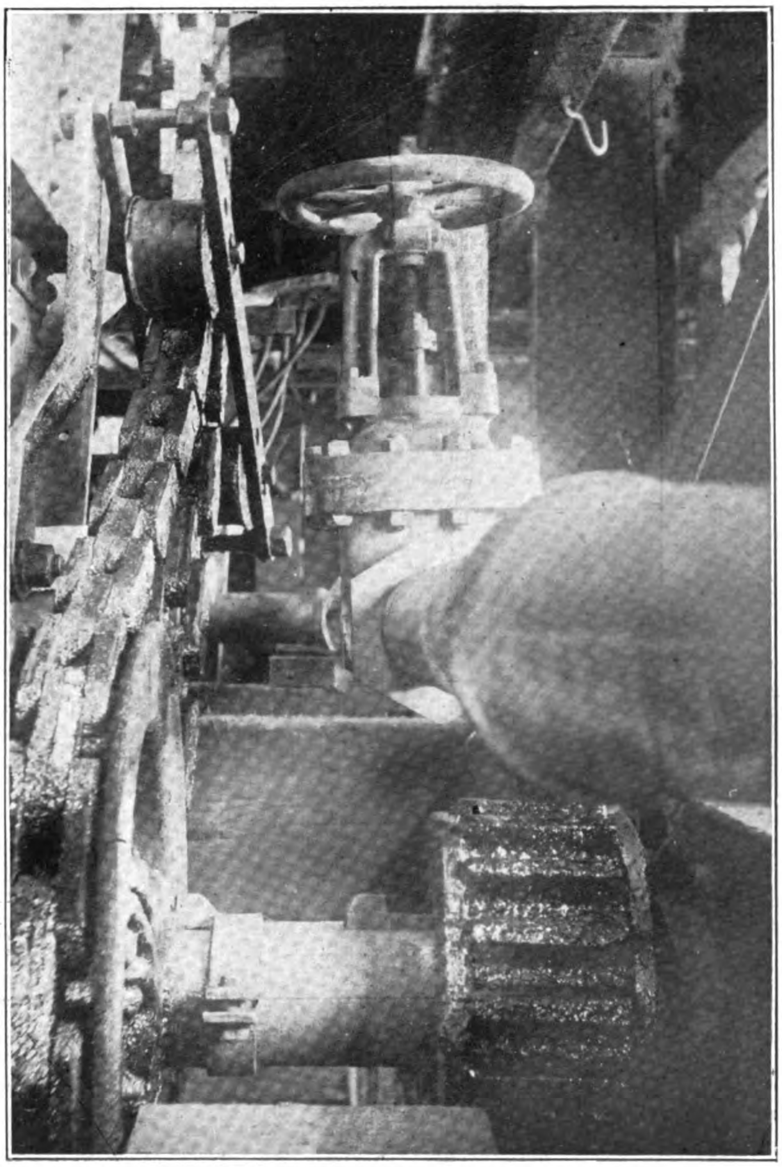
OPERATION AND RIGGING OF SPUDS.—The raising of lowering of either of the forward spuds is accomplished at the will of the Leverman on the operating bridge, through lever controls governing seperate $8\frac{1}{2}$ by 8-in. double cylinder reversable spud engines. The spud cables used are $1\frac{3}{4}$-in. diameter plough steel, 6 by 37 construction, with steel centres. One end of both upper and lower spud cable



View of Starboard Girder of "Leader Carriage"—Pile-driver "Mammoth"
(*Note*:—Rollers under Girder)



40-Ton Steel Derricks on Pile-driver "Mammoth"



Propelling Mechanism, Pile-driver "Mammoth."

is clipped to the spud engine drum. The cable leading from the underside is carried forward through the hull, below deck, and up through the deck at the spud, over an idler sheave and down under the lower sheave housed in the spud, then up to the second set of adjusting bolts. A "pin up" of the forward end of the driver of about 16-in. is possible with this equipment.

As the stern spud is used only to prevent swinging, it is not equipped with a top sheave. The rigging for raising this spud is similar to that for the forward spuds but lighter, however no seperate spud engine is used ; the $1\frac{1}{4}$-in. cable attached to this spud being carried forward through the hull below deck whence it is trained to a drum driven by the main engine, situated on the second level of the leader carriage.

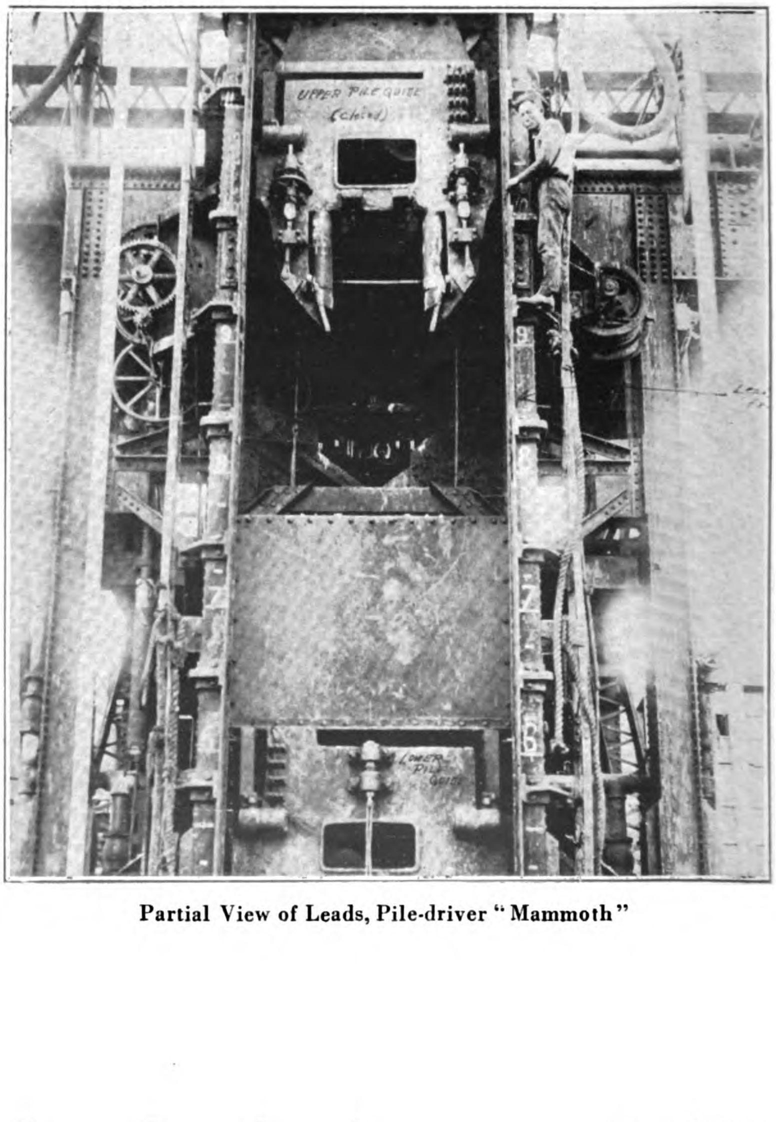
LEADER CARRIAGE.—A heavy carriage of structural steel, upon which is mounted the main machinery including the carriage propelling mechanism also carries the steel leads, the tipping (screw) engine and a battery of steam and electric driven jet pumps. It is designed to move fore-and-aft on rollers through a distance of 7-ft. 6-in. Essentially it is made up of a pair of steel box girders, stiffened and braced with cross frames ; a pair of longitudinal trussed frames riveted to the after ends of the girders and a four post steel superstructure supported on the girders. The forward portion of the carriage rests on two nests of 6 eight inch steel rollers, which in turn bear on and move in a pair of steel track channels bolted to bolster timbers over the centre bulkheads of the hull. The after portion rests and slides on two plained slide bearings.

All steam jet pumps and part of the electric jet pumps are mounted on the lower level of the carriage about 2-ft. 6-in. above deck, while the main engine and drums are carried at the rear of carriage on heavy cross beams at the second level approximately 11-ft. 5-in. above deck. The tipping engine is also on this level, but forward. The operating platform occupies the third level, 27-ft. above deck, and it is here that all lever and other principle controls are centreed. The fourth level, 34-ft. above deck carries two pairs of cross beams at the rear which house the pile and hammer line guard sheaves is roofed to afford protection to the Leverman on the operating platform below.

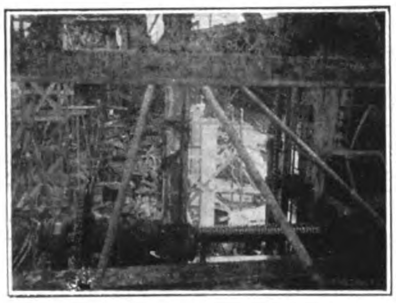
A heavy transverse girder rests on and is secured to the forward end of the carriage about 11-ft. 6-in. above deck and carries the lower pintle which receives no weight from the leads ; its function being to transmit motion in a transverse direction to the leads and to permit swiveling of same. A second transverse girder is secured to the front columns of the upper carriage frame, 34-ft. above deck, directly over the lower girder and carries the upper pintle bearing which in turn supports the entire weight of the leads, hammer and pile. Propulsion of the carriage is effected by means of a rack and pinion driven by the main engine ; the rack being securely fastened to the deck.

LEADS.—The steel leads, especially designed to move transversely across the face of the leader carriage or to swivel about the upper pintle bearing for driving batter piles, are 93-ft. 6-in. long from top of pile sheave to water line and of "U" form in cross-section, measuring 6-ft. 3-in. across the open face and 4-ft. 9-in. in depth. Structurally, the leads consist of a number of heavy cast steel yokes spaced 6 to 8-ft. apart, plated up on both sides, open in front, stiffened with angles in each corner and heavy diagonal bracing in the back, except at both extremities where solid back plating was used and at the upper pintle where a heavy plate diaphram extends the full distance between yokes. The top of the leads is capped with beams and plates arranged to support the large pile line and hammer line sheaves on bracketed bearings. A track for guiding the steam hammer, made up of "Z" bars, extends the full length of the leads on both sides. Near the top of the leads the track slopes away towards the rear and permits the hammer to completely enter the leads ; thus presenting a clean and unobstructed face to piles turned up across the frame. An automatic hammer locking device locks the hammer after it has entered the leads.

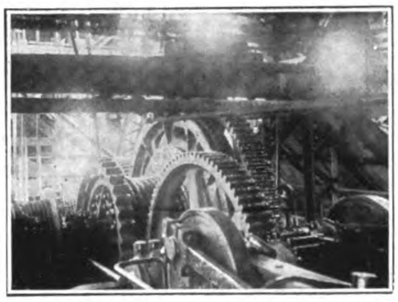
Suspended within the leads is the movable upper pile guide which can be held at any desired elevation. During the process of turning a pile up and into the leads, both upper and lower pile guides remain in a collapsed or turned down position. After



Partial View of Leads, Pile-driver "Mammoth"



Upper Screw-shaft—Pile-driver "Mammoth"



Main Machinery, Pile-driver "Mammoth"

the pile has been suspended in the leads, both guides are turned out to give support to the pile and the fingers of the upper guide are then laid over to prevent the pile from falling outward. The lower guide, which is stationary, is hung within the leads at a fixed elevation.

LEADER TIPPING ENGINE.—Movement of the leads is accomplished by lever controls governing the single 8½ by 8-in. double cylinder reversible tipping engine, located on the second level of the leader carriage, which drives both the upper screw shaft operating on the upper pintle bearing and the lower shaft connected with the lower pintle. The simultaneous operation of both upper and lower screw shaft produces a transverse movement of the leads while the operation of either upper or lower screw shaft, independently, swivels the leads about the upper pintle. The leads may be moved while in a vertical position from one side of the carriage to the other through a distance of 9-ft. or may be brought to a 1-3 batter and then moved in either direction through the same space.

MAIN MACHINERY.—The main machinery consisting of the pile hoist, hammer hoist, stern spud hoist and pile guide drum is located on the second level of the leader carriage and is driven by a single 12 by 16-in. double cylinder reversible engine.

OPERATING PLATFORM.—All principle motions of the driver are controlled from the operating platform. From this platform the Leverman commands a good view of the work and is in an excellent position at all times to see the signals made by the superintendent on the pier deck. Twenty five lines of control originate here ; the most important ones being centreed in or near the lever stand facing the leads.

POWER PLANT.—With the exception of the battery of 6 electric jet pumps, all machinery is operated with steam furnished from a 76-in. by 18-ft. locomotive type boiler—A.S.M.E. standard—under a pressure of 150 pounds.

A small verticle standby high pressure boiler has been installed for use in case of an emergency, to raise or lower spuds and to operate the anchor windlass. Power for the operation of the electrically driven jet pumps on the driver is brought from shore at 3,300 volts and stepped down to 250 volts for operation.

LARGE SPECIAL STEAM HAMMER USED.—The big hammer used to drive the piles was especially constructed for this project, and has several features of importance, principal of which is the safety device for preventing the ram from operating unless the hammer has been fully seated upon the pile to be driven. The hammer including follower casing, stands 17-ft. in height, measures 36-in. across its face and 26-in. in depth, and weighs with follower approximately 32,000 pounds. The main body is cast iron and contains the cylinder, valve chest and ram guides. The cylinder is of 14-in. bore ; 36-in. stroke and operates a 4,000 pound ram. The piston is double acting and with an effective steam pressure of 80 pounds the hammer develops approximately 4,000,000 foot pounds of work per minute—striking at the rate of 85 blows.

The follower is of cast steel and is designed to fit over the hair pin and the reinforcing rods which project above the head of the pile. A spike wood cushion block of native hardwood known as mountain Dungon, which is very tough and fibrous and which is banded with ½-in. flat steel 4-in. wide and 18-ft. long wrapped 3 times around and riveted with countersunk rivets closely spaced fits on top of the follower and receives the direct blows of the hammer. Cushion blocks last on the average for the driving of 6 piles. Where the driving has been very hard some blocks have given out after driving a single pile.

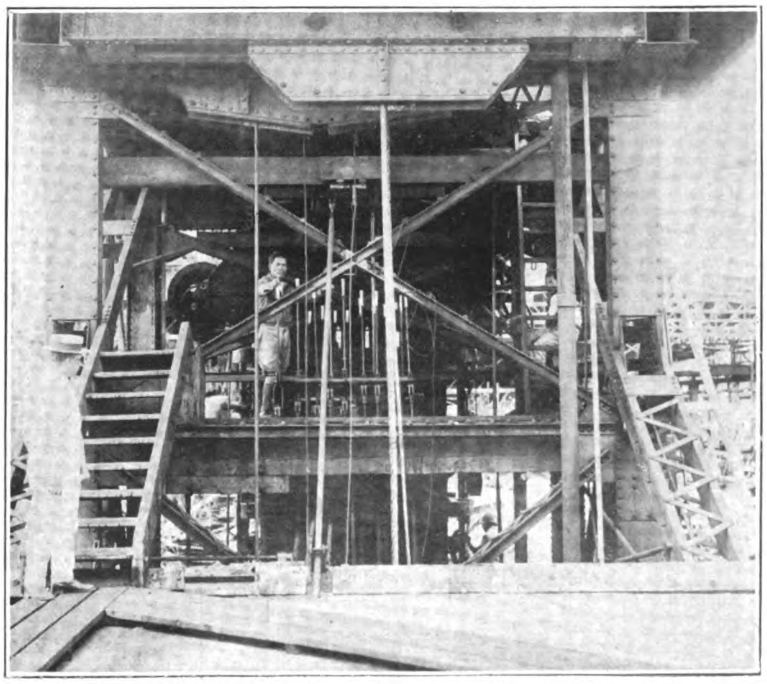
A pair of roller guide brackets are attached to the upper part of the hammer body and to the follower casing, and travel in the hammer track of the leads, thus permitting the accurate location of the hammer over the pile.

HIGH PRESSURE JETS.—A battery of two single stage 50 pound, two-2 stage 100 pound and two-4 stage 200 pound centrifugal pumps, electrically driven, are split into two banks of three pumps each connected in series, and supply water at the rate of 500 gallons per minute under a pressure of 350 pounds to both of the three jet lines. Each pump is by-passed to enable the use of any two in case of a shut down of a third. The three sizes of pumps were installed with a view to furnishing a maximum pressure when jetting operations are most difficult and to provide for a saving of power by cutting out one or two pumps on each jet line while operating over that portion of the pier site where less difficult jetting was to be found.

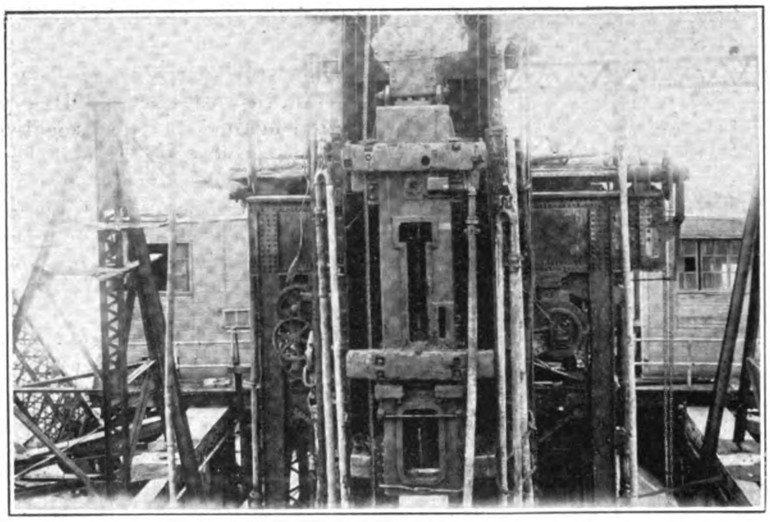
DERRICKS AND DERRICK ENGINES.—A 40 ton stiff leg derrick is bracketed to each of the forward corners of the hull for handling piles up to 80-ft. in length without the use of a stiffening or equalizing device and for handling piles above this length with a stiffening beam.

Each derrick is operated with an independent 10 by 12-in. double cylinder non-reversing hoisting engine (Starboard engine double drum, Port tripple drum), controlled by a bank of latched quadrant levers conveniently mounted in each derrick engine house so as to command a full view of the fall blocks ; the tripple drum engine being used with the Port derrick which is equipped with an extra fall block required for handling the pile beam. "Swinging" is accomplished entirely by the manipulation of the forward spuds ; pinning up with the Port spud causing the Starboard derrick boom to swing away from the leads, the opposite effect being obtained with the Starboard spud.

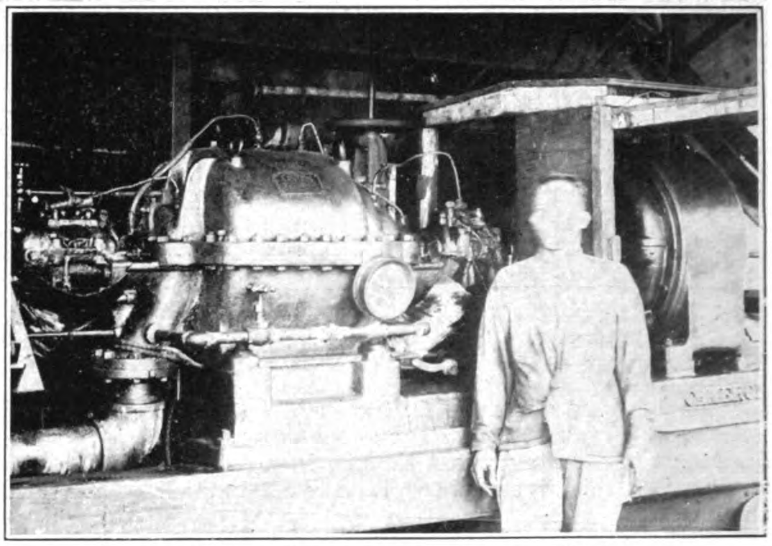
PILE DRIVING OPERATIONS.—The loaded pile barge is brought into position just in front of the leads. While the end of the barge is drawn slowly past the centre of the leads two members of the crew fasten the shackle of the pile line to the hairpin in the head of one of the piles. The barge is then drawn on until the pile is about centreed before the driver. With the barge stayed in this position, the crew attach the Port and Starboard hoisting rig to the socketed flat wire pile slings ; the latter having been placed about each pile as it was loaded on the scow. The hoisting rig consists of a Port and Starboard eight part block set, reaved with ¾-in. plough steel cable, the head block of each set being suspended from the top of the leader frame. When hoisting 110-ft. piles the Starboard rig is attached to the pile at three points and the Port rig the same. Piles a 100-ft. long are raised by using 3 points of the Port rig and two points of the Starboard rig, while for those of 90-ft. but two points of each rig are attached. Two equilizing sheaves are used on both sets for 6 point suspension ; one on the Starboard and two on the Port for 5 points and one each for 4 point suspension. The pile is next hoisted evenly in a horizontal position to an



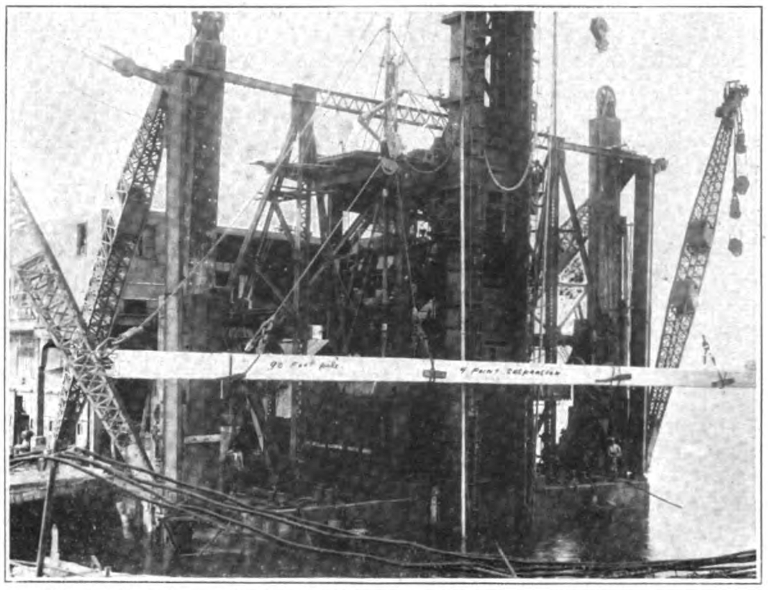
Operating Platform, Pile-driver "Mammoth"



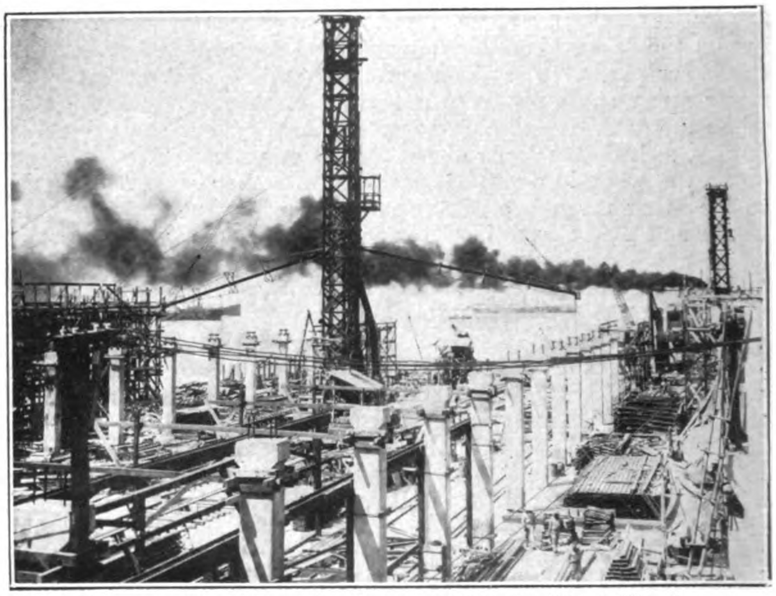
Special 32,000 Pound Steam in Operating Position Pile-driver "Mammoth"



Battery of 4 Stage Centrifugal High Pressure Jets Pumps Pile-driver "Mammoth"



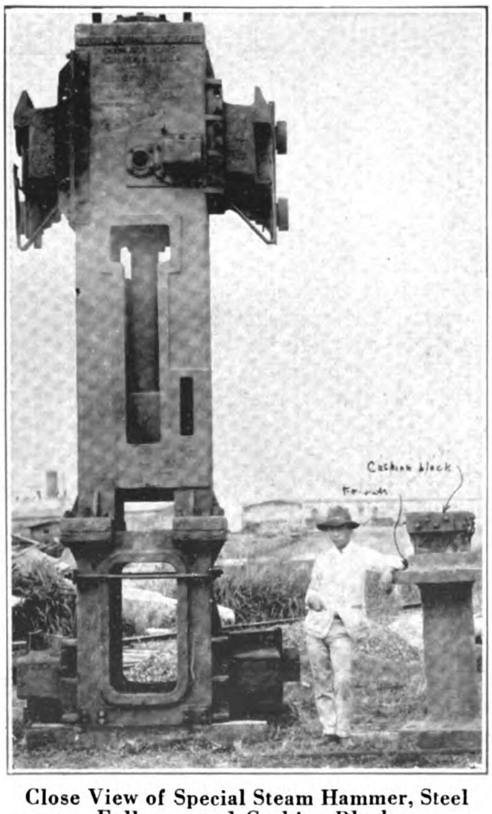
Pile Hoisted to a Horizontal Position 15-ft. above Deck Prepartory to Turning up into Leads-Pile-driver "Mammoth"



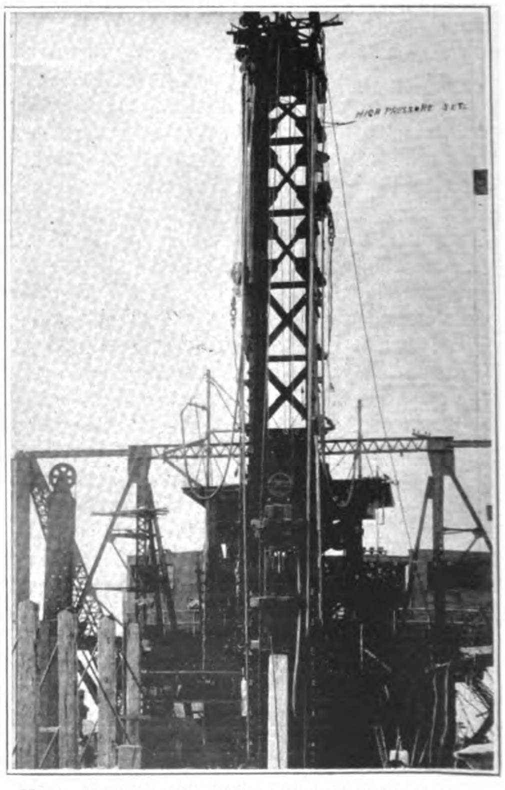
Superstructure Travelling Concreting Plant—Pier 7, Manila

Interior View—Pier 7

Interior View



Close View of Special Steam Hammer, Steel Follower and Cushion Block



View Showing High Pressure Jets Pile-driver "Mammoth"

elevation about 15-ft. above the deck of the driver. The pile barge is then drawn away and the Starboard rig hoisted, bringing the pile into a sloping position. During this operation and as the head of the pile rises, all slack is kept out of the pile hoist line but no appreciable strain is permitted on it. The Port rig is then slacked off free, thus transfering the entire weight of the pile to the Starboard rig, which bring the pile almost vertically under the Starboard side of the leads. Centering in the leads is now effected by burtoning to the pile hoist line.

No appreciable deflection occurs in the piles turned up into the leads by this method and a careful examination has failed to reveal cracking in any degree.

The pile is soon freed of the hoisting slings, and the upper and lower pile guides are turned up into position.

Vertical Driving.—After a pile has been suspended in the leads and stayed with pile guides, all spuds are raised and the driver is brought into approximate position by means of the usual head, stern and breast line which are all controlled by steam and held on dummy capstans. With the pile approximately spotted, or within a few feet of its proper position in either direction the forward spuds are run down and the stern spud is dropped. This fixes the position of the hull and the exact spotting of the pile is then accomplished by propelling the leader carriage either forward or aft and by moving the leads laterally in either direction. When the pile is correctly spotted it is lowered into the mud until it comes to rest; the heads of the 110-ft. piles usually standing 55-ft. above water at zero stage. The steam hammer is next run down and over the pile. The upper pile guide is then turned down to clear the hammer as pile and hammer move downward. The full weight of the hammer pushes the pile down approximately another 10-ft. leaving its head 45-ft. above water. The jets are next swung into position along side of the pile and are lowered and churned while steam is opened into the hammer.

From 15 to 55 minutes of continuous driving and jetting is usually required to get the piles down into the baquias, depending on the nature of the underlying strata of materials. Some piles have required 4 hours to drive due to encountering several relatively thick layers of sticky clay in certain parts of the area; most of this time, however was utilized in jetting and loosening up the material and not in hammering. The number of blows struck have varied from 1105 to 4430 in driving a pile to position. Aided by high pressure jets, the piles are being driven to refusal at grade without damage of any importance to the heads; a very little spawling at the edges of the pile taking place.

Driving Batters.—In driving batter piles the operations are similar to those for the vertical piles except that the bow of the driver has to be skewed off to make an angle of about 10 degrees with the transverse bent of piles in which the batter pile is to be driven to avoid striking the adjacent vertical piles driven in the same row with the point of the batter pile.

With leads battered to a 1:3 slope the pile is partly supported by the rollers of the upper and lower pile guildes and is lowered into the mud without injury to its skin. Only the jet which lies on the upper side of the pile can be used to assist driving a batter pile.

Driving Progress.—With the method outlined above, of handling long piles from scow to leads, a maximum of 8 piles per 10 hour day can be driven. This number can be increased to 12, using the stiffening beam lifting rig for up-ending the piles, but the use of the beam method is limited to perfectly clam weather.

The stiffening beam is handled by the Port boom, but can be handled with either. By the beam-boom method a pile is swung in a horizontal position directly from the scow alongside to a position in front of the leads where it is up ended. In this way much time used in attaching and removing slings can be saved. Piles up to 80-ft. in length can be safely handled by the boom when slung at two points, without using a stiffening beam.

Examination of Piles After Driving.—To ascertain the condition of piles driven at various locations over the pier site where a variation in material was encountered in driving, a number of piles were pulled and carefully examined not only at the point but throughout the length of the pile. The examination revealed no damage whatsoever and indicated that the method of driving was satisfactory.

Test of Bearing Power of Piles.—As the depth of hard material varied considerably, at test load of 200 tons was applied to a few piles whenever a considerable amount of variation in penetration occurred. To avoid delaying the progress of the driver, special testing apparatus that could be quickly moved from one location to another was built.

This apparatus consists of a testing beam of structural steel; a hollow steel cylinder to set on the pile and two test barges. Heavy timber and lengitudinal wails are bolted against the pile selected for test and six others in line, about 4-ft. below zero tide. The steel cylinder is then placed over the protruding bars of the pile and is filled with dry sand. A rectangular wooden cap of hardwood cylindrical in form on to the underside is placed on top of the cylinder so as to bear on the sand and the test beam is raised and seated on the wooden cap. Both test scows are then floated in place, one on each side of the pile to be tested. This done, a cable is reaved around the sheaves in the cross frames located on the scows and over the sheaves in the test beam directly above, thence to the engine drums. The scows are then raised so as to be clear of the highest tide and are loaded with water and steel.

Under the maximum loading these piles are driven to support, an apparent settlement of 11 millimeters (about 27-64 of an inch) occurred, part of which was deformation. Under an additional loading of 100 tons a further settlement of 11 millimeters was recorded. Upon removal of all load, after the lapse of 15 days, a recovery of 8-½ millimeters (about 21-64 of an inch) was noted. Had the pile not been loaded beyond 100 tons the net settlement realized would probably have amounted to 3½ millimeters or approximately 9-64 of an inch.

Construction of Pier Shed Superstructure.—Concreting of the superstructure is carried on from a central mixing tower and chutting plant equipped with two one yard mixers and a double line of boom chutes mounted on a steel car. As work progresses, the plant is advanced down the centre of the pier on rails. A dinky locomotive brings up the aggregate and cement. All batches are mixed 2½ minutes.

All structural steel is assembled and riveted on the deck of the pier and erected in complete units by the locomotive crane.

Cost of Pier and Cargo Handling Equipment.—The total cost of the completed pier and pier head including mechanical cargo handling equipment will be approximately $4,500,000.00.

Manufactures of Cargo Handling Equipment.—The gantry cranes were built by the Wellman-Seaver-Morgan Company while the interior cranes were built by the Shepard Electric Crane and Hoist Company and by Pawling and Harneschfeger. The Industrial trucking equipment was furnished by the Baker R. & L. Company of New York. Converters and other electrical equipment in the Substation was built by the Westinghouse Company.

Manufacturers of Construction Equipment.—The machinery on the driver was manufactured by several concerns. All of the principle machinery and structural parts were built by the Bucyrus Company of Millwaukee, Wisconsin, while the special steam hammer was made by the Union Iron Works of Hoboken, New Jersey. The derricks and anchor windlass were built by the American Hoist and Derrick Company.

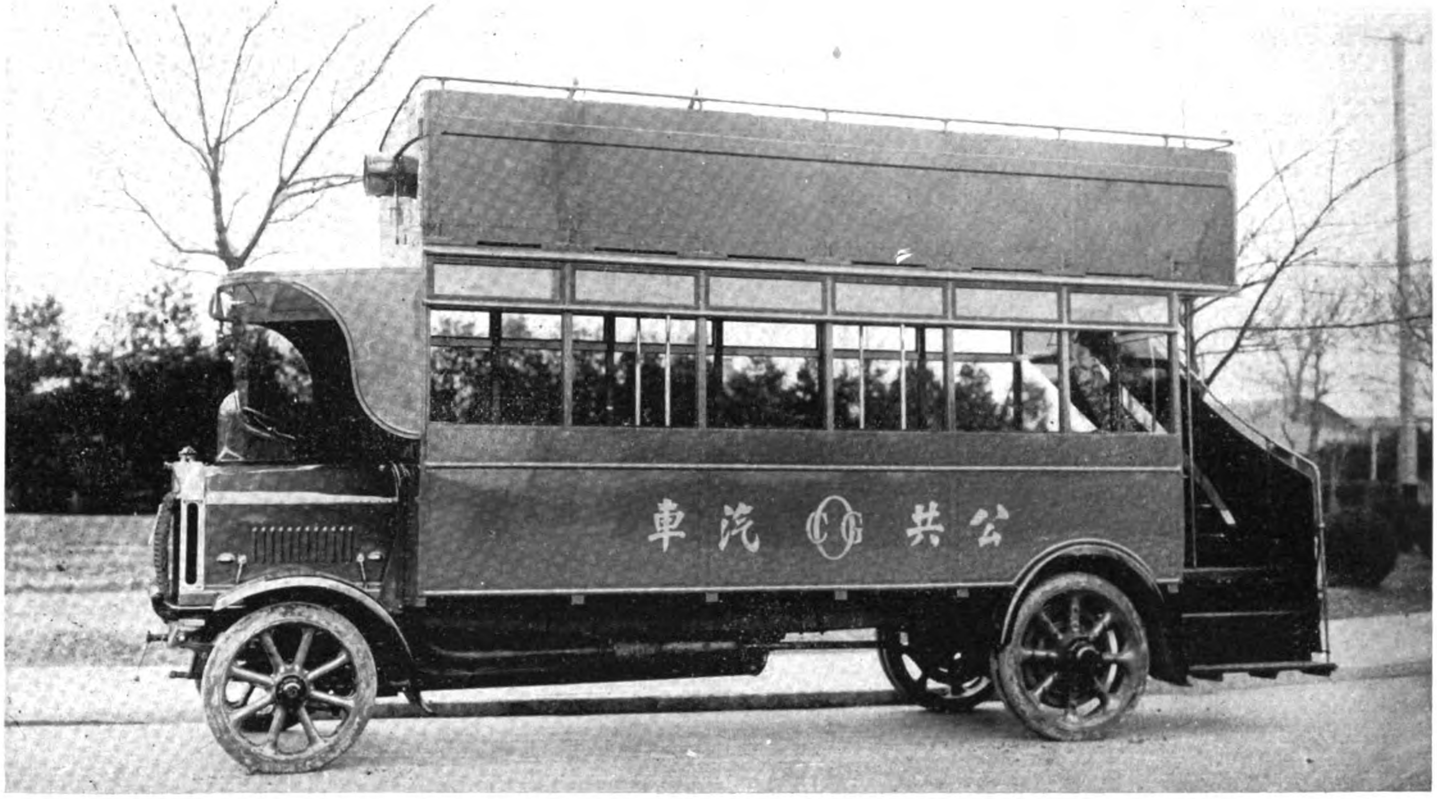
Personnel.—The pier is being constructed for the Insular Government of the Philippine Islands by the Bureau of Public Works, under the immediate supervision of the writer as Chief Engineer of the project and Walter J. Grodske as project engineer. Plans for the pier and plant were prepared by the writer and developed under his personal supervision.

Acknowledgement is made of the loyal assistance rendered by Messrs. Leroy H. Thompson, mechanical engineer, Louis L. Vincent electrical engineer; Jean M. Allen and Ware Berry, driver superintendent—all of the Bureau of Public Works, Manila.

The Asiatic Motor

The first annual number of "The Asiatic Motor," appeared in March and clearly indicates that this magazine has come to stay. "The Asiatic Motor" is the official organ of the Automobile Club of China, the Hongkong Automobile Association and the North China Automobile Club.

The annual number contained interesting articles on automotive activities in the Far East and is plentifully illustrated.



Shanghai Gets Double Deckers

WE show a photogragh of the new Double Deck Omnibus which the China General Omnibus Company hope to place on the streets of Shanghai in the near future: The Public have watched with great interest the progress which this company has made in the few months of its existance and have learned to appreciate the convenience and comfort of the fine Single Deck Saloon Buses which are now such a familiar sight in the streets. The arrival, therefore, of something new from this Company's workshops is avaited with keen interest.

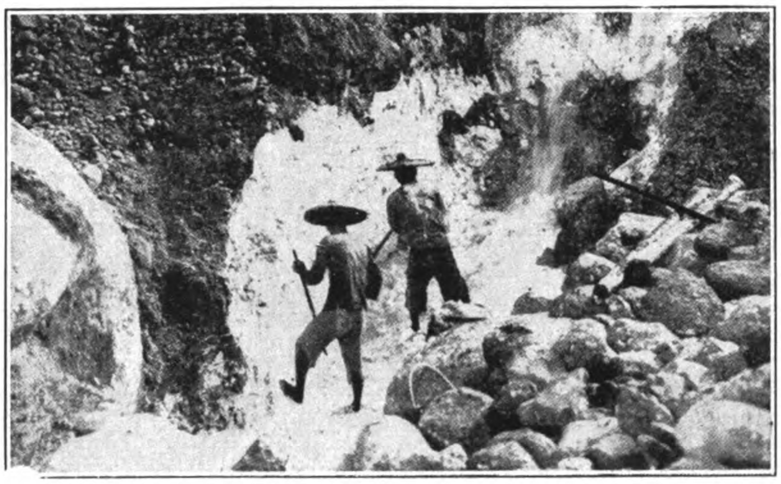
The body is of the well known London pattern with additional comfort to the passenger in the well sprung seats, similar to those already in use. The interior will seat 24 passengers all, except four, facing forward, these four being seated longitudinally over the

(Continued on page 188.)

Shanghai's New Busses

Chinese Women Cleaning Tin Ore

A group of Chinese women cleaning rough concentrates of ore by washing them in wooden pans. This is the most primitive method of dressing ore, but thanks to the skill attained by the workers it is effective. This washing in pans is largely used by Chinese and Malays to save the small amounts of tin that escape concentration on the mines and are washed away with the lighter grains or "tailings," and accounts for a large amount of tin ore annually. In the foreground are some half-coconut shells which are largely used by miners for concentrating small samples of ore.



A Small Chinese *Lampan*

A small ground-sluicing mine or *lampan* in which the water, seen falling in a small cascade on the right, is brought to the ore. The two Chinese are breaking up the soft tin-bearing ground with crowbars. It falls into the stream, where the water carries off the lighter constituents, leaving a concentrate of tin ore with heavy impurities which are separated later.

Landmarks in the Tin-Mining Industry

Leaving Primitive Chinese Methods Behind

By T. R. A. Windeatt, M.I.M.M.

ALTHOUGH it is well known that the main products of the Federated Malay States are tin and rubber, it is not so fully realized that the mining industry is mainly responsible for the rapid development and wonderful prosperity of the country. Records exist of tin-mining by Malays, Siamese, and Chinese at the time when the first Cornish mines were opened many centuries ago, but the production of Malayan tin, commonly known as "Straits tin," was not appreciable until the discovery of the Larut tin-fields in the State of Perak by Chinese miners. Mining operations were carried on under great difficulties; the country was in a state of anarchy, and faction fights were frequent among the numerous clans of Chinese. This led to an appeal by the ruling Prince of Perak to the British, then established in Singapore, Malacca, and Penang. In 1874 the Treaty of Pangkor was drawn up, and the existing system of administration was gradually evolved. Under equitable rule tin-mining prospered, and the richness of such fields as the Kinta Valley and Batang Padang in Perak, and the mining districts in Selangor became widely known.

The Chinese possessed no elaborate machinery, but excavated and washed the surface deposits with water from the hills nearby, employing large numbers of coolies for this purpose. Workings were generally limited to some 20-ft. or 30-ft. in depth, only very primitive pumps being available to keep the mines dry. Fortunately for these early miners, deposits were extraordinarily rich and tin ore was easily won, yet the output from the whole of the peninsula fifty years ago was estimate at less than 450 tons.

Stopping a Decline

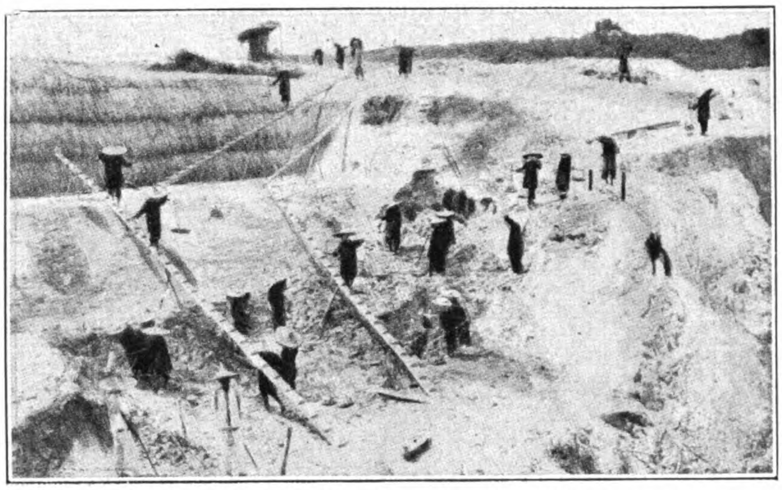
Following the introduction of what was virtually British rule, taxes were regularly collected, and the revenue derived from the mines provided funds for construction of roads and railways. These opened up the country, and rendered it suitable for the extensive

The Effect of Ground-Sluicing in the Mountains

Ground-sluicing can most readily be employed in hilly country where the steep slopes make it easy to conduct small streams of water wherever they are required. The effect of ground-sluicing on a large scale in the mountains is seen in this picture. Although such ground does not look promising for vegetation, it is surprising how soon a rank growth appears on it again. In some places old *lampans* such as this stretch for miles in the valleys and make rapid progress on foot impossible.

Part of a *Lampan* Showing Boulders Supported by Wood

Where big boulders are numerous the mountain streams effect a natural concentration of tin ore under them, and as this is very rich ground, the Chinese burrow under the boulders to win it, after diverting the stream if there is so much water as to make the ore inaccessible. The removal of the sand destroys the support of the boulders, and they have to be propped up with timber; but as the Chinese are careless about choosing props strong enough to bear the weight, it sometimes happens that the boulders fall and crush the miners underneath.

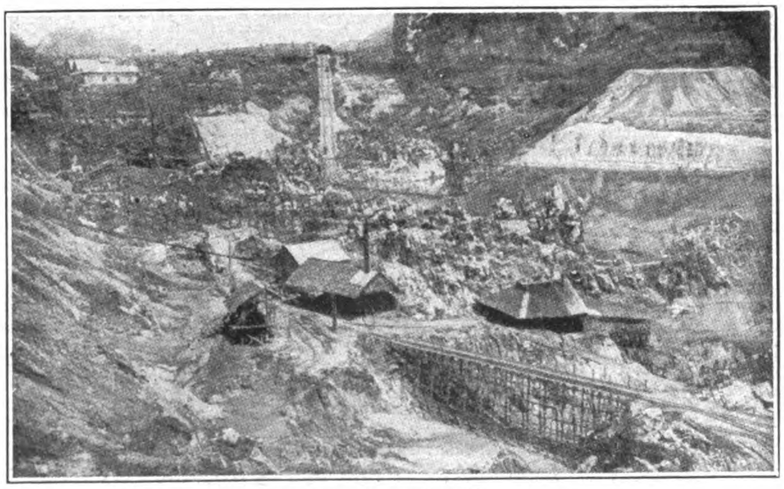


Women Working in an Open-Cast Mine

rubber estates, which may now be seen from Penang to Singapore. In 1904 the Federated Malay States exported nearly 52,000 tons of tin ore, or 56 per cent. of the world's output, the bulk of this amount being produced by Chinese mines. The output gradually declined, and in 1921 had fallen to 34,490 tons, but additional machinery installed by Europeans after the war caused an upward trend, and during the past year exported tin reached a total of 44,042 tons.

The geology of the mining-fields is complex. Briefly, tin deposits are alluvial, and are derived mainly from certain of the granite hills, which form the most prominent physical feature of the country; also, to a smaller extent, from instrusions into limestone, the bedrock in many of the important mining districts. Most of the large alluvial mines are situated on the western side of the peninsula, near the contacts of limestone and granite rock, where the highest tin content is usually found. Tin occurs as the oxide, cassiterite; in alluvial deposits it is frequently about the size of fine shot and resembles brown crystalline sand. It is noted for its exceptional purity, and may be found in alluvium consisting of sand, clay sand, or very stiff clay. Lodes of tin ore occur in the granite hills, but with the exception of Pahang Consolidated, Limited, where they are vigorously exploited, production amounting to some 1,600 tons annually, underground mining is at present of small importance.

The mining of alluvial deposits presents many varied problems, but the principles are the same throughout, from primitive Chinese workings to the most elaborate hydraulic mines and dredges. The alluvium is excavated, and, if necessary, puddled with water to set free the tin. The mixture is then passed into a stream of water flowing in a ditch or sluice provided with adjustable wooden slats or "riffles." The quantity and velocity of water in the sluice is so adjusted that its force is sufficient to carry away the lighter waste while leaving a concentrate of the heavy tin oxide behind the riffles. This concentrate is periodically removed, rewashed, and freed from the last impurities. After being bagged, either wet or dry, it is



A Large Open-Cast Mine

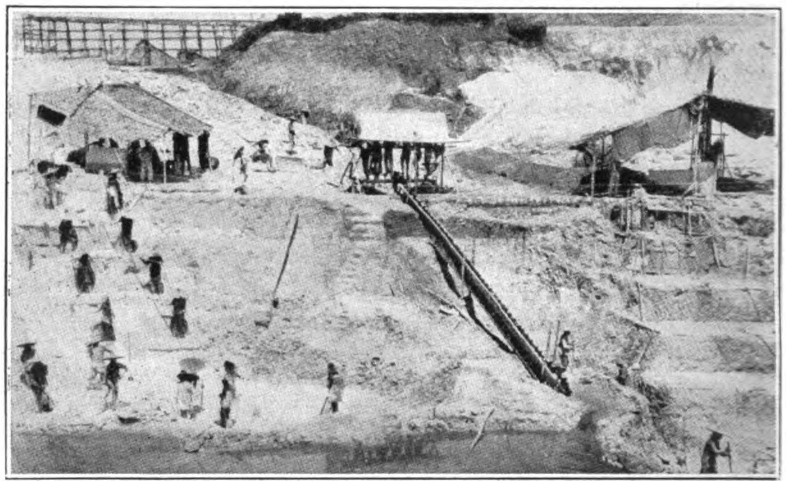
A deep and extensive mine near Gopeng. On the far side of the mine are two inclined truck-ways, and in the foreground are rails for the trucks extending across the mine.

ready for sale to the smelting companies. Only after smelting does it assume the familiar metallic appearance of tin.

The Chinese still produce nearly half the tin from Malaya, but with a few notable exceptions their workings are primitive and small. For hill workings the Chinese lampan system is economical, but in the valleys and flats only very rich patches near the surface can yield profits when worked by hand labor. Gravel pumps, introduced from Australia, are now largely employed by Chinese to lift to the surface material excavated by hand. These plants are popular, chiefly because of the low capital expenditure necessary for their installation. Owing, however, to the inefficient portable steam engines used to drive the pumps and the cost of manual labour, ground cannot be treated unless it is of high value. To produce profits it is frequently impossible to avoid "picking the eyes out of the mine," and consequently large areas of land are rendered valueless.

Early Chinese Enterprise

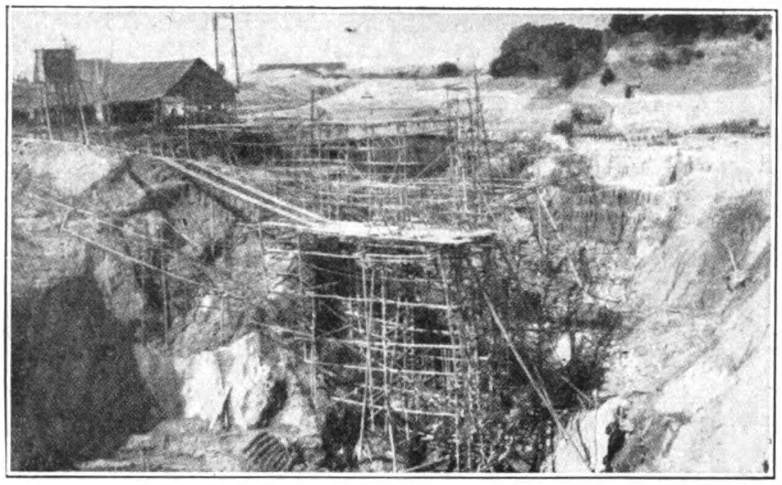
The Chinese deserve great credit for their early work and enterprise. Willing to take risks which appear highly speculative, it is not uncommon for large fortunes to be made. A striking instance of this occurred last year in the Silibin district, near Ipoh, where a Chinese lady had been financing five or six coolies to work a small mine. Little, if any, profit had been made, but three weeks before her sub-lease was due to expire a pocket of almost pure tin oxide was struck. A scene of intense activity ensued. A continuous stream of coolies was employed ceaselessly loading tin straight from the mine into bullock-carts, and by the end of the month considerable wealth had been amassed.



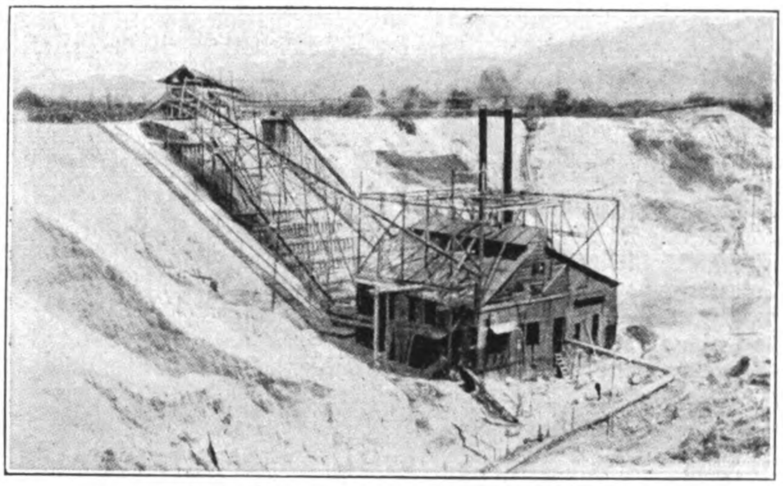
An Open-Cast Mine with a Chinese Pump

Among the earliest European mining companies formed to work in Malaya Cornish capital was largely represented, and the hydraulic system was introduced for the treatment of hilly ground. A river is impounded high up in the hills by a dam, and a steel pipeline constructed from the dam to the property to be worked. The pipeline is so designed that on reaching the mine the water, due to gravity, has attained a pressure of from 100-lb. to 200-lb. to the square inch. It is distributed to the various working faces and discharged by monitors, or swivelling nozzles, against the hillside. The powerful jets of water rapidly cut into the stiffest clays, and the hillside is broken down, puddled, and run into sluice boxes, where concentration of the valuable mineral is effected.

A modification of this arrangement is employed to work flat ground. Open excavations, or paddocks, are cut by monitors, the broken material being lifted to sluice boxes at ground level by means of hydraulic jet elevators or gravel pumps. These mines frequently reach a depth of from 800-ft. to 100-ft., and cover an area of over ten acres. Gopeng Consolidated, Limited, the largest hydraulic tin mine in the world, exemplifies this system. The main pipeline (partially owned by Kinta Tin Mines, Limited) is eight miles long, 45-in., in diameter, and supplies 6,000 cubic feet per minute. In addition, a second pipeline brings to the mine a further 1,100 cubic feet of water per minute. Hand labor having been supplanted by water-power, visitors are invariably struck by the samll number of coolies to be seen. During the past year over 1½ million cubic yards were treated at less than 3½d. per



Scaffolding in a Chinese Mine



A Tin-Mining "Barge" with Gravel-Pump

yard, the cost of winning tin ore being approximately £25 per ton. Retention of sand and waste from such workings is a problem of considerable magnitude, and large tailings, dams, and spillways are necessary to prevent serious silting of rivers and streams.

The year 1912 saw a further landmark set up in the annals of tin-mining in Malaya. The Malayan Tin Dredging Company proved a bucket dredge capable of withstanding the heavy wear and of making a good recovery of tin from deposits overlying bed-rock of limestone pinnacles. To-day there are over forty dredges at work throughout the country, producing nearly one quarter of the tin from Malaya, and dredges are entirely responsible for the increase in the production of Straits tin.

Dredging is particularly suitable for working swamps, where the cost of keeping dry an open excavation would be prohibitive, but almost any flat land may be dredged, provided that the ground does not contain excessive quantities of timber, boulders, or clay. When a dredge is constructed the pontoon is built on solid ground and launched into the dredge pond, a small excavation filled with water some 8-ft. or 10-ft. deep. Steel superstructure is next erected on the floating pontoon, engines, boilers, winches, and pumps installed, sluice boxes built, and the ladder and bucket line set in place.

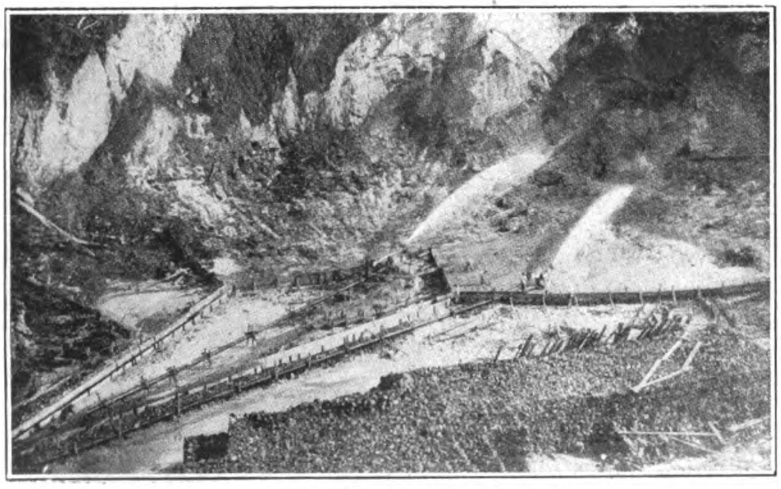
As the endless band of buckets rotates each bucket digs into the edge of the pond, the dredge being moved from one side to the other by wire ropes. The ladder is then lowered, allowing the buckets to cut at a deeper level, thus gradually deepening and widening the working face. A complete cut having been made, the dredge is pulled forward by a head line and the operation repeated. The material lefted in the buckets passes into a revolving cylindrical screen where it is broken and puddled by powerful jets of water. The sand and tin released pass through holes in the screen to sluice boxes, where the tin is recovered, while stones and lumps of clay roll to the end of the screen, and, together with tailings from the sluice boxes, are dumped astern. A dredge digs ground in front of the pond and dumps it after treatment at the back. In this manner the dredge and also the pond in which it floats can move forward over dry tracts of land.

The district surrounding Taiping, the capital of the State of Perak, has an interesting mining history. In the past it was vigorously worked by Chinese, who employed thousands of coolies in open-cast mines, but as the surface deposits were exhausted the mines closed down, and fifteen years ago these fields had been almost abandoned. With the introduction of the bucket dredge renewed interest was taken in all flat areas. The Taiping flats were prospected by Europeans, who found that tailings, together with virgin ground situated at too great a depth for the Chinese to reach, would yield good profits if worked by bucket dredges, Tekka Taipeng, Limited, was the earliest European company formed for dredging in this district, and Kamunting Tin, Limited, operated the first bucket dredge. There are now over a dozen at work, a number of which are controlled by strong Australian groups. Without exception, satisfactory returns have been produced by all these machines.

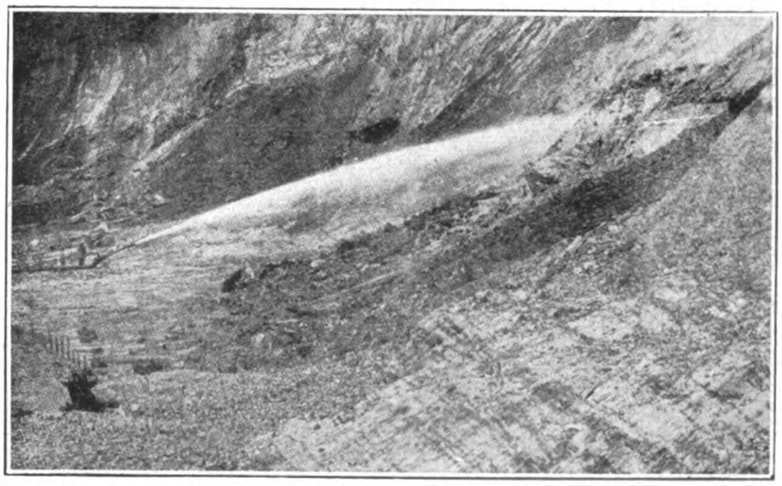
Improved Dredgers

Great progress has been made in dredge design, both in respect of reduction in cost of operation and increase in efficiency ; some of the latest dredgers are capable of treating one and a half million cubic yards annually at a cost of about 4d. per yard. Mechanical rakes are being tested experimentally to reduce coolie labor in sluice boxes, and the Yukon Gold Company is operating two dredges on which the sluice boxes have been replaced by jigs. A recent innovation is the cutter dredge, three of which are at present undergoing running tests. The main difference between this type and the bucket dredge is the substitution of a revolving cutter and gravel pump for the bucket line. Highly efficient for harbor work, their adaption to mining is being watched with great interest.

A class of mining which has not been described is the open-cast system, where trucks running on inclined haulages bring to the surface material excavated by hand. This method is employed



Two Hydraulic Monitors at Work



A Monitor at Work. In the Foreground are Veins Containing Tin-ore

to work deep lead deposits of exceptional richness, such as those occurring at Tronoh Mines and the Lahat Mines in Perak, and Sungei Besi Mines in Selangor. Open paddocks have been worked at these mines to depths of over 200-ft. At Tronoh Mines the deep leads for many years yielded large profits, and when these were nearing exhaustion, bucket dredges were installed to work the flat portions of the property, and have proved highly successful in maintaing the fine record of this mine.

Mining land is prospected by means of bore-holes or pits sunk at regular intervals under skilled supervision. Material from the holes is measured, and, after washing, the concentrate of tin ore weighed. In conjuction with geological examination it is possible to make an accurate estimate of the tin content of any particular area and the profit to be derived on mining the land. Given suitable conditions, alluvial ground containing an average of one pound of tin oxide per ton, or .05 per cent., will yield large profits when worked by the hydraulic system or by dredging, and companies can be quoted which pay high dividends to shareholders by treating ground of half this value. In comparison, it is interesting to note that Cornish mines usually require some 20 pounds per ton to cover the costly underground exploitation and recovery of tin from rock.

Four Big Assets

In addition to the tinfields, Malaya possesses four great assets to the miner—viz., good native labor, ample fuel and timber, an equable climate, and excellent facilities for transport. Essentially an agriculturist, the Malay is little attracted by work at the mines, but the women are skilful at the concentration of tin by panning. The majority of laborers are Chinese, who prove very satisfactory under European direction. The Chinese coolie is a cheerful and willing worker, and when skilled commands high wages. He is loyal and reasonable, and in times of necessity will undergo considerable hardship on the mutual understanding that we will share in the good times which follow. Southern Indians are also employed, mainly on earthwork, but they are not physically so well fitted for heavy labour. Indentured coolies are not found in Malaya, and natives can leave their employment whenever they desire by giving due notice. The employer who treats his labor force fairly seldom has cause to complain of shortage of labor.

Administrative posts at the mines are usually held by British or Australian engineers, although practically all nationalities are represented. For such appointments it must be emphasized that technical training or practical engineering experience are not alone sufficient qualification. It is essential to select the right type of man, who will treat the natives with understanding and justice.

Until recently the only fuel burnt at the mines was jungle wood from the forests which cover the undeveloped interior and " bakau " from the extensive mangrove swamps friniging the coast. The discovery of coal at Rawang, in Selangor, was an event of far-reaching importance. The Rawang collieries now produce some 320,000 tons annually, which, though low in calorific value, has proved more economical than wood when burnt on mechanical grates. Coal is now used on many dredges and at nearly all the mines which generate electirc power. The growing need of miners for public supplies of electric power are as yet inadequately met. At Kuala Lumpur, the capital of Perak, however, a large station is in course of construction and a scheme for production of hydro-electric power estimated to cost several million pounds is at present under consideration.

The success of Malaya as a producer of tin is due in no small measure to the equable climate and splendid river system. Apart from two short periods rainfall, which averages some 90 inches per annum, is regular throughout the year, and during the dry seasons mining operations are but slightly curtailed. A glance at the mining returns of Nigeria will at once show the serious handicap of severe drought.

All land in the Federated Malay States is the property of the State, and mining land is held on lease. Leases are acquired from Government by direct application, or more frequently by means of a prospecting licence and subsequent selection of an area.

The main source of revenue to the State from the mining industry, apart from indirect taxation, is a dury on the export of tin. Thus is based on a sliding scale depending on the market price of tin and varies from 10 per cent. to 14.9 per cent. of the value; although heavy it is equitable when considered as payment for the land worked. Fees for licences and premium on land have been nominal, and the annual rental is one dollar (2s. 4d.) an acre. This policy of the Government has encouraged development of mines and enabled capitalization to be kept within sound economic limits.

Government officers of the Mines Department, under the Senior Warden of Mines, are responsible for the administration of the Mining Enactment and for all technical records, while the acquisition of land is dealt with by district officers and the Land Office. Mining interests are represented in the East by the Federated Malay States Chamber of Mines, and by the Malayan Chamber of Mines in London. The writer is happy to record the very cordial relations existing between these two bodies and the Government.

No article on Malayan mining could be complete without mention of the assistance rendered to the industry by the Government at the outbreak of the war and again in 1920. On each occasion the price of tin fell rapidly and the ore became unsaleable. The Government entered the market as a purchaser, on the second occasion in conjunction with the Straits Trading Company and the Dutch Government. Without such timely help the position at the mines would have been extremely serious, and it is gratifying that this enterprise of Government eventually returned a handsome profit.

The country is now in a state of transition. Primitive Chinese methods, so successful in the past, are becoming unprofitable, and the future of Malayan mining is dependent upon the treatment of low-grade areas on a large scale by efficient and economical machinery. When the alluvial flats are finally worked out—and few would have the temerity to estimate when that will be—there is every reason to believe that the industry will contime to flourish by working lodes in the hills.

New Tankers for Dutch East Indies

The Rotterdam Drydock and Shipbuilding Company have received a contract for the building of two new tankers from the Koninlijke Petroleum Maatschappij, for service in their trade.

Steel Piping Contract for Singapore

The Municipal Commissioners of Singapore have recently placed a considerable contract with Messrs. Stewart anh Lloyds, Ltd., for the supply of 18 miles of steel piping, of an average diameter of 36 inches.

Best Year for Dodge Brothers

(Continued from page 168.)

" Mr. Haynes, of course, insists that he is simply carrying out the principles that would have been followed by John F. and Horace E. Dodge, were they still in personal supervision. He began learning these principles just 25 years ago, having first met John Dodge on January 1, 1900, when he went to work for him. Mr. Dodge, at that time, was superintendent of the National Cycle and Automobile Co., of Hamilton, Ontario. The meeting with Horace Dodge followed a few months later. During the many years of their subsequent association, Mr. Haynes naturally had every opportunity to observe and analyze the methods and policies that brought the Dodge Brothers such great prominence and success and he has always said that as long as those principles continue to govern an institution, it will prosper.

" The continuous growth of Dodge Brothers is emphatic proof of the truth of this statement, but it must also be remembered that it requires tremendous vigor and initiative, as well as sound business judgment, to see that those principles are continually adhered to. That Mr. Haynes possesses these characteristics to a marked degree is evident from his record."

Mr. Nichols also expressed the belief that the year 1925 would be even more prosperous than 1924 and that production plans are being made accordingly. Dodge Brothers Dealers are uniformly optimistic and looking forward to a period of activity excelling that of the war days.

Kapok and its Uses*

Botanical Origin of the Fibre

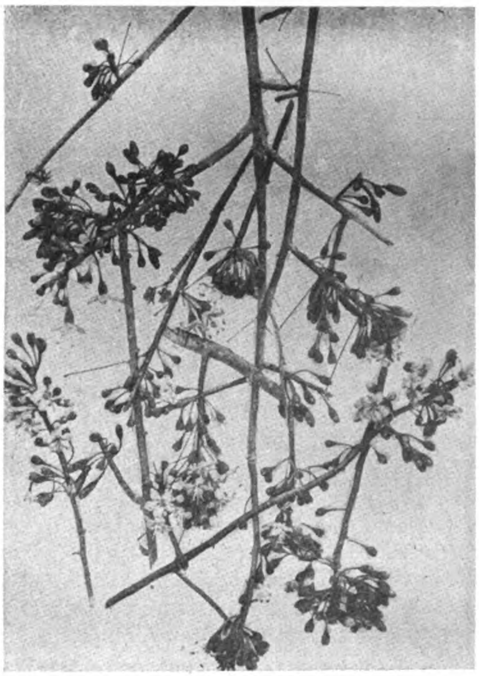
THE family of the Bombacaceæ is numerous and widely spread over tropical countries; its fruits contain a large quantity of silky fibre that envelops the seeds.

Even in former days these fibres were collected by the natives and used for various purposes, but it was not before the second half of the last century, when by way of trial some small parcels of these fibres were exported from Java to the Netherlands, that these vegetable silks became of more than local importance.

As the extraordinary properties of these fibres became better known, demand increased. Other tropical countries soon followed the example of Java, and paid special attention to the export of kapok.

Commercial Names for Vegetable Silks.—The fibres obtained from the Bombacaceæ, were formerly known by various names in commercial circles, such as kapok, silk cotton, pflanzendaunen, etc.

Of these names, that of *kapok*, under which the Java product was put on the market, has been generally adopted, while the others have fallen into disuse.



Kapok Blossoms

Unfortunately there is a tendency also to use the name of " kapok " for the products of the allied species of *Ceiba* and *Bombax* both belonging to the family of the Bombacaceæ, instead of restricting it to the product of the true kapok tree, the Ceiba Pentandra. In this artical the name *kapok* will exclusively be used for the tree (Ceiba Pentandra) and its product; in no case will it be used to denote any product of the allied species.

According to the botanical family from which it originates, the fibre varies considerably in properties, which is also evident from the considerable differences in price.

Attention must be given to another allied species of the Ceiba, viz., the Ceiba acuminata, growing wild in Southern Mexico and producing a silk floss, known there as pochote. The pochote, which has a shorter fibre than kapok is exported in small quantities only i.a. to the U.S.A. and it appears that the quality of the exported product varies greatly. As to buoyancy and resiliency it seems that pochote equals the Java kapok.

Kapok Picker Climbing Tree

The Origin of Kapok.—Java kapok, which is by far the best quality, is produced by the Ceiba Pentandra. Gaertn (=Eriodondron Anfractuosum D. C.), whereas fibres of lower value from British India, Cochin-China, etc., are obtained from the fruits of Bombax Malabaricum and other Bombax varieties.

The kapok tree is planted in many of the islands forming the Netherlands East Indian archipelago, more especially in Java, which alone is responsible for about 95 per cent. of the total exports of kapok from the Dutch East Indies.

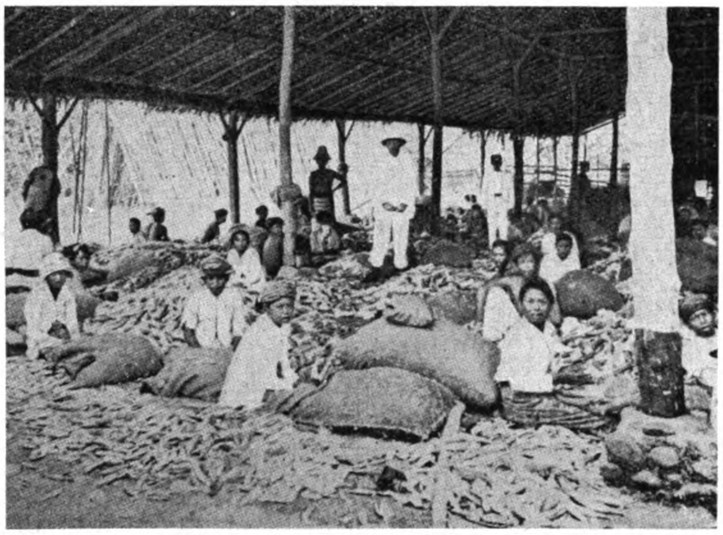
The Distribution of the Kapok Tree in Java.—The kapok tree is chiefly found on native holdings and along fields and roads, but also on some 60 estates under European management, principally situated on the north coast of Java in the residencies of Samarang, Pekalongan and Surakarta, and yielding about 6 per cent. of the total Java crop.

With its straight trunk and its long horizontal branches almost devoid of twigs and its scanty foliage, the kapok tree presents a peculiar and a characteristic appearance.

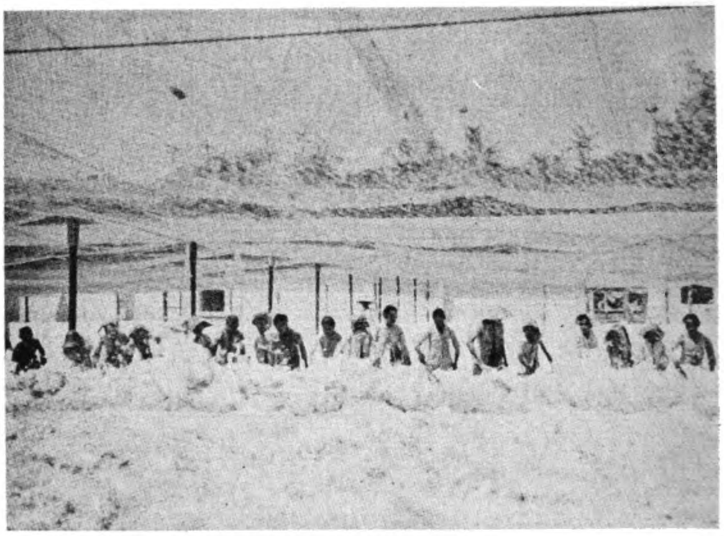
---

*Division of Commerce Department of Agriculture, Industry and Commerce, Buitenzorg (Java), 1925.

Transport of Kapok



Separating the Fibre, the Seeds, Husk and Core in the Shed



Drying of Kapok

Crop.—The fruits are harvested as soon as they are ripe, the fibre subsequently being separated from the seeds, the husk and the core in special factories.

The kapok is cleaned or partly cleaned by hand ; but in order to obtain a first class floss, its subsequent treatment by machinery is necessary. The seeds form a by-product and are used by oil manufacturers.

Further Preparation.—Thanks to the care bestowed on the preparation in Java, kapok, in the condition in which it is placed on the market, contains only few impurities, the manufacturer abroad having simply to remove these before proceeding with the carding.

Markets for Java Kapok.—The chief markets for Java kapok are in the first place the U. S. of America, followed by Australia and in the third place the Netherlands.

Formerly Amsterdam was the chief world market for kapok, where the consumers from the whole of Europe and America could cover their requirements. But the importance of the Netherlands as a central market enormously decreased during the war ; direct shipment to the United States came into prominence and showed a great development ; when taking into consideration the export to the Netherlands one should keep in mind that formerly Germany disposed of considerable and ever increasing quantities of kapok.

It is noticeable that the consumption of kapok in Great Britain, as is also the case in North European countries such as Denmark, Sweden and Norway, is still comparatively small.

Kapok as a Stuffing for Mattresses.—Whereas formerly the general idea was, that horsehair, crin végétal, cotton waste linters, etc., were the best and most healthy stuffing for mattresses, now that the admirable qualities of kapok for filling purposes are better known, this fibre has gradually taken the place of these stuffing materials which, although certainly less expensive, are inferior to kapok in every respect.

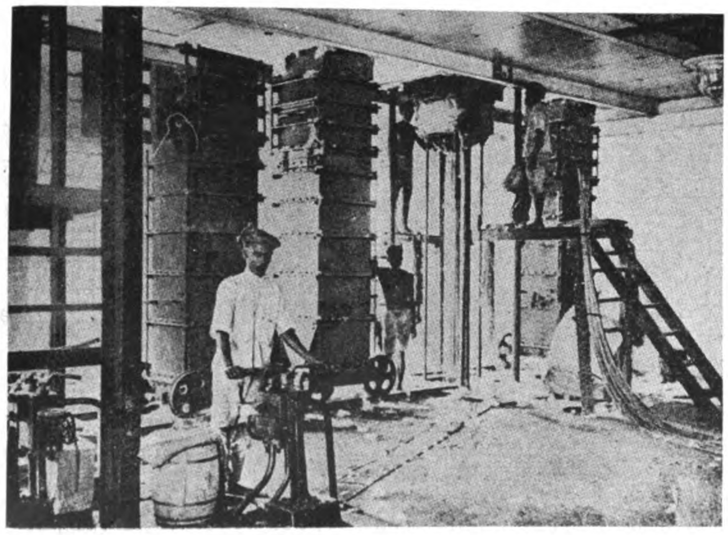
At the present time it may be said that kapok has commercially attained the foremost ranks of filling fibres and for these purposes it now enjoys an unlimited variety of uses which are constantly increasing. For purposes of upholstery its non-hygroscopic character, its softness and resiliency render it particularly suitable.

Kapok has the advantage above all other stuffing material of being a very resilient fibre, owing to which fact it has a great capacity for filling, *i.e.*, small quantities of the fibre are sufficient to fill large spaces, its elasticity moreover being of a most lasting nature. A mattress stuffed with kapok will resume its original dimensions as soon as a weight resting on it is removed. Matting and hardening after long use, such as in mattresses made from horsehair, crin végétal, woodshavings and seaweed, and the consequent necessity of opening and reshaping is unknown in mattresses stuffed with kapok. Moreover kapok as a vegetable fibre is less liable to harbor insects than the other materials employed in upholstery. Owing to its great capacity for filling, kapok mattresses are light and have the advantage of being easily handled.

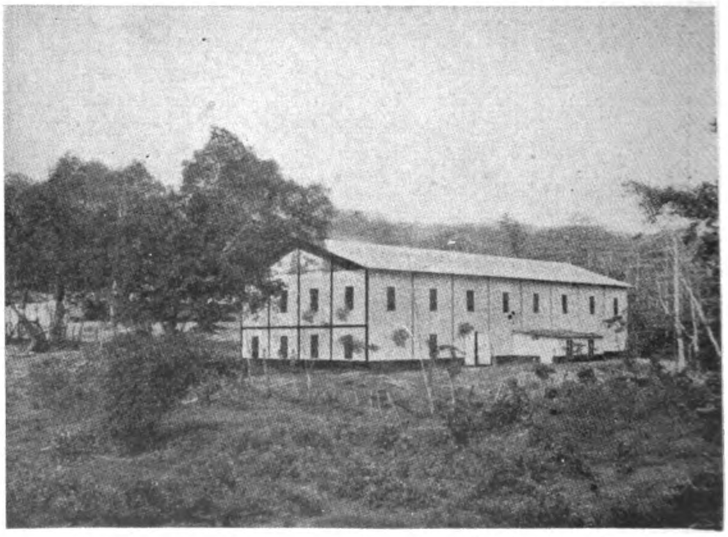
As is clearly shown in the table below, the weight of the kapok necessary for a mattress of certain dimensions is less than in the case of the other stuffing materials mentioned above, in the long run the cost of a kapok mattress consequently being lower than a mattress of any other material.

A single mattress of 3 × $6\frac{1}{3}$-ft. needs :

	lbs.		lbs.
Java kapok ..	17.6—19 8	Crin Végétal ..	26.4—28.6
Horsehair ..	26.4—28.6	Alpine Grass ..	25.4—28.6
Seaweed.. ..	33.0—35.2	Straw	28.6—32.0
Woodshavings ..	33.0—38.0		



Pressing and Baling Kapok



Kapok Factory Siloewak Sawangan at Pekalongan, Java

It might here be mentioned that when horsehair, crin végétal, etc., is used, the stuffing is mostly enclosed in a thin layer of kapok or cotton to give the mattress the necessary softness.

Flosses from different sources show great variety in elasticity; thus 20-lbs. of Java kapok will do the same work as 29-lbs. of British Indian Bombax floss.

The superiority of Java kapok is fully recognized by the well-known authority Sir George Watt, who in his standardwork: The commercial products of India (page 522) says: " the Indian floss has fetched less than that of Java.

" This is by some believed to be due to defective methods of collecting, cleaning, packing, pressing, etc., by others and perhaps with greater reason, as due either to climate or stock of plant grown.

" Certainly the opinion advanced by some writers (in the Indian press particularly) that *kapok* is but a Dutch name for the well-known *semal* cotton— the floss of *Bombax*—is quite erroneous; the floss of Eriodendron†) is far superior to that of *Bombax*, and the two must never be confused together."

Opponents of the kapok mattress declare, that one of the disadvantages of a kapok mattress is that it is less cool in summer. A proof of the unfounded nature of this assertion is the fact that kapok is universally used in tropical and subtropical regions for mattresses and cushions.

In addition to its great elasticity kapok fibre has several other properties, which give this vegetable silk the precedence of other stuffing material for mattresses.

Of these properties, the non-absorbent quality of kapok should be mentioned in the first place.

Kapok mattresses do not easily become damp and are consequently soon dried and once more ready for use, kapok that has been damp, not losing its former elasticity in drying.

The slow drying of other materials such as seaweed, and the consequent rapid rotting of the covers of the mattresses need not be feared when kapok is used.

The non-absorbent properties of kapok are possessed by none of the other materials mentioned.

Dry Sterilization of Kapok.—According to the authorities of the pasteur institute in Paris kapok can be sterilized by heat at least three times without losing any of its properties or being seriously damaged, whereas other upholstry materials do not usually survive this treatment more than twice. Therefore kapok should always be used as a stuffing material for mattresses in hospitals.

Thanks to these qualifications, in which kapok surpasses all other stuffing materials, its use for this purpose is rapidly increasing.

Kapok Mattresses in the Army.—Kapok mattresses are coming into use not only in the case of private individuals, but also in the armies of various countries. Before the war extensive experiments were made in the German army, with a view to comparing kapok mattresses with others. The result of these experiments, as already anticipated, was that the superiority of kapok was so clearly demonstrated, that it was soon definitely decided to use no other mattresses in the German army.

Kapok as Furniture Stuffing.—The qualifications of kapok, which give it the precedence of other materials for stuffing mattresses also causes it to be far preferable to horsehair as a stuffing material for furniture.

For the same reasons Java kapok is superior to so-called kapok of other origin.

Kapok as a Filling for Bandages in Surgical Dressings.—As a stuffing for bandages kapok is also being founf increasingly suitable for the following reasons :—

Kapok is elastic and does not become compact after long use.

Kapok does not absorb moisture.

Kapok can be dry sterilized.

Kapok is voluminous and consequently bandages stuffed with it are light.

Kapok as a Stuffing for Life-saving Appliances.—As is the case with other purposes for which kapok is employed, its use as a stuffing for life-saving appliances is strongly increasing, which is only natural considering the peculiar suitability of the fibre for that purpose.

The following qualifications are necessary in stuffing material for lifebelts and lifebuoys :—

1. Great buoyancy.
2. Even when submerged for some days, the buoyancy should still be retained.
3. After being dried, life-saving appliances should regain their original buoyancy as much as possible.

To what extent do stuffing materials as generally used comply with these demands?

On comparing the proved buoyancy of the different stuffing materials, to ascertain how many times their own weight they are able to carry when submerged, the following results are obtained :

Prime Jave kapok	25—30	times its own weight
British-India Bombax " kapok " ..	10—15	„ „ „ „
Reindeer hair	11	„ „ „ „
Cork	6	„ „ „ „

The buoyancy of kapok is therefore about five times as great as that of cork and about three times that of reindeer hair.

These figures show that kapok is obviously far preferable to cork and reindeer hair for this purpose.

A lifebelt stuffed with 2-lbs. of Java kapok has a carrying capacity of at least 50-lbs.

All stuffings have the disadvantage that their buoyancy decreases with long submersion; whereas in the case of cork and reindeer hair this deterioration takes place quickly, with kapok the decrease is only 10 per cent. after 30 days submersion. As it will often happen that a life-saving appliance is submerged for several days, kapok is consequently highly preferable to other materials for this purpose.

Kapok also regains its original buoyancy after drying, a peculiarity which no other stuffing possesses, and which is of course of great importance in life-saving devices. Another advantage of kapok for this purpose is its disinclination to absorb moisture, owing to which damp kapok dries quickly and putrefaction of the covers of lifebelts, etc., is very unusual.

As kapok is a very voluminous article, life-saving appliances filled with this material will not adhere to and impede the movements of the drowning person. This cannot be said of all other materials.

In a general way it may be stated that cork is gradually being superseded by Java kapok; as appears from the specifications of the naval department, Prime Java kapok in the U. S. of America is a basis of the life-saving regulations.

Further Uses of Kapok.—The use of kapok as a textile has not met with the success expected by the different inventors. German textile experts have attempted to spin kapok by removing the ligneous parts, but the fibre then proved to have lost a good deal of its qualities. The chief difficulty of spinning is due to the fact that kapok fibre has a smooth slippery surface and therefore lacks cohesive force; moreover kapok fibre is short of staple, straight and brittle, while cotton fibre is long, tough and possesses a natural twist.

The very qualities that make it most valuable as a stuffing material, that is its resiliency and the tendency of the fibre to separate, are qualities diametrically opposed to those adapted to spinning. A spinning fibre should have felting properties and a tendency to cling together.

Consequently it is not probable that kapok will ever play a prominent part as a spinning fibre.

However, owing to the already mentioned qualities of kapok its application for other purposes may be expected in a greater measure. Kapok does not readily conduct warmth and has consequently already been widely used as a lining for aviators' clothing and in winter garments. For this purpose kapok is not spun, but is simply spread and stitched between two layers of the material. Articles of apparel thus treated have the advantage of being light, warm and cheap. On the same principle kapok has also been used in the manufacture of light, warm blankets that take the place of heavy and clumsy eiderdowns, woollen blankets, etc.

Lately kapok has been found to be an excellent stuffing material for refrigerators, for which purpose it is specially fit, as it is a poor conductor of heat and besides does not attract moisture.

Why Should Java Kapok be Preferred to Kapok of Different Origin? The answer is simple: Java kapok has a quantitative and a qualitative control of the world's market. Yearly exports of Java kapok amount from 12 to 17,000 tons, compared to which the exports from other kapok-producing countries are insignificant. Exports from the Philippines amount to no more than 300 tons, from Indo-China to about 70 tons, Ceylon exporting about 300 tons in 1922 and Ecuador 100 tons in 1920, etc.

†Old name for Ceiba Pentandra Gaertn.

Java may consequently be said to practically supply the world's demand for kapok. Although this does not prove the qualitative superiority of Java kapok, the general preference for this product points to special qualities that are of great importance to merchants and manufacturers.

While in other countries kapok is a so-called small article to which attention is sporadically paid, *e.g.*, during favorable market conditions, in Java, kapok occupies a permanent place among the marketable products ; kapok is a so-called big article of standardised significance. Each year the trading association at the principal ports set up standard samples as a basis for transactions, arbitration offices settling any differences that may arise. In this way the foreign buyer is assured of the quality of the product that he has bought.

Packing and pressing are also carefully regulated. Moreover there is another advantage connected with the purchase of kapok in Java, *i.e.*, the certainty of exclusively obtaining kapok from the true kapok tree, Ceiba Pentandra, which is very often not the case with kapok from other producing countries.

No less important than this *botanical* purity is the *mechanical* purity of the product. Kapok from certain European managed estates in Java contains a maximum of seeds and impurities no higher than 0.3 per cent., the ordinary kapok exported having a percentage of seeds and impurities of 3, 5 or 7 per cent. according to the standard desired. The higher grade of purity of Java kapok consequently signifies a considerable economization of freights and especially of wages in the consuming countries.

Marketing of Kapok.—The trading associations in the two great ports of shipping have a special subdivision for kapok, which protects the interests of the Java kapok dealers. The stipulations of the kapok trade in Samarang, Sourabaya and Batavia are given below. As may be seen from the appended statistics, Samarang is the principal place of export for kapok, more than 50 per cent. of the export from Java being handled by that town. Sourabaya is the next in importance and finally Batavia. Formerly smaller quantities were exported by other Java ports, but during latter years kapok is shipped from the above-mentioned three principal ports only.

Every year standard samples of kapok are set up by the trading associations.

Sales are effected by the intermediacy of a broker ; in a standard contract the liabilities of both parties are laid down. In the case of a difference of opinion between the parties, this may be laid before the kapok arbitration office of the trading association concerned.

The Kapok Market at Samarang.—Prices are contracted on a bais of ci.f. net weight on shipping or net delivered weight.

Prices are fixed according to the unity of weight or money prevailing in the countries of destination (Holland guilder-cent per ½ K.G., England pence per lb., France francs per 100 K.G., U.S.A. $ cent per lb., Australia pence per lb.)

Settlements are usually made by means of 90 d/s and 60 d/s D/A draft against a confirmed irrevocable credit opened by the buyer ; 90 d/s however are of common usance.

Quality of the Kapok.—The qualities, which are generally handled at Samarang are the following : A contract, Prime Java kapok, containing a maximum of 3 per cent. of seeds and impurities, B contract, Prime Samarang kapok, with a maximum of 5, and C contract, Average Samarang kapok, with a maximum of 7 per cent. of seeds and impurities. Some European estates in the neighborhood of Samarang produce a very fine product containing a maximum of 0.3 per cent. of seeds ; these kapoks are bought at estate standard.

The U.S.A. generally order three qualities, viz., B and C and further the so-called America quality, ranging between B and C contract. New York, the chief market in the U.S.A., requires B and America quality, while sometimes even C quality is shipped to San Francisco.

Australia generally orders C quality, while also a great deal of the so called Australia quality is forwarded. It is impossible to give a definite description of this quality ; in a general way its quality is an off-C, but it is impossible to state how much this quality is below the C. In this respect the sellers at Samarang follow the suggestions of their buyers in Australia.

Lately this country, however, showed an increasing interest in good qualities with a consequent increase in demand for B contract.

Europe requires A and B qualities only. Holland usually contracts for Prime Java, but only with a view to the seeds and impurities, as the staple and color of B are quite sufficient.

England, France, Spain and Scandinavia generally order B contract.

Packing.—For export the kapok is pressed in gunny bags which are reinforced by iron hoops.

Generally double bales, containing 100 K.G. net of kapok are shipped. The pressing differs according to the destination. While Holland requires pressing to a maximum of 4 piculs* to the cubic metre, other countries in Europe require a heavier pressing : for these countries pressing of 4.65 to 4.75 piculs to the cubic metre is applied.

America too requires a heavy pressing of about 4.75 picul to the cubic metre with a content per bale of about 100 K. G. net of kapok.

Packing for Australia generally takes place in double bales weighing from 160 to 170-lbs. and measuring 10/12 cubic feet. This works out at a maximum of 4.40 piculs to the cubic metre. Kapok, however, is also shipped to Australia in single bales weighing 100 to 110-lbs. and measuring 8/10 cubic feet. This works out at a maximum of about 3.50 piculs to the cubic metre.

The Kapok Market at Sourabaya.—Generally speaking the conditions attached to kapok for export correspond to those usual at Samarang.

The assortment, however, is different. In the local market at Sourabaya three qualities are transacted, *i.e.*, Prime Madura, Prime Porrong and Prime East Java.

Prime Java in which the above-mentioned qualities of Prime Porrong and Prime Madura are included, is sold to Holland. Prime East Java does not belong to this quality. Inferior qualities are not delivered by contract, but are sold at auctions.

America imports Prime East Java as well as Prime Porrong and Prime Madura under these names.

As a rule the inferior qualities are exported to Australia, but during latter years Australia has also been appearing on the market for the better qualities of Prime Madura and Prime Porrong.

Conditions for pressing, packing and paying practically correspond with those at Samarang.

The Kapok Market at Batavia.—The market for this article is of no great importance ; supplies, chiefly from the residency of Bantam, are small and the quality is not judged as favorably as the Samarang or Sourabaya kapok, though it must be stated that the average kapok is very clean and pure. In contrast to Samarang and East Java the kapok at Batavia is sold at gross weight for net weight, in which case one should allow about 5¾ per cent. for tare. The kapok should only contain 1½ per cent. of impurities. As a consequence of the imperfect pressing installations, pressing generally does not exceed three piculs to the cubic metre, and that only for Bantam kapok, while pressing of other kapok is considerably less.

* 1 picul = 61.76 K.G.

Shanghai Gets Double Deckers

(*Continued from page 180*).

wheel arches and permitting a small vestible at the entrance to facilitate ingress and egress. Access to the upper deck is by means of an stairway from the back platform, this upper deck being accomderted with comfortable garden seats. In accordance with Police Regulations safety gates will be fitted to the steps, so that jumping on or off a bus whilst it is in motion will be prohibited.

The body is fitted to a Tilling Stevens chassis similar to that used under the Single Deck Bodies. This chassis, as described in a previous issue, is of the Petrol Electric type without clutch or gearbos. The absence of these accessories renders the " get away " most smooth and completely does away with the jerks that are almost always produced by the average driver when using his clutch.

The upper deck will be a complete novelty to Shanghai, and, as it is said that the only way in which to see London is from the top of a Bus, opportunities will now be given to residents and visitors alike of viewing our city from an entirely different view point.

Siam Cement Works

An Up-to-Date Plant at Bangsue

IT is well known that a few of the industries which have recently been started in Siam have a generation of usefulness behind them, and have become widely known because of the prominent part they take in the development of the resources of the country. Others there are of equal importance, but their value has undoubtedly been overlooked because of their potentialities.

Perhaps one of the newest of Siam's larger industries is that of making cement, and the business promises well. In past years Siam has consumed huge quantities of cement in her railways and other constructional works, and what has already been consumed is infinitesimal to what will be required in the days to come.

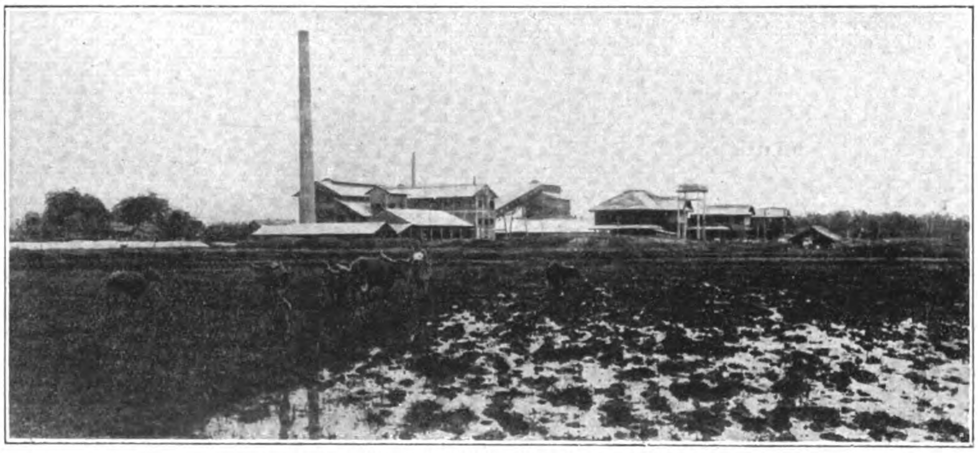
Everywhere one sees works of public utility in progress. Railway extensions, bridges, new wharves and warehouses, and new buildings are being erected, and these plans for the further development of Siam all call for this important article.

In former days most of the cement was imported either from Hongkong or Haiphong, and we have heard of shipments coming from Europe. But it has now been proved that as good a cement can be made in this country as elsewhere, and the Siam Cement Co., Ltd. has proved it. This is practically a new company, being floated in 1913, but its future is assured. It can turn out all the cement that is required in Siam ; and those who take an interest in construction work and in cement making should visit this plant at Bangsue, where they will be cordially received by the genial managing-director, Mr. Oscar Schultz.

Now, although cement is the commodity on which this company was established, this is not only its sphere of activities, for it can manufacture fire-clay and stoneware goods, if required. This, however, is not being done at present, as there is very little demand locally for this class of goods. The plant at Bangsue is thoroughly up-to-date and of a standard equipment designed and constructed by F. L. Schmidt & Co. of Copenhagen.

We find there machinery of the most modern type, which includes a rotary kiln, 35 metres in length. The power to drive this plant is obtained from the Samsen power station. The current received is about 3,500 volts, but this is reduced to 500 volts ; and a load of about 400 k.w. is constantly in use. The output now is about 140,000 barrels annually, but when the work of extending and improving the plant is completed—at about the end of the year—and the installation of a new rotary kiln, 56 metres long—the total capacity of the factory will then be about 300,000 casks a year. The machinery is controlled by one switch gear, which provides for the running of all, or any section, of the plant, besides which there are automatic switch boxes attached to each motor.

Leaving the power house we come to the investigation of the actual cement manufacturing plant, and here we learn the general principles underlying the production of cement. Portland cement is made by the calcination to incipient fusion, *i.e.*, till almost melting, and subsequent grinding of a mixture of calcareous and argillaceous materials of such a composition as to chemically saturate one another during the process of manufacture. In order to achieve this end, it is necessary for the raw materials to be not only carefully proportioned, but also to be very finely ground, so that the particles of calcareous matter may be in intimate contact with the particles of argillaceous matter, and that when they are subjected to the fire, proper chemical combination takes place.



PORTLAND CEMENT WORKS IN SIAM

Working on the wet process, oil used as fuel for the rotary kiln. Constructed to F. L. Smidth & Co.'s design and equipped with their machinery

The first stage of manufacture, therefore, concerns itself with the preparation of the raw materials prior to being burned. This preparation, which is the most important process in the whole of the manufacture, consists of—

(1) Correctly proportioning
(2) Finely grinding, and
(3) Intimately mixing the ingredients.

The raw materials used are chalk and clay. The chalk is obtained from Chongkae and Ban Moh, while clay is procured on the spot, at Bangsue, where there is a good supply.

The method of preparing the raw material is interesting. The clay and chalk are first broken down to a thin " slurry " in ordinary wash mills, and is pumped through to a tube mill, having a charge of 4,000 kilos of pebbles, which makes for fine grinding. These wash mills are ten metres in diameter. From the tube mill the material is transferred to four storage tanks, each with a holding capacity of 200 cubic metres.

This way is called manufacturing by the " wet process," which is considered to be the best method, as it has been found that handling raw materials in a wet state ensures a more thorough mixing, and a better cement results.

From the tanks the wet mixture is pumped into the rotary kiln, where the burning takes place. The burnt cement then leaves the kiln in the form of nodules and goes to the cement mill, which consists of a ball mill, having a charge of 3,000 kilos of steel balls, and a tube mill, with a charge of 4,000 kilos of pebbles.

This is done by pumping the mixture into a tank on the top of the kiln house, whence it is fed by gravity to the rotary kiln. This revolving furnace has a slight slope to enable the mixture to travel slowly from one end of the kiln to the other, thus meeting the fire in its progress and being slowly raised to the full temperature of calcination. The kilns are fired at the lower end by means of finely powdered coal, blown into the kiln with compressed air. At the hottest part of the kiln, an intense white heat is obtained, at which temperature the two ingredients integrate chemically, and form the compounds which are essentilly Portland cement, but the material leaves the kiln as a kind of hard black gravel—technically termed " cement clinker."

The cement clinker, after being cooled in a blast of cold air, is turned out in the compound for a few weeks, in order to " mature." It is then fed into a set of mills, somewhat similar to those at the raw material end. A small addition of gypsum is made at this stage in order to control the setting time of the finished cement. After passing through these mills, the material appears as the well-known Portland cement, and is led away over a belt conveyor to the store.

The whole of the raw material preparation is under the supervision of a well-equipped laboratory. During the day seventy-two samples are taken at the various stages of manufacture and carefully tested, and any adjustments made in accordance with the tests obtained, so as to ensure a cement of good quality being produced. It is in this way we have tried to describe, without going into technical language, that cement is made.

The Siam Cement Works occupy about thirty acres of land at Bangsue, and there is a railway siding in the compound for the prompt despatch of its products. It has a labor force of 190 Siamese men and 30 women, and about 100 Chinese workmen,

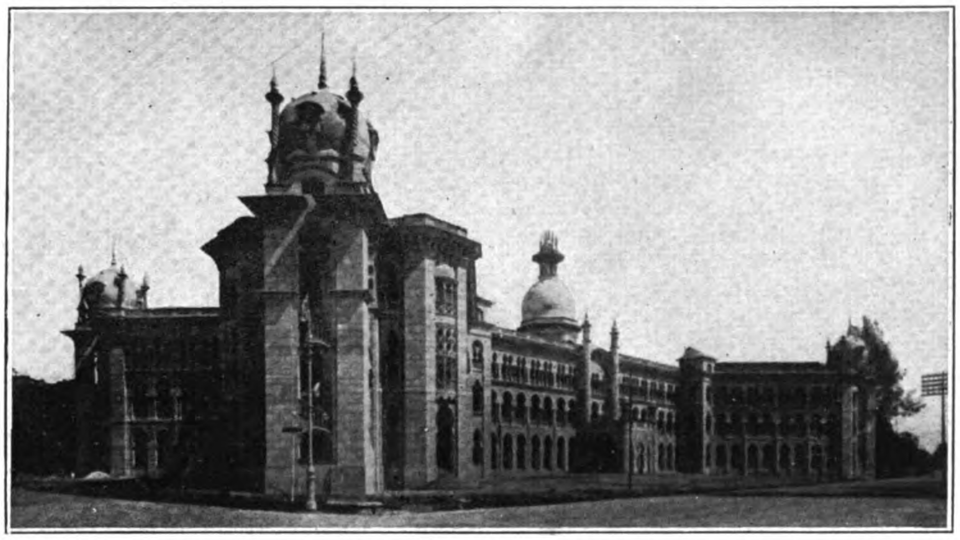
Foresight in Railway Construction

Twenty Years' Needs Fully Provided For

By P. A. Anthony (late General Manager F.M.S. Railways)

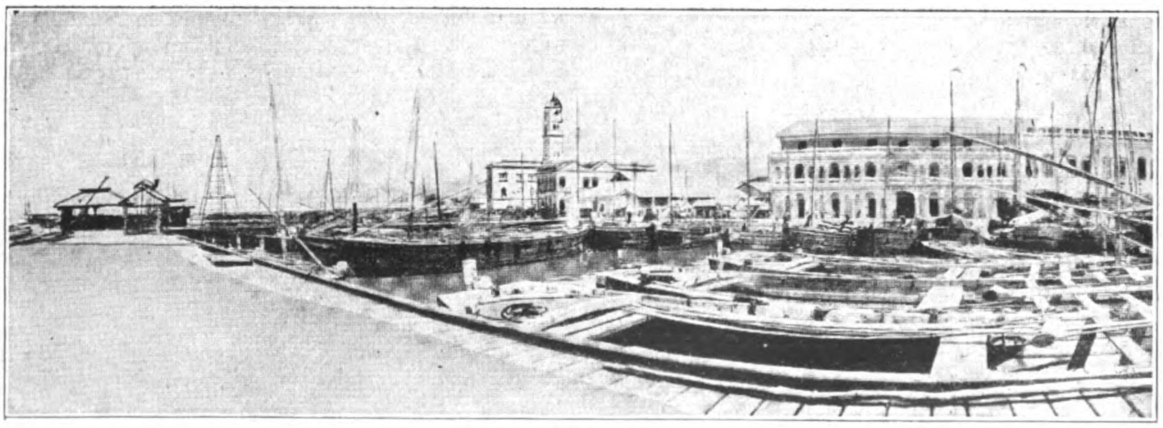
WHAT are known as the Federated Malay States Railways cover the whole system of British Malaya, not only in the four Federated States, Perak, Selangor, Negri Sembilan, and Pahang, but in the territories of the Straits Settlements—that is, Malacca, Province Wellesley, and Singapore, besides the Unfederated States of Kedah, Perlis, Kelantan, and Johore. With one exception all these lines are the property of the Federated Malay States Government, the exception being the railway—part of the main line—some 120 miles in length through the State of Johore, which belongs to that State, but is leased and operated by the Federated Malay States Railway Administration.

All the railways are of the metre gauge and, thanks to the wise judgment of consulting engineers in earlier years and to the fortuitous circumstance that there was no great stint of money, a high standard was adopted from the outset and easy curves and gradients obtain through country involving heavy earthworks and bridging and a high cost per mile for construction. This early policy, consistently followed, has been fully justified by results, and Malaya has now over a thousand miles of railway of sound construction, well equipped and maintained, and fully equal to the work which will be required of it during the next twenty years. At all the more important stations yards have been laid out on a large scale, such portion of the work as is necessary for the immediate future being put in, leaving ample room for expansion at reasonable cost.



The F.M.S. Railway Station Kuala Lumpur

The main line traverses the western coast of the peninsula from Singapore to the Siamese border north of the small State of Perlis; there are connections by rail with the coast ports at Singapore, Port Swettenham, Prai and Penang, Malacca, Port Dickson, Teluk Anson, and Port Weld, of which the first three are ocean ports. On the eastern side of the peninsula a line is being constructed northwards from Gemas, immediately outside the Johore boundary through Negri Sembilan, Pahang, and Kelantan, joining up with a branch of the Siamese State Railway, which has been built through the State of Patani. This railway is complete with the exception of a gap of about one hundred miles now under construction. It is almost entirely a development line, opening up a large tract of jungle-covered country, which in course of time will become flourishing plantations, but it forms also an alternative route between Singapore and Bangkok, the Siamese capital.



Railway Offices, Penang

The Federated Malay States Railways linked up with the Siamese State Railways in 1917, the junction being made at Padang Besar on the Perlis-Siamese frontier. A considerable and steadily increasing traffic has grown up as a result of the excellent facilities which the railway affords, Siam exporting large quantities of rice, pigs, cattle, and poultry, whilst a biweekly express passenger service between Penang and Bangkok has proved very successful, and is rapidly becoming a popular tourist route. The journey occupies two days and a night, some 36 hours, and the service has brought Siam a week nearer Europe. Exceedingly comfortable day and night coaches, besides restaurant cars, have been provided by the Siamese Railway Administration, and the journey can be made with the greatest comfort, particularly during the period when the north-east monsoon is blowing, as the temperature is moderate and pleasant, whilst the discomfort of the rough weather in the China Sea is avoided.

The journey between Singapore and Penang takes 24 hours in each direction; there are two through services daily, one leaving in the morning and the other at night, both from Penang and Singapore. There are admirable sleeping and restaurant cars, and every possible effort has been made to render the journey as pleasant as possible—no easy task during the intense heat of the day. To the tourist the journey is of considerable interest, particularly if the northern half of the trip is taken by day. Very little of the jungle which formerly covered the land remains in the neighbourhood of the railway, but it will be observed that all the distant hills and mountains are forest clad to their topmost ranges, even if 5,000 or 6,000-ft. high. A mountain range extends down the centre of the peninsula like a backbone, and is noticeable at various points on the railway journey.

Practically all the railways have been built by the departments' own construction staff, a method which has proved economical and satisfactory also from the point of view of the substantial character of the work done. Malaya is not a country for cheap railway construction, the great rain fall, 100 to 200 and 300-in. in the hills, and the consequent great floods, the

treacherous nature of the ground and its tendency to slip, the numerous rivers (many of them are of considerable size in flood-time) require thoroughly substantial work being put in, and this is necessarily expensive. The organization was formed some 25 years ago, and has been increased or diminished according to the financial or other circumstances prevailing. A nucleus has, however, always been maintained, and a number of the sub-contractors and others have worked for the department for many years.

The engineers employed on railway construction are usually recruited through the Crown agents for the Colonies, as also are all the Europeans employed by the railway department. Construction engineers are engaged on agreement for three or four years with possible extension, preference being given to those who are unmarried and who have had experience in tropical countries. With the exception of a small staff of accountants, storekeepers, and works foremen, there are no other openings for Europeans on railway construction.

The work itself is carried on by a system of petty contracts, earthworks, bridge work, and laying and ballasting of the permanent way, and so on being given out in the form of piece-work contracts to Chinese, Bengalis, and Tamil Indian labour, and to Malays. Even the wild and timid Sakais, the aboriginal race of negritos who live in the remoter forests, can sometimes be induced to do such work as jungle clearing. This method of carrying out work is very popular with the Chinese, who love any enterprise where there is an element of uncertainty as to the amount of profit which can be made and where long hours and industry bring a greater reward. Many of these men have followed the work of the department for years, some have retired with modest fortunes, and in certain instances have invested their savings in rubber and other tropical products planted on land adjacent to the railway which they helped to build with such cheerful perseverance.

A notable engineering work completed in 1924 was a bridge over the Kelantan River on the eastern line already described. This fine structure consists of five spans of 250-ft., and five spans of 150-ft. and is 60-ft. in height above normal river level to allow for the great floods which occur during the heavy rains of the north-east monsoon period. It forms a striking object viewed from the river, while from the bridge itself there is a remarkable panorama of river, forest, and mountain, native village and rice field. It has been built on the system already described, and, being free from defect or blemish, is a work of which the engineers are justly proud. Last year saw the completion of a hill railway on the island of Penang, also by the railway construction department. This railway is 1¼ mile in length, with grades varying from 1 in 4 to 1 in 2, rising from 100-ft. above sea level to an altitude of 2,400-ft. Transport is by means of cars hauled by a wire rope electrically driven and with a half-way changing station. The journey from the foot of the hill to the summit occupies 18 minutes, and it is anticipated that this little railway will revolutionise life in Penang. It will make it possible to reside on the hill, going and returning from business daily. The temperature on the hill is ideal, and the views are comparable with the most beautiful in the world.

Two other important works were also finished in 1924, but in both cases they were executed by a well-known Westminster firm of contractors under the supervision of consulting engineers. One was the construction of a causeway across the Strait of Johore, which separates the island of Singapore from the mainland of the peninsula. Formerly traffic on the railway was carried on by means of waggon ferries, while passengers left the train and were carried across the Strait in steamers to rejoin the train on the other side. But goods taffic was rapidly reaching the limits of the capacity of the waggon ferries, and some other means of transport became necessary. A causeway, composed of granite rubble, has therefore been built across the Strait. It is 60-ft. in width at the top, in order to carry two lines of railway and a roadway.

A lock has been provided for the passage of craft up and down the Strait. The embankment contains over a million tons of granite rubble, the water in the Strait being ten fathoms deep. The new naval vase site is within a short distance of the causeway on the eastern side. The other large work referred to was the completion of deep-water wharves at Prai, opposite Penang . An electric power station is being erected there by the Penang Municipality, and the cheap power supplied should be an inducement to the erection of factories, for which there are good sites with water, rail, and road access.

A Complete Ribbon

The opening of the Johore causeway made the " ribbon of steel " complete from Singapore to the west bank of the Menam River in Siam. But the city of Bangkok really lies on the east bank, and consequently the Siamese Railway administration is now constructing a bridge over the river in order to carry the southern railway from Singapore right into the heart of the city and into the fine station which hitherto has been the terminus of their northern system. These northern lines, partly metre and partly standard gauge (4-ft. 8½-in.), are all being regularised as metre gauge. At the same time extensions are being made to the French colonies to the eastward, where also there is railway activity, and it should not be many years before the metre gauge railway is continuous from Singapore into China. A connection between Siam and Burma and between Assam and Burma has long been talked of, and various routes have been surveyed.

The headquarters of the Federated Malay States Railway Administration are at Kuala Lumpur, the Federal capital. The staff is housed in a building completed in 1916, immediately outside the station, and together they form a fine architectural group in an Eastern style well suited to the environment. There is an hotel over the station run by the department, and another at Ipoh, the northern industrial capital, where a fine station was built in 1915. The railway workshops are situated about three miles from Kuala Lumpur and cover 150 acres. The shops are well equipped and up to date, employing some 2,000 men. The shop foremen are Europeans, recruited from British railways, but the artisans, fitters, and others are either Chinese, Eurasian Malays, or come from various parts of India. Many of them served their apprenticeship in the shops and have remained on permanently.

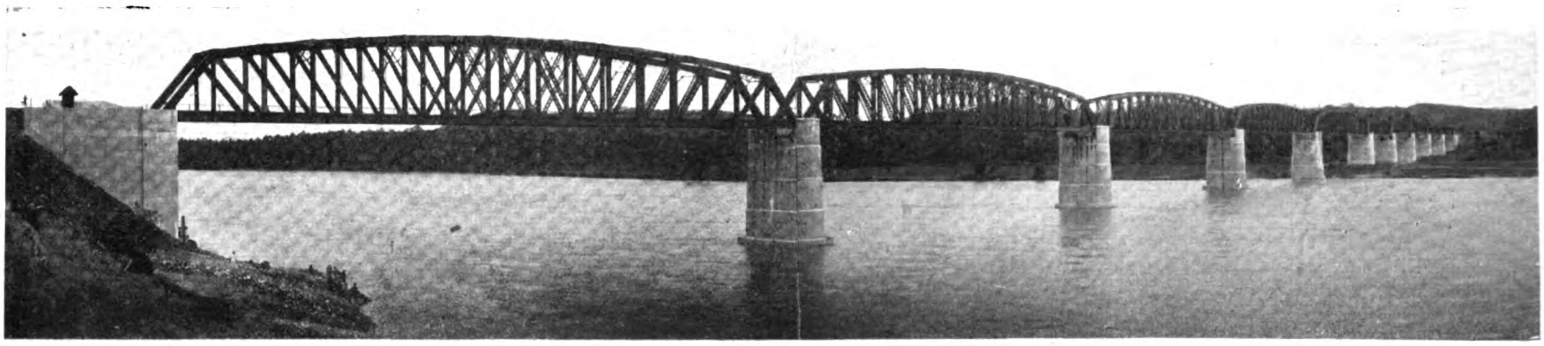
Chinese Coachbuilding Work

As regards the work done in the railway workshops, in locomotive work only repairs are dealt with, new locomotives usually being purchased from British manufacturers. Waggon and coach bodies are built there, in addition, of course, to the usual maintenance repairs. Some very fine coach building work is turned out by Chinese workmen, and compares favorably with the best English work. The coaches are built of local timbers, are well turned out and equipped ; the standard length over all is 60-ft. and the breadth 8-ft. 10-in., which is unusually wide for a metre gauge. A notable model of a sleeping coach with bunks at right angles to the length of the coach, an unusual feature on a metre gauge line, was exhibited in the Malayan Pavilion at the Wembley exhibition. This model was made entirely, down to the smallest detail, by workmen employed in the shops.

The majority of locomotives are of the Pacific type, a general utility engine both for goods and passenger work being found most suited to the character of the traffic. The latest of these have an axle-load of twelve tons. Covered goods waggons, carrying a ten-ton load, with a tare of five to six tons, are the type principally in demand, and are best suited to the climatic conditions, where very few classes of goods can be carried in open trucks protected by sheets owing to the torrential rains. A large number of bogie open waggons are in use for the transport of fuel. These carry twenty-eight tons, and have a tare of twelve tons. For locomotives the railways use coal supplied by the Malayan collieries. It is a lignite of moderate quality, but as it is cheap to mine it can compete with imported coal and gives reasonably good results. It has replaced the firewood cut from the mangrove forests, which was formerly used. The bulk of the passenger traffic is thirdclass. The number of passenger carried in 1923 was 10 millions, and nearly two million tons of goods and merchandise was transported.

New Type of Fishing Vessel

In Holland a new type of motor coaster has been developed in the past year, being a small ship of about 100-ft. length by 20-ft. beam, and 6-ft. 6-inches depth, fitted with an 80 h.p. heavy oil engine and auxiliary sails. These ships are usually constructed with a continuous trunk of about 24-inches height, with a small hatch opening forward and a larger hatch of about 33-ft. length aft, the engine room and accommodation for the skipper being aft. From the growing number of orders for this type, it appears to yield satisfactory results in service. They are particularly adapted for fishing purposes.



Guillemard Bridge over Kelantan River

The Guillemard Bridge over the Kelantan River

ON July 19th, 1924, H.E. the Governor of Straits Settlements and High Commissioner, Federated Malay States, Sir Laurence Nunns Guillemard, K.C.B., K.C.M.G., officially opened the bridge over the Kelantan River near Tanah Merah, Kelantan, which has been called Guillemard Bridge to commemorate his period of governorship.

The bridge is situated about 35 miles from Tumpat, the terminus of the Railway in Kelantan which line when linked up with the line in Pahang will form the East Coast line, giving through connection between Singapore and the Siamese lines. The western line *via* Kuala Lumpur, Penang and Kedah has been open for through traffic with Siam since 1918. The Pahang-Kelantan line was commenced in 1912 but the work has been subject to interruptions. From 1914 to 1918 work was completely stopped on account of the war and from 1921 till 1924 it was considerably slowed down on account of the financial situation. The work is now being pushed on vigorously over the whole length and it is hoped that the line will be completed by the end of 1927. The total length from Kuala Lipis in Pahang to Tumpat in Kelantan is 187 miles, and of this length 23 miles have been opened for traffic in Pahang and 53 miles in Kelantan.

The Guillemard Bridge is by far the largest bridge in the Malay Peninsula and is 2,166-ft. long over all, being composed of five clear spans of 250-ft. and 5 spans of 150-ft.

The height from the river bed to the under side of girders is 55-ft.

The Kelantan river at the bridge site has a normal low water width of 1,100-ft. but in the N.E. Monsoon it is subject to floods of 30 to 35-ft. above the normal level, and the width increases to over 2,000-ft.

The bridge was commenced in 1920 and completed in 1924 but on account of financial circumstances progress was slowed down over a considerable portion of this period.

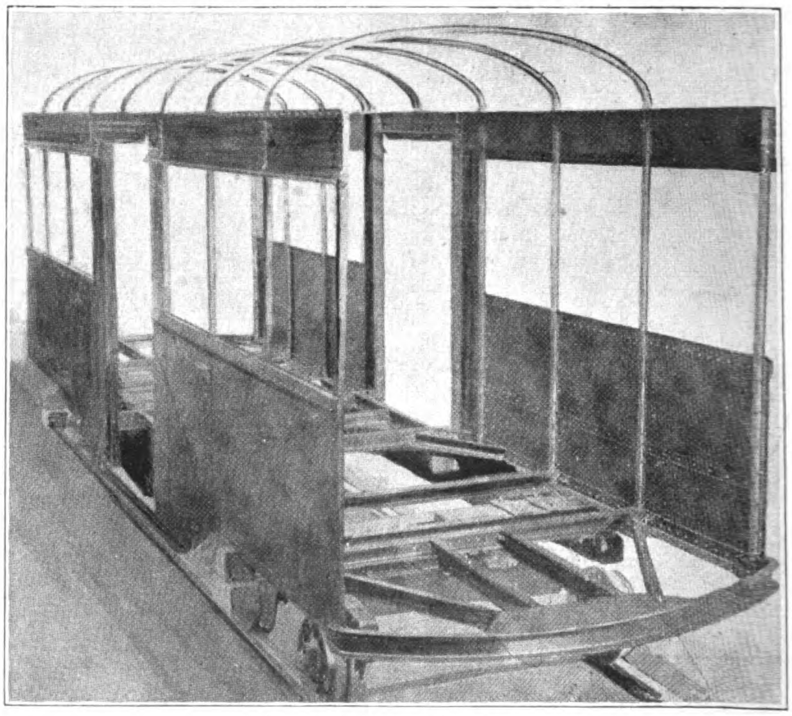
The two abutments are founded on 4-15 foot diameter wells and 2-12 foot diameter wells. Three river piers are founded on 41′ by 20′ circular ended wells and 6 piers on 2-18 foot diameter wells. The greatest depth of wells below river bed is 57-ft., and a good foundation was obtained on hard shale. The wells which are of concrete were sunk where possible in the dry, and by grabbing when the water could not be pumped out, additional concrete being added to the wells as the work of sinking proceeded. No serious difficulties were encountered in the sinking. On completion of sinking the bottoms of the wells were sealed by a diver when the water could not be pumped out, and the wells filled up with concrete.

The work of building of the piers and erection of steelworks presented no difficulty save that the seasons when the river is liable to floods, which are fairly regular, had to be watched.

The quantity of concrete and brickwork in abutments and piers is about 20,000 cu. yds., and the total weight of steelwork in the girders is 2,776 tons. The design and construction of the piers and abutments of the bridge and the erection of the steelwork were carried out by the Construction Department of the Federated Malay States Railways and the steelwork was supplied by the Metropolitan Carriage Wagon and Finance Co., Ltd., Old Park Works, Wednesbury, through the Crown Agents for the Colonies.

Steel Frame and Brill 79-E Trucks for Shanghai, China

A unique and most interesting shipment was made from the Philadelphia plant when, following the dispatch of ten Brill 79-E Trucks, a skeleton steel frame for a single-truck centre-entrance. This type car was built up, dismantled in sections, and boxed for ocean transport to Shanghai Electric Construction Company, Ltd., China.



Steel Frame for Shanghai

This company, which operates the concession for electric tramways in the International Settlement of Shanghai, is equipped for the construction of wooden carbodies and, following the modern tendency toward steel-frame bodies of light-weight construction, purchased the frame illustrated which was designed and fabricated in such a manner to facilitate the quick and satisfactory reassembly of the sections upon arrival at destination.

The Yungan Hydro-Electric Light

By J. E. Skinner

ABOUT four years ago, after many and lengthy discussions, arrangements were made and a contract drawn up which would have put in a hydro-electric plant for Yenping City when General Wang Hing-chang threw his monkey wrench into the wheels and the whole project fell through.

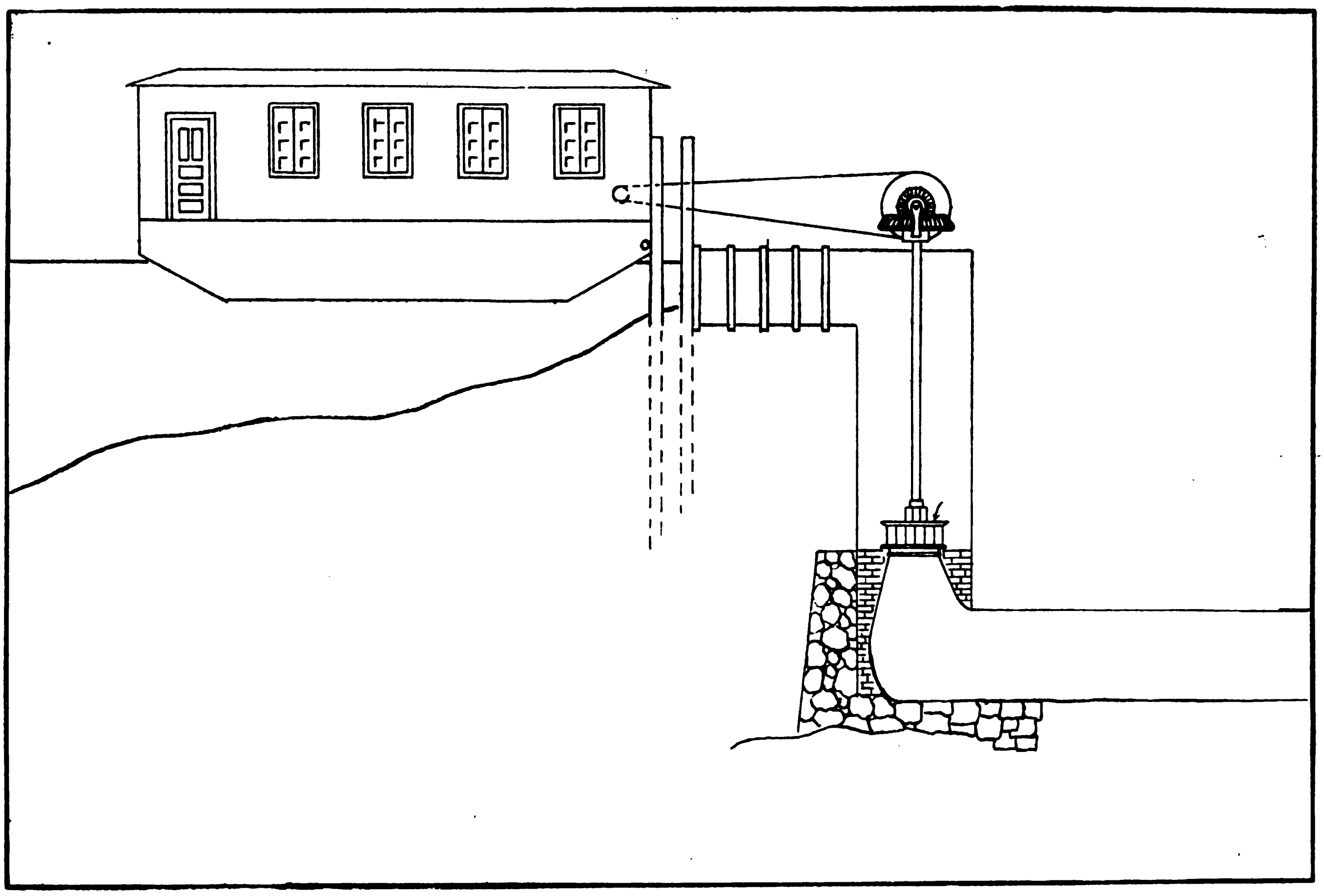
Then we moved to the city of Yungan, nearly a hundred miles farther inland, where also there had been talk of such an undertaking. Here, in the summer of 1923, a company was organized and shares sold.

It was proposed to utilize a navigable little stream which joined the main river right at the city. A low dam, of ancient make, had been thrown across it a short distance above the mouth, and we were given a share in the use of the mill race and site. The dam had to be repaired, strengthened, and raised about a foot to give us ten feet head. From the power site to the centre of the city was only 2,300-ft.

It was nearly a year before the shipment reached Foochow, and meanwhile the political situation had completely changed. A good number of our shareholders had been driven out of the country and were unable to meet their payments. In the darkest hour the American-Oriental Bank of Fukien came to our aid with a loan on very generous terms and enabled us to carry on.

In addition to the political troubles a part of our dam was washed out by the unusual floods of last summer, and this required considerable time and money to repair.

In June I went to Foochow to bring up the machinery which had been waiting there for over a month already. I arrived in just the nick of time, for the generator had been left on the Bund, and a big flood was reported by telegraph as on the way down river. A hard half day's work raised it high enough so that the flood, the highest in many years, only reached its base. It would have been completely covered, and perhaps ruined, by that muddy water had it been left down.



The Lay-Out of the Plant

The stream runs through an alluvial plain, and the main dam, nowhere over three or four feet high, is simply built on coarse gravel. To support the timbers we made use of the common Chinese method of heavy cribs, about four by eight feet in size, filled with boulders.

The next problem was where to place the generator, as once in a long time all this part of the valley is inundated to the depth of eighteen or twenty feet, or more. It was finally decided to place it on a big houseboat in the forebay. The plan was referred to competent engineers at home, who promptly sat down on it, but as no other way seemed practicable we went ahead, and now after a two months trial we can say it appears to be working well.

In the fall of 1923 we sent G.$3,000 to Mr. E. F. Black, of the Fukien Construction Bureau, and it is to him that much of the success of the whole enterprise is due. He very kindly planned the purchase in America of a 25 K.V.A., 480V. generator, 3 phase, 60 cycle, Crocker Wheeler make. The water turbine is a 36-inch wheel, made by the Fitz Water Wheel Co. of Hanover, Pa.

It is no easy matter, under the most favorable conditions, to arrange for the transport of such heavy freight so far inland, and there was much trouble and delay before it was all loaded on to two boats rated at 10,000 lbs. capacity each. The water-wheel was all taken to pieces, which made that much easier to handle, but when the 1,800 lb. generator went down into the bottom of the boat I feared the bottom would give way.

The trip of two weeks up the Min rapids was unusually uneventful, we neither bumped a rock not saw a bandit, though boats both ahead and behind us were held up, and our own boats on the return trip to Foochow suffered a serious wreck.

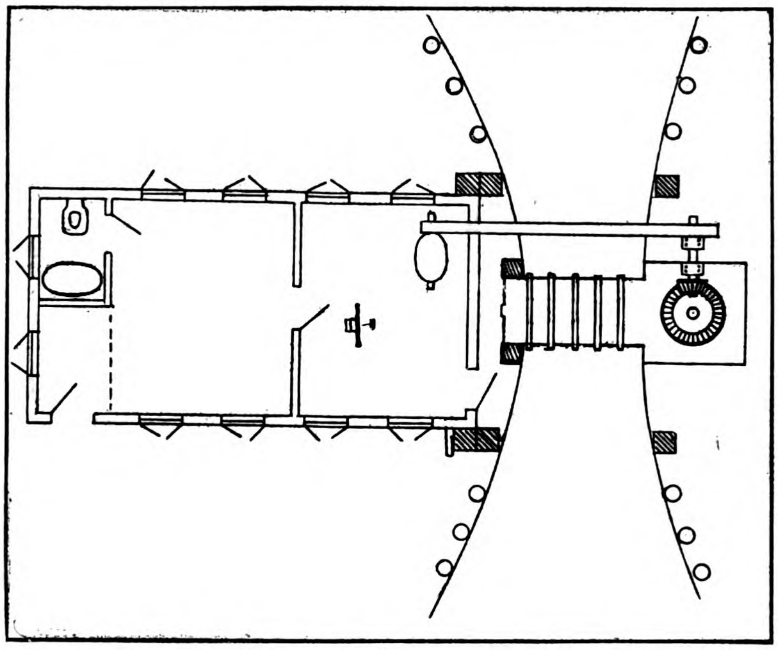
Reaching Yungan City the generator was lifted out and slid down poles to the bank. That very night didn't a sudden freshet come along and completely cover it! Fortunately the water was not at all dirty and the next day we hauled it up out of the river and carried it to the shop where it rested all summer, giving it a good chance to dry.

Meanwhile, poles were being erected, repairs on the dam completed, and wires strung along the principal streets.

Our Chinese staff was composed of two ex-teachers, now treasurer and secretary, a third teacher acting as machinist, whose theoretical knowledge was extremely limited and whose experience was about nil, and two line men, one of whom had the good luck to work for about two weeks with Mr. R. H. Steininger, the Yenping representative of the Fukien Construction Bureau.

Never having the least experience in handling electrical machinery I was myself fortunate in having the opportunity last summer to assist Mr. Steininger install the small, oil-burning mission plant in Yenping. We are also very deeply indebted to him for his expert advice, and kind assistance in purchasing wire, lamps, and other accessories from firms in Shanghai.

By December we had the turbine in place and running, and the boat usable. We did not wait for all the finishing touches but placed the generator, excitor, and switchboard, joined up to the main line and started. The political situation had again changed with the return to power of those who had been helping finance the project at the start. The victorious General Lu had never seen any kind of electric lights and he drove us up to start them before we were really ready, so he could feast his eyes upon them before he had to return to Yuki. He was so delighted that, before leaving, he said, " Come to Yuki and put a plant there. The money will be waiting for you."



Cross-Section of Plant

We found on unpacking the transformers that several had been badly damaged in transit. We patched them up and put them in place, and then found the iron pins for the insulators had been left in Foochow by mistake, so we ran our lines setting some insulators on spikes, elsewhere using ordinary porcelain knobs. Anything to quickly get light into the shops.

Oil was selling at $7 a tin, and often not available at all. Occasionally we would have a short circuit, and have to shut down until the fault could be located and remedied. Once I thought we were done for, as one of the bearings on the generator got hot and stuck fast ! I had never taken such a machine to pieces, but we went at it, and finally by sawing through the bearing managed to free it. It has given trouble since.

We are now completing the wire installation, and hope soon to have the city fairly well illuminated. Judging by the present clamor for lights we may expect the total capacity of the plant to be utilized at an early date.

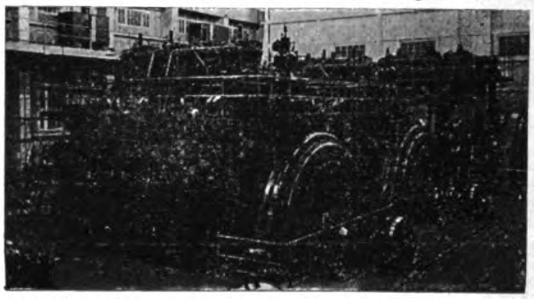
People are coming from long distances to see the magic of water being changed into light, and letters are coming from other places asking for information, and requesting me to buy the machinery for them.

With water-power as convenient and abundant as it is all over Fukien there is no reason, except the political one, why it should not be widely utilized, and I am sure this is only a small beginning of an important development of such enterprises.

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE
No. 4 AVE. EDWARD VII
Power Station, French Concession, Shanghai
2 by 1,500 bhp. 2-cycle Sulzer Diesel Engines
1 by 3,600 bhp. " " " Engine

蘇爾壽工程事務所
上海愛多亞路四號
本公司常備目錄供給各界 垂詢工程事務亦易誠酬答



Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, STATIONARY AND MARINE DIESEL ENGINES, Airless Injection Diesel Engines, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

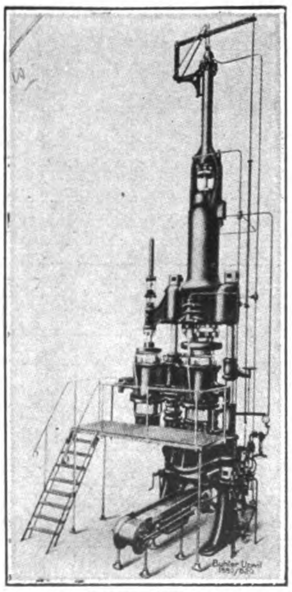
WINTERTHUR. SWITZERLAND.

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 Employees abt. 2,000



Vertical Paste-goods Presses, Type KF—KF IV for working with accumulator.—Patent Buhler

SPECIALITIES:

- Portland Cement Works
- Bricks and Tile Making Plants
- Chocolate and Cocoa-Factories
- Breweries and Malteries Powder and Celluloid-Presses
- Crushing and Breaking Machinery
- Silico-Calcareous Brick Works
- Paste-Goods Factories
- Briquetting Plants
- Rice-Mills
- Roller-Mills for Soap and Paint Manufacture
- " Duplex " Newspaper Printing Presses
- Conveying Plants of every kind

For particulars apply to the
Far Eastern Office: BUHLER BROTHERS
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. ...

JUN 17 1925

THE FAR EASTERN REVIEW

FINANCE ENGINEERING COMMERCE

上海仁記路拾六號

遠東時報

STAND BY CHINA

IS THE ORIENTAL VALUABLE TO THE PACIFIC COAST?
DISCRIMINATION UNFAIR AND UNCHRISTIANLIKE
THE VILLAGE GROUCH
THE CONSORTIUM AGAIN
CHINA'S TRIBUTE TO CEMENT
LABOR IN CHINA
HISTORY OF MINING IN THE PHILIPPINES
THE ORIENTAL DEVELOPMENT COMPANY IN KOREA
THE TIENTU LIGHT RAILWAY
MANUFACTURING INDUSTRIES OF NORTH MANCHURIA
THE "ATAGO MARU" AND THE "AKUSA MARU"
DUTCH EAST INDIES RAILROADS
USE OF ELECTRICAL MACHINERY IN CHINA
THE SOYA BEAN IN MANCHURIA
RECONSTRUCTION OF THE KIAOCHOW-TSINAN RAILWAY BRIDGE
NEW DRY DOCK OF KIANGNAN DOCKYARD

Vol. XXI May, 1925 No. 5

A. L. TAYLER

TRADE MARK

"PALMETTO"

is the ideal packing for far distant points where the transportation is so long as to affect most packings.

"PALMETTO" IS THE MOST ECONOMICAL PACKING ON THE MARKET BECAUSE

It lasts so long, not so much of it is required.
It contains no rubber, therefore climatic conditions do not affect it—its quality is the same in the tropics as elsewhere.
The quality of "PALMETTO" is always the same as the materials of which it is made are not affected in any way by age.
"PALMETTO" is made to give economical service, not to effect frequent sales.
For steam, especially high pressure, superheated steam and compressed air "PALMETTO" is without an equal.
Free working samples sent to prove the economy of "PALMETTO'S" long service.

AGE AND CLIMATE
DO NOT AFFECT "PALMETTO"
as it contains no rubber or other substance that can be so affected

GREENE, TWEED & CO.

Sole Manufacturers:

109 Duane St., New York, U.S.A. Stocks carried by
China, Shanghai — E. W. Langdon & Co.
Japan, Tokyo — Horne Co., Ltd.

GOODELL-PRATT

1500 GOOD TOOLS

DEPENDABLE DRILLS FOR EVERY PRACTICAL PURPOSE

Breast Drill No. 6, capacity 0 to ½ inch.

The Goodell-Pratt line of drills is complete and up-to-date in every respect,—Automatic, Reciprocating Hand or Breast, Ratchet Hand or Breast, Breast and Ratchet Breast, Combination Breast and Chanin, Bench Drills, etc.

BREAST DRILL NO. 6

Malleable iron frame with adjustable breast plate. Polished hardwood handles. All teeth are machine cut; steel pinions. Two speeds "fast" and "slow," obtained by turning the Shifter Knob. Accurately turned steel spindle. All steel chuck with three hardened jaws for holding Round Shanks 0 to ½ inch. 16 inches long, weight 4¼ pounds.

HAND DRILL NO. 4½

Polished rosewood handle, with screw cap, for holding drills. Malleable iron frame. Large Gear and Steel Pinion are nickel plated to prevent rusting. All teeth machine cut. All steel chuck, with three hardened jaws, holds Round Shank Drills 0 to 5/32 inch. Eight drill points, 1/16 to 11/64 inch, are furnished with each tool. Length of tool, 10½ inches; weight 14 ounces.

Hand Drill No. 4½, capacity 0 to 5/32 inch.

Free catalogue will be supplied on request. *Export orders* given especial packing and careful attention throughout.

GOODELL-PRATT CO., Toolsmiths, Greenfield, Mass., U.S.A.

Representatives:

Muller, Phipps & Sellers, Ltd.
Room No. 758 Marunouchi Building, Tokyo
(Central P. O. Box No. 98)

Muller & Phipps (China), Ltd.
N.K.K. Building, 2 Canton Road,
Shanghai, China

Muller, Phipps & Sellers, Ltd.
Dojima Building, Osaka
(Central P. O. Box No. 63)

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum

VOL. XXI MAY, 1925 NO. 5

CONTENTS:

	PAGE
STAND BY CHINA	195
IS THE ORIENTAL VALUABLE TO THE PACIFIC COAST?	196
DISCRIMINATION UNFAIR AND UNCHRISTIANLIKE	198
THE VILLAGE GROUCH	200
THE CONSORTIUM AGAIN	201
LABOR IN CHINA	202
CHINA'S TRIBUTE TO CEMENT	203
HISTORY OF MINING IN THE PHILIPPINE ISLANDS	*204
THE ORIENTAL DEVELOPMENT COMPANY IN KOREA	*207
MANUFACTURING INDUSTRIES OF NORTH MANCHURIA	*211
FORESTS OF THE RUSSIAN FAR EAST	*217
USE OF ELECTRICAL MACHINERY IN CHINA	*220
IRRIGATION IN FUKIEN	*222
DUTCH EAST INDIA RAILROADS	*224
THE "ATAGO MARU" AND THE "ASUKA MARU"	*225
RECONSTRUCTION OF THE KIAOCHOW-TSINAN RAILWAY BRIDGES	*228
THE TIENTU LIGHT RAILWAY	*229
INDIAN CONTRACTS	230
"RANCHI"—A NEW P. & O. STEAMER	*231
THE UJIGAWA ELECTRIC POWER COMPANY	*232
MACHINERY MARKET IN CHINA	233
WORTHINGTON LOCOMOTIVE FEED WATER HEATER AWARDED MEDAL	*234
BRISTOL PORTS ABOLISH FAR EAST FREIGHT SURCHARGE	235
LARGEST TURBINES FOR EXPORT ORDERED BY JAPAN	235
THE SOYA BEAN IN MANCHURIA	*236
NEW DRY DOCK OF KIANGNAN DOCKYARD	*238
AGRICULTURAL EXPERIMENT STATION IN JAVA	241
STEEL WORKS FOR SHANSI	241

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allan, Whyte & Co., Ltd............. 27
Allen & Co., Ltd., Edgar 11
American La France Fire Engine Co., Inc. 35
American Locomotive Sales Corp..... 25
American Tool Works Co. 1
Armstrong, Whitworth & Co., Ltd., Sir W. G........................ 19
Associated British Locomotive Manufacturers for China 49
Attwater & Sons 48
Avery, Ltd., W. & T................. 11

Babcock & Wilcox, Ltd. 36
Baldwin Locomotive Works.......... 65
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 2
Bethlehem Steel Export Corp. 31
Bliss Co., E. W. .... Under Index
Brill Co., J. G..................... 39
British-American Tobacco Company (China), Ltd. 9
Browning Co., The 63
Bucyrus Company 17
Buhler Brothers 242
Butterfield & Swire 44

Canada Carbide Co., Ltd............ 70
Chambers Scott & Co., Ltd. 14
Chartered Bank of India, Australia & China 48
Chinese Eastern Railway 52
Columbia Ribbon & Carbon Mfg. Co. 70

Daido Electric Power Co., Ltd. 28
Dai-Ichi Ginko 62
Dai Nippon Brewery Co. 34
Diamond State Fibre Co............. 15
Dixon Crucible Co., Joseph 70
Dodge Brothers..................... 5
Drewry Car Co., Ltd. 13

Electricity Department, S. M. C. 6
Etchells Congdon & Muir Ltd. 7
Escher Wyss & Cie................. 16
Evans & Sons (Wolverhampton), Ld., Joseph 2

Fairbanks Co. 35
Fairbanks Morse & Co. 15
Fuji Gassed Spinning Co. 10

Gas & Fuel Plants, Ltd. 14
Gleniffer Motors, Ltd. 13
Goodell-Pratt Co. .... Cover
Goulds Manufacturing Co........... 14
Green Island Cement Co., Ltd., The.. 20
Greene, Tweed & Co. .... Cover
Greenfield Tap & Die Corp........... 21

Hongkong Rope Manufacturing Co. . 20
Hongkong & Shanghai Banking Corporation............................ 59
Hongkong & Whampoa Dock Co., Ld. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd....... 58
International Banking Corporation.. 55
International General Electric Co., Inc............................. 51

Japan Sugar Co., Ltd. 6
Jardine Engineering Corporation, Ltd., The 12
Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. 10
Kawasaki Dockyard Co., Ltd....... 33
Kitchen & Wade 62
Kokusai Kisen Kaisha.............. 45

Link-Belt Co. 63
London Directory Co., Ltd........... 61
Louisiana Planter & Sugar Manufacturer, The 62

Manning, Maxwell & Moore, Inc..... 14
Mather and Platt, Ltd.............. 3
McConway and Torley Co........... 52
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd..... 38
Mitsubishi Marine & Fire Ins. Co., Ld. 38
Mitsubishi Shoji Kaisha 18
Mitsubishi Warehouse Co. 38
Mitsubishi Zosen Kaisha, Ltd........ 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. 18
Mitsui Bussan Kaisha 26
Mustard & Co....................... 52

Nippon Menkwa Kabushiki Kaisha.. 50
Nippon Yusen Kaisha 46, 47
Nipponophone Co., Ltd. 34
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd......... 24
One Hundredth Bank, Ltd., The.... 59
Osaka Shosen Kaisha 42

Pooley & Son Ltd., Henry 4

Redpath Brown & Co., Ltd. 15
Reyrolle & Co., Ltd., A. 7
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 7

Sale & Frazar, Ltd. 8
Shanghai Dock & Eng. Co., Ltd...... 32
Shanghai Municipal Council 6
Siemens China Co. 36
Smidth & Co., F. L. 41
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. 17
Standard Oil Co. of N. Y. 29
Standard Underground Cable Co... 14
Stewarts & Lloyds Ltd. 16
Sturtevant Co., B. F. 63
Sulzer Bros. 242
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd. 60
Superheater Co., The.............. 27

Thornycroft & Co., Ltd., John I. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 17

United States Steel Products Company........... ... 23, 37, Back Cover

Waggon-und Maschinenbau Aktiengesellschaft Gorlitz. 71
Wallace & Tiernan Co., Inc. 27
Walworth International Co. 4
Westinghouse Electric International Co. 74
Williams & Co., J. H. 3
Worthington Pump & Machinery Corporation...................... 73

Yarrow & Co., Ltd. 21
Yokohama Dock Co. Ltd. 34
Yokohama Specie Bank, Ltd. ....Cover

ONE OF THE MANY TYPES OF TIN CONTAINERS

MADE ON BLISS MACHINERY.

Bliss No. 21 Special Oil Can Head Press.
For blanking and forming tops and bottoms of rectangular oil cans.

For the manufacture of rectangular olive oil or cottonseed oil cans such as illustrated above, we build complete lines of machines.

The machine shown is one of a number required for making approximately 2,500 cans per day of the type illustrated.

Building machinery of this kind has been our specialty for over 68 years. Our machines embody the most modern and best devices developed by experience in actual use.

In order to quote intelligently on the equipment best adapted to your work be sure to send us samples or sketches showing dimensions and state the approximate daily production you wish to obtain.

BLISS FOR MACHINERY

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N. Y., U. S. A.**

American Factories: BROOKLYN, N.Y. HASTINGS, MICH. CLEVELAND, OHIO. SALEM, OHIO.

FOREIGN SALES OFFICES AND FACTORIES:

ENGLAND, Pocock St., Blackfriars Rd., S. E., London ITALY, 345 Via Nizza, Turin FRANCE, 54 Blvd. Victor-Hugo St. Ouen, Paris

FOREIGN REPRESENTATIVES:

India—Duff Engineering Co., Ltd., D. S. Clive Building, Calcutta

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, MAY, 1925 No. 5

Stand by China

An Address by Mr. George Bronson Rea, Delivered before the English Club of The Higher Commercial School, Tokyo, on April 29, 1925.

I HAVE been asked to say a few works about China. It is rather a big subject covering many phases and angles, all interesting and important and all having a great bearing on the future of Japan. The future of your country politically and economically is bound up in the future of China. If China goes under and fails to establish a strong central authority it will have a very disastrous effect on the future of Japan and complicate the problems already confronting your people and government. The best interests of Japan are therefore best served by the establishment of a stable government in China, no matter what the political completion of such a government may be, whether it be one headed by the present chief executive, Tuan Chi-jui, or by any of the other military or political chieftains. For, on the establishment of a stable and unified government bringing internal peace and the enforcement of law and order throughout that vast domain, hinges the future development and prosperity of the Chinese people, and on their prosperity and ability to purchase from abroad, hinges the future economic existence of Japan.

You may sell your silk to America, you may distribute your chinaware,your piece goods and toys throughout the other countries of the world, but in the final analysis, the vast majority of your other manufactured products must find an outlet in the land of your nearest neighbor. If Japan is to succeed as an industrial nation she must reverse the present unfavorable balance of trade by increased exports and the only market that is open to you for real development and expansion lies in China. To accomplish this, there must be a ground work of friendship and sympathy between the two peoples. There must be a complete understanding as to each others problems and aspirations and on the part of Japan everything possible must be done to wipe out the old anti-Japanese feeling and bring to the people of China the realization that Japan is their friend. Fortunately, much has been accomplished along these lines. Your business men and government have laid the foundation of this friendship by a policy which leaves nothing to be desired. As a result of this new program, it may be said that public opinion in China, especially amongst the intelligent classes is for the first time in twenty years not unfriendly towards Japan. It has not been an easy matter to overcome the deep rooted suspicion and hatred of Japan which permeated all classes of Chinese society, but a consistent, honorable and broad-minded attitude on the part of your statesmen has finally convinced the thinking Chinese of your sincerity. On this foundation you must build. On this foundation lies your one hope of success in the struggle for existence. On the friendship of the 400,000,000 Chinese people depends your ability to survive as an industrial nation. Lose that friendship and as time passes, you will pay the penalty.

The United States bases great hopes on the future expansion of its trade with China but American capital has done nothing as yet to advance that trade by furnishing capital for developing the resources of that country. Great Britain also looks to the markets of China to consume many of her manufactured products and has contributed many millions of pounds for the development of its industries and railways. In fact, it may be said that outside of Manchuria, British capital has been the principal instrument in the building up of China's railway system and the development of its trade possibilities. American, British, French, Russian and other foreign interests may enjoy a very definite position in China, but far above them all, are the interests of Japan whose investments in that country are now valued at roughly Y.5,000,-000,000.

Japan's Economic Interests

Manchuria has been the special field for Japanese activities and here it is estimated that the present value of your investments will reach nearly Y.3,000,000,000 of which about one half is represented by the properties owned or controlled by the South Manchuria Railway Company, Japanese capital now owns outright about 40 per cent. of the total splindlage in China's cotton mills and with the advances made by your banks to Chinese mill owners, it is possible that the extent of your interest in this one industry will reach nearly sixty per cent. Your bankers have advanced nearly Y.45,000,000 to the premier iron and coal enterprise of China, (the Han Yeh Ping Coal and Iron Company) while other millions have been invested in property and minor industrial undertakings which give you the premier position in the development of the country. When you add to all this, Japan's interest in the Shantung Railway and mines, the loans to the Chinese Government which have built the Kirin, the Ssupingkai-Taonan Railway and now the extension of the latter line towards Tsitsihar, the loans to the provincial Kiangsi Railway Company and the loans of the Yokohama Specie Bank to the Ministry of Communications, you will begin to realize something of the immense stake Japan has in the peaceful and uninterrupted development of China, a stake which places your country in a position where at all costs, without sacrifice of national honor, you are obligated to play the game fairly and squarely with the Chinese.

China's Laborers

In many respects you are in a very vulnerable position by reason of some of these investments, especially in the textile industry. China is passing through a transition stage in which the workers are being organized under the political wing of the Kuomintang party and instigated to strikes and disorders by the propaganda of the Soviet. The only manufacturing industries in China in which the workers are engaged in sufficient numbers to justify organization are the cotton mills. Hence, in any movement for the bettering the living conditions of the factory workers, the textile industry would be the first point of attack. This will help to explain something of the motives underlying the strike of the Chinese operatives in the Japanese owned cotton mills of Shanghai, which has now spread to Tsingtao. When, to the grievances of the workers—whether justified or not—is added the dormant anti-Japanese feeling which has not died out amongst the lower classes,

you will begin to understand how delicate is the position of Japanese capital invested in such enterprises. It is for this reason, that the Japanese must make every effort to understand the psychology of the Chinese workmen and win their sympathy by equitable treatment and betterment of their living conditions.

It will be difficult during the next few years of political evolution and increasing labor troubles completely to eliminate these factors which make for bad-feeling and national hatreds, but there is every evidence that the Japanese government and your capitalists interested in China have fully grasped the significance of the new movement and are taking every honorable and fair measure to meet the wishes of the Chinese workers. It is not my purpose to stress this situation except to use it as an added argument to strengthen the statement that the future of Japan in China must be based on a thorough and complete understanding of the forces operating to change the outlook of the Chinese in the same way that similar forces are working in Japan to evolve a new cultural and political structure out of your old ideals and traditions. Japan herself is passing through a period of transition adapting and adopting the best that the civilization of the west has to offer her and she is still far from perfection. Much remains for Japan to accomplish before she attains a firm industrial and commercial position in the struggle for existence and there are still political storms looming on the horizon which you must face and weather.

You must remember that China is now navigating through uncharted political seas practically without guidance. No captain has come forward to grasp the wheel and steer the ship of state clear of the rocks. When the old Manchu regime was swept away in the revolution of 1911, there was nothing to take its place. The republic has been a failure but there is little doubt that left to themselves the Chinese people will evolve some suitable form of government that will meet their own peculiar ideals of what a government should be. The China of to-day is not the China of ten years go, nay, of even five years ago. In the same way that the Japan of to-day faces the future with a different outlook that it did three years ago, so the viewpoint of the Chinese people is changing, and it is vital to the future of Japan that during these years of travail and stress through which the Chinese must pass that they be assured of your friendly and sympathetic aid in the event that their unmanageable craft drifts on the rocks and is handed over to an international salvage organization. I do not mean to convey by this that any foreign nation is seriously hoping for the break-up of China. That is, to use American slang, " old stuff." The nations of the world have outgrown the old ideas of twenty years ago and at the Washington Conference, China was presented with a bill of rights which firmly establishes her position in the family of nations. There is no government, signatory to the Nine Power Treaty which does not honestly and sincerely hope that China will be able to surmount her difficulties. On the other hand, these expectations may not be realized and the day may arrive, if present conditions endure, when China will lay a hopeless wreck inviting foreign intervention and the imposition of new infringements on her administrative rights in order to satisfy her creditors.

Friendship and Sympathy

This then is the danger to China that calls for the sympathy and aid of Japan, for it goes without saying that if China's administrative independence be further impaired and the day of the full restoration of her sovereign rights postponed for another long term of years, it will react on the position and prestige of Japan. It is fortunate that you have at the head of your Ministry of Foreign Affairs a statesman who has visualized what all this means to the future of your country and whose perfect command of English enabled him to lay down in no uncertain words the firm determination of his government to oppose any plan which might in any way bring China's administrative bureaus under international control. I am convinced that this friendly message carried to the Chinese people at this time of great national uncertainty when others are openly advocating further foreign control over their administrative bureaus, has contributed to a new conception amongst the thinking men of that country as to Japan's real aims and policies.

However, diplomacy and the utterances of statesmen carry little weight unless backed up by the full force of public opinion, and here again, it is gratifying to be able to state that these friendly opinions do represent the thought of the masses of Japan. These thoughts however, must be expressed in actions. Actions speak louder than words and it is not alone the actions of your government which will cement this friendly feeling with China but the attitude of the private individual in dealing with the Chinese. It devolves upon the men, who, like yourselves, will carry the brunt of Japan's future trade activities in China to make this policy a success. When you realize all that this means to the future industrial greatness of your country, upon which depends your ability to survive in the grim struggle for existence that each year becomes more intense, you will understand and take to heart that the first and loftiest obligation of every Japanese is to stand by China, with sympathy and forbearance, with tolerance and hope and with all your resources. This is the message that I, an American, bring to you young men starting on your commercial career.

Is the Oriental Valuable to the Pacific Coast?

An Impartial Survey into Conditions

A CANADIAN-AMERICAN study of the Oriental on the Pacific Coast has been made by the Survey of Race Relations which were presented at a conference at Stanford University which met between March 21 to 26, 1925. The survey was made under the direction of a group of professors and social workers who are experts in this particular field. The purpose of this survey has been to discover and interpret some of the chief facts about relations between Orientals and Occidentals on the Pacific Coast. " There has been no intention of formulating policies or programs. In making this study, every precaution has been taken to avoid bias. The committees directing the Survey have included men and women differing widely in their viewpoints on racial matters, but agreed upon the importance of ascertaining and making available the information, impartially and critically secured, so that there would be no excuse for quoting two sets of alleged facts with regard to any aspect of race relations covered by the study."

A study is made of population and vital statistics, which show that the Japanese population has been increasing but at a decreasing rate of increase since 1890. The ratio of the Chinese and Japanese to the total population in California has been steadily declining since 1900. In 1920, this ratio was 2.9 ; while in 1900, two decades previously, it was 3.8. However, in some counties in California the ratios of the Chinese and of the Japanese to the total population are considerably in excess of this percentage. Thus in San Joaquin County, the per cent. of Chinese and Japanese to the total population was 7.7 ; while in Yuba County this percentage was 34.5.

The frequently quoted birth rates of the Japanese are high because they are extremely crude. They do not take into account the fact that the Japanese are the youngest age group in California and that a very large number of women of marriageable age have come into the state since 1907. Moreover, these crude birth rates are based upon an estimate of Japanese population which undoubtedly

is smaller than the actual number. An analysis of the official statistics of the California State Bureau of Vital Statistics shows that the birth rate of the Japanese is very nearly the same as the birth rate of the white population of the state. In 1922, the average issue per white *mother* was 2.63, the average issue per Japanese *mother* was 2.83, and the average issue per Chinese *mother* was 3.26.

The facts show that the reason for the apparent high birth rate among the Japanese is that few Japanese marriages are childless. Thus, in the white population of California, the number of married women per birth in 1922 was 8.0; while among the Japanese in the same year the number of married women per birth was 3.2, and among the Chinese, 1.6. Again, the number of births per one thousand *married* women of child-bearing age among the white population of California was 125.5, among the Japanese, 317.2, among the Chinese, 621.1.

This apparent discrepancy is due, among other things, to the fact that there is a high percentage of childless marriages in the native population, and to the more youthful ages of Japanese men and women.

5. Available and reliable corroborative statistical data indicate that somewhat over one-third of the Japanese population in California are native-born Americans.

The Chinese have gone through a process of urbanization, leaving the farm areas and settling in the cities where they become merchants.

Vocationally there has been a clear tendency on the part of the Chinese to withdraw from the competitive forms of labor and business and to enter less productive urban callings. In some of the cities, notably in border and seacoast communities, there is a pronounced tendency for an increasing number of Chinese to engage in lotteries and other disorganizing callings.

Prior to the passing of our anti-alien land legislation the Japanese had shown a distinct movement toward concentration in the small fruit and vegetable agricultural areas in British Columbia and the three American States. They had withdrawn gradually from those sections where the use of expensive and heavy machinery had been increasingly practiced. For instance, practically every wheat-growing county in the State of Washington shows a decrease in Japanese population during the past decade. On the other hand, King and Pierce counties, where the cities of Seattle and Tacoma are located, have shown marked increases in that population during this same period.

Unlike the Chinese, the Japanese, prior to the passing of the anti-alien land laws, had shown no marked tendency toward urbanization. They were the least urbanized immigrant group in the country.

Social conditions among the Chinese and Japanese lead to the interesting conclusions that they are law-abiding and healthy and of little expense to the community.

"1. The Survey has sought to investigate and discover the differing tendencies among the different Oriental peoples to social disorganization in crime; and particularly, to investigate the value of the organizations which the different Oriental communities have created to meet the difficulties and exigencies of American life.

2. The Oriental, apparently, has been of very little expense to the American community. Such records of relief agencies as have been studied indicate that the amount of relief given is very small. The extent of poverty, delinquency, and crime—insofar as dealt with by American agencies—is slight.

3. It appears that the organization of the Oriental communities, in every case, has grown up out of the necessity of meeting the strains of life under American conditions. Their organized groups have rendered a service, not only in imposing a discipline upon the members of the Oriental community but in protecting them from conflict with the larger white community outside. This has been apparently, and in the first instance, the origin of both the Chinese Six Companies and the Japanese Associations.

4. All the more intelligent immigrant groups, when subjected to prejudice, have set up similar institutions and organizations. An investigation relative to pauperism among immigrants, made by the United States Immigration Commission in 43 cities, covering the years 1850-1908 inclusive, showed that the proportion of native-born who received aid was very much greater than that of foreign-born. This was especially true of the more recent immigrants to the United States from southern and southeastern Europe, against whom there has been noticeable prejudice.

A study of the health of Orientals shows that, compared with 16 per cent. of the white population, only 6 per cent. of the Chinese and Japanese population suffer from nervous diseases. Although Orientals are rarely affected with circulatory diseases, the Chinese and Japanese are far more susceptible than white people to epidemic diseases."

Agriculture

Because of differences in soil, climate, seasons, tenancy, and in the nature of farm merchandise, no generalizations are possible regarding most agricultural products raised on the Pacific Coast. The farming situation in Victoria or Vancouver cannot be readily compared with conditions in the three Pacific Coast States. Even within the single State of California, a careful differentiation must be made between the rice fields, the orchards in the foothill counties, the berry regions, the metropolitan trucking and fruit districts, and the reclaimed lands of the desert. The problem of water is of cardinal importance, since the best agricultural lands are irrigated; and it is in these sections that the Orientals have been large productive elements.

Arid lands present not-to-be-neglected considerations which require a high degree of science and technology in order to use but not "mine" the soil, to provide a careful utilization of the available water supply so that the person on the end of the ditch will not suffer, and to administer natural resources for the common good. Water is the great limiting factor in the Pacific Coast agriculture. The great lesson of the desert is that every farm worker must sacrifice his personal independence for the community welfare. Into this carefully organized and disciplined system the Japanese, unlike the native white, can make immediate adjustment. If proper account is taken both of the natural tendency of the Japanese to associate a plentiful application of water with good farm management, and of the soil wastage process under a one to three-year lease, then these Oriental people are entitled to an especially high rank as agricultural producers.

Great changes have taken place in the racial composition of agricultral labor. Forty years ago over half the farm laborers in California were Chinese; while to-day very few of that race are left in agriculture. In British Columbia the Chinese are the great market gardeners and supply the majority of the vegetables grown in that province. In California the Japanese have risen so rapidly from the status of laborer to tenant that at the present time they are no longer available as a large laboring class but are themselves important employers of Mexicans in Imperial Valley.

With the disappearance of the Chinese from agriculture and with the decrease of Japanese in this work, the question arises: who is to do the manual work? From all indications it appears that at least for some years to come the Mexicans will be used more and more, with the Filipinos and Porto Ricans as later and less important groups. The East Indians and the negroes specialize in cotton.

The so-called white labor in California is, to a large extent, made up of alien peoples, notably Italians, Portuguese, Swiss, Scandinavians, and Armenians. The real economic competition in agriculture is not so much between the descendants of the white pioneers and the Orientals as it is between the later European immigrants and the Orientals. A five-months' firsthand survey in the Great Valley of California brings increasing testimony that the sons of white farmers of pioneer and later stock are leaving agriculture for business and the professions.

Most California farmers expect the future labor supply to be furnished mainly by Mexican migratory workers. Many large ranchers, who are recognized locally and nationally as worthy citizens, are seriously advancing the proposal to bring in Chinese indenture labor on a ten-year basis, men only to be admitted, in order to clear and develop lands which cannot profitably be worked without a plentiful supply of cheap labor. This proposal has its recognized, objectionable features and would require special legislation; yet it is presented here because it is being seriously entertained in a quiet fashion. A third alternative is the selection of settlers from other parts of the United States.

In California the high price of land in many sections, justified by economic, social, and climatic factors, is a deterrent element to any widespread influx of farm population. Few of the migrants from the Middle West continue as farmers. Moreover, the seasonal aspects bring about a migratory class, formerly hoboes and Orientals, but now largely Mexicans. Living conditions on the ranch or

farm are in many cases unsuited to most white labor. Therefore, the supplanting of Mexican and much of the Oriental labor would require investment in living accommodations which present owners are unable or unwilling to furnish.

In the United States the Japanese are in demand as tenants and foremen because they are willing to work during all hours, their women are frequently field workers, they are willing to engage in intensive hand labor which does not appeal to the white man, and they are reliable. Because of their dependability and frugal habits, many bankers and distributors consider them superior risks; thus frequently they are enabled to borrow money easier or at a lower rate of interest. Many employers object to the Japanese because they are not contented to remain as laborers at a low wage. As a rule the Oriental receives as high or higher compensation than the other races and they tend to become good spenders. A director of a great national farmers' organization states, "The Oriental is a commodity. He is not cheap labor, but he finishes his job." This verdict is representative.

Had there been no Alien Land Law, the Japanese would probably have acquired a great deal of rural property and as fast as they could; but, in the meantime, aliens ineligible to American citizenship would have enjoyed merely a tenant status. There is evidence already that this legislation is driving many Japanese growers off the land into the business occupations of the city; yet another change is that landowners, unwilling to see their property lie fallow, are selling outright to Japanese minors. This is producing a situation which, in the opinion of thoughtful California pioneers, is apt to mean that after a decade or so, large acreage will pass into the hands of second generation Orientals who will become capitalists, creating thereby another distinct problem. In enacting similar legislation, most Pacific and Western States are stumbling into an intricate situation which they have not taken pains to figure out.

To develop the rich agricultural lands along the Pacific Coast, more agricultural workers are necessary. In the sense that Orientals shall continue to be required because they do work that no others can perform, it is true that they are prone to engage in industries or types of labor not attractive to other elements; at the same time, under fair working conditions, non-Asiatics can perform every task undertaken now by Chinese, East Indians, or Japanese.

Second Generation

1. There are in the United States several thousand native-born Japanese and Chinese boys and girls who are American citizens. The Japanese are such comparatively recent arrivals that very few of their American-born children are in college or in the professions as yet. Native Americans have hardly become aware of their existence.

2. The American-born presents the most interesting and fascinating problem of any racial group. All the evidence goes to show that the native-born Oriental tends to acquire naturally and inevitably all the external mannerisms, sentiments, personal characteristics, and loyalties of the American community in which he grows up. This takes place frequently in the case of the Oriental in spite of the most strenuous efforts on the part of the older generation, particularly true of the Chinese, to preserve the Oriental tradition.

3. The Japanese are very eager to give their children an education—if possible to send them to college. The Chinese are apparently not so eager to send their children to school solely for the sake of an education. They wish to fit them for some occupation or career where they can earn a living. In many cases, when the Chinese cannot establish their children in businesses in this country, they send them beck to China to be educated."

The Survey is only a preliminary one and its report warns against drawing conclusions therefrom. Nevertheless, it is interesting to note from the report that much of the anti-Japanese propaganda on the Pacific Coast is obviously untrue and is designed to mislead Americans in other parts of the United States as to conditions in California and other Western States. It would be well for the Survey to consider another phase of the question:

The United States is apparently making every effort to win the good-will of the people of China and Japan. Every American agency in the Far East is doing everything humanly possible to achieve this end. At the same time and paradoxically, the American Congress passes legislation forbidding the people of these countries to enter the United States except under certain umbrageous stipulations. The Chinese and Japanese are proud people, easily offended and long suffering. Nothing can possibly hurt them more than to be regarded as inferior races. During the past century, since Chinese and Japanese have been visiting Europe and America, they have come to know that much of the talk of their inferiority is not based upon fact. Even admitting that certain western nations like the United States and Great Britain have developed a superior mechanical technique and a more efficient governmental system, they know that others are far behind them in these phases of life as well as in the cultural expressions of human civilization. To place the Chinese and the Japanese below the American and Servian, for instance, in the scale of human development is as baseless as it is unfair. It hurts the sentiments of the Chinese and Japanese. It hurts the position of the Americans in China and Japan.

Discrimination Unfair and Unchristianlike

Colonel Birch Helms, American Banker, Says Have Faith in the United States

War Talk Misleading

COLONEL Birch Helms, a member of Blair & Company, New York Bankers and Deputy Director of the Military Intelligence Division of the United States during the War, delivered an address before the Pan-Pacific Club in Tokyo, which he has been visiting after a trip to Australia in the interesting of a wider co-operation among English-speaking peoples.

In the course of his address, Colonel Helms said:

Although perfect understanding between English-speaking peoples is of vital importance, yet it is just as imperative that nations bordering on the Pacific Ocean should acquire an impartial unbiased clear conception of the difficulties confronting their neighbors. To be more specific, every endeavor should be directed towards inspiring a spirit of earnest friendship and mutual regard between Japan, Great Britain and the United States of America.

The American people do not fully appreciate the ideals, the traditions or problems of the Japanese, while the Japanese do not quite understand the peculiar conditions prevailing in the United States concerning the treatment of international questions.

For many years, the cordial relations between the United States and Japan have been unrestrained. Popular opinion in America always favored the Japanese and recognized that the wars of Japan were for purposes of defense and to preserve the integrity and security of the Japanese people. But unfortunately within recent years there has been a transformation in the American public attitude towards the Japanese, which I should like to discuss.

In 1916, the question of Japanese immigration into the United States was claimed by Californians to be of an economic nature. The latest figures of the Japanese Foreign Office indicate that there are more Japanese in the United States and Hawaii than in any other foreign country, thirty thousand more than in China including Manchuria. It is evident that this Japanese colony must have had some effect on economic conditions of our Pacific shores but whether the competition was as serious as has been claimed can not be ascertained because from an economic basis, the Japanese immigration question soon developed into a political issue in California.

The result of the presidential election of 1916 made California one of the political pivot states of the Union.. The centre of political gravity in the United States has gradually shifted westward from New England to Ohio, then to Indiana and now to the middle west with California as a crucial state in all national elections. What happens in California is now of vital interest to the remainder of the country and much space in the newspapers is accorded to Californian events. The influence of this one state alone on the politics and policies of the country is very great indeed.

Immigration Question

Thus the Japanese immigration question, which was peculiar alone to California now engages the attention of the entire nation. In the course of time it would have become a dead issue if there were not a more or less fertile field for the discussion of racial questions in the arena of American politics. Our great Civil War was fought over a race problem. As a result of that war, the United States is now confronted with one of the most serious racial questions in modern history, namely the position to be occupied by twelve millions of Afro-Americans, negroes and mulattoes, in the social economic and political life of the country.

Furthermore there arose during the World War, a very delicate situation in the United States where nationalities rather than races were facing each other with all the resurrected hatreds that have permeated Europe for centuries. Germans, Austrians, Hungarians and some Irish were ready to war upon English, French, Italians, Polish and other allied people with terrible vindictiveness although they were all citizens of the United States.

Instead of being a melting pot for races, the United States became a boiling pot and many thoughtful Americans concluded that we might be called the Divided rather than the United States of America. As a result, public opinion in our country was focused upon the desirability of restricting immigration, so that there would not exist in the United States large undigested and unassimilated foreign groups, which in times of emergency would be more attached to the United States.

It was amid this tense atmosphere that our immigration laws were enacted and there might have been no discrimination against the Japanese if the American public opinion had not been led to believe by some of our newspapers that Japan was preparing to declare war upon the United States if any immigration legislation were to be passed. The Disarmament Conference dispelled all apprehension in that direction until the immigration bill itself came up in Congress for action, when through a diplomatic misunderstanding the expression "Grave consequences" was interpreted to mean war.

Since that time there does exist in certain quarters in the United States a belief that Japan is preparing to go to war with us on this question of immigration. Such sentiment is inflamed by speeches as the one delivered by Sir Charles Higham in New York predicting another world war in which the Japanese will make an aerial attack on the Panama Canal and California and land in Mexico. His remarks may not be taken seriously, but on the other hand, there are many other Englishmen such as Britten Austin, who maintain that the Russo-Japanese agreement involves a war between the Anglo-Saxon Powers and Japan, although they overlook the trade agreements between Japan and France in Indo-China. Whatever may be the justification for all this war talk, there can be no question but that the attention of the military and naval general staffs of the different nations concerned is being directed towards international developments in the Pacific.

Now a Closed Matter

Rather than have the question of Japanese immigration become a bone of international contention conducive to war, President Coolidge has publicly stated that it is a closed matter. But there is another reason why it is a closed matter. If Japan insists that this question be reopened, then Senator Johnson will have another opportunity to conduct a national campaign on racial issues against the Japanese and the Republican Party does not desire any such an insurrection within its ranks at the present time for popular opinion can be too readily inflamed by the yellow press on this matter. Senator Johnson is an able and brilliant statesman and can always make a virile campaign.

It appears to me that it would be far better for Japan to delay emphasizing this issue now and wait until the American people through a more intimate knowledge of the Japanese in the United States come to know them better as well as the Japanese travelling through our country and then through their own volition, the American people may realize that it is not only unfair and unchristianlike to discriminate against the Japanese but that such injustice is most undesirable from an economic and political standpoint. Such a course is far preferable to war, which like a great earthquake or fire would be attended with no good for any of the participants because the trade and commerce of all concerned would be destroyed while much treasure and precious human life would be sacrificed again in the world's history so that national pride and honor could be avenged.

Japanese Suspicious

The Japanese people undoubtedly have their misgivings as to the equity of the action of the American government, since they can point to a resolution adopted at a conference of jurists at Copenhagen in 1897 and more recent resolutions of the League of Nations against discriminatory legislation concerning immigration but considering the practical aspects of this immigration question, the laws of the United States would permit of no more than two hundred persons from Japan entering the United States if our recent legislation had not been passed.

It is most unfortunate that the impression is spreading that Japan is making ready for war on this immigration question, especially as it affects no more than two hundred persons. This impression exists strongly in western United States, in Hawaii, the Samoan Islands, the Philippines and Australasia. The revival of the Singapore Base, the increase of the Australian fleet and other factors emphasize the belief that trouble is brewing in the Pacific. Barriers against Japanese immigrants are being extended in the western and southern hemispheres and the psychology of the situation is far from reassuring.

War Talk False

That such impressions concerning Japan are without any foundation in fact cannot be doubted. That they are false can be readily appreciated by those of us here in Japan at the present time. On all sides there are evidences of a desire for military and naval retrenchment, especially in the vernacular press. Just recently it was reported that the dismissal of 6,000 men from the military and naval arsenals constituted a serious labor problem. Even the newspapers of yesterday carry a statement that four divisions of the army will be officially disbanded in conformity with the financial retrenchment policy of the government. It may be that the money saved by these reductions is being expended upon aircraft, cruisers and submarines as is maintained in some of the newspapers but there is certainly no appearances of war preparations to one travelling through your country still struggling with the destruction created by the earthquake and fire and confronted with a huge reconstruction program.

Instead of planning a war against Great Britain and the United States, the Japanese are looking askance at what appears to be warlike co-operation between Anglo-Saxons against Japan. It is only natural that Japan should observe with concern the revival of the Singapore Base, when there is no nation in the Pacific near to the British Dominions other than Japan, which has strong navy. It is not strange that Japan should wonder what is meant by an increase in the Australian fleet and by the maneouvres of the American fleet in southern waters. The fear that prevails in other lands that Japan is preparing to attack the United States and Australia has its counterpart here in your midst that the Anglo-Saxons are either working together or tending to work together against Japan. Without rhyme or reason there is germanating in the Pacific inflammatory elements which an accidental spark might kindle into a terrible and disastrous conflagration.

Disarmament the Hope

The time is opportune for Japan, Great Britain and the United States to unite in some program of disarmament in the Pacific, so as to dispel the suspicion that Japan will attack the Anglo-Saxons and also that England and the United States are gradually drawing together in common defense against the empire of Japan. However at such a conference all the sacrifices should not emanate from Japan. England and the United States should take such steps upon their own initiative as would reassure the Japanese people as well as the Japanese government that your security and integrity will never be disturbed in the Pacific, so that you will be justified in reducing your first line of defense. Simultaneously England and the United

States should evolve a plan whereby Japan will find some place for the reception of her surplus population, either through economic expansion or through the acquisition of territory. We must co-operate in economic plans or go to war with each other as Europe did in 1914.

Within sixty years, Japan has become an industrial nation and she must depend on the outside world for raw materials. Either Japan must have other lands for her growing population or fewer restrictions must be imposed upon her in obtaining raw materials, so that her people may earn a comfortable and profitable livelihood at home. Economic expansion involves a freer hand for Japan in the Orient and repressing those Americans and British, who strive to foment dissension between Asiatics in the Orient.

The day has passed when as one distinguished statesman remarked at the Peace Conference in Paris, " Japan has our sympathy but the problem of over-population is her own affair." If the over-population of Japan is to remain her own affair and Anglo-Saxons continue to exclude Japanese nationals from their lands as well as restrict Japanese commercial expansion in the Far East, then I apprehend that some day in the not far distant future there will be an explosion in the Pacific that will shake the foundations of this earth with as bitter a racial struggle as the world has ever witnessed.

The white race may feel proud in the realization that it dominates nine-tenths of the people of this world although it makes up only one-third of its population but one wonders what the other two-thirds of the people of this earth will do when it dawns upon them that they control only one-tenth of the human family. As the white race occupies so small a portion of the earth proportionately to the territory it administers, the difficulties of a racial war must be apparent without any elaboration. Even a combination of Russia, Germany and Japan demands serious thought and nothing should be done by England or the United States to encourage or direct Japan to such an alliance.

Japan has a market of five hundred millions of people at her doors. Industrial efficiency and economy will provide livelihood for many more of her people but not all of them. The unoccupied portions of Japan will not absorb as many people as is popularly supposed. It is in the interest of Japan, England and the United States to work together to solve this problem, not by war preparations but through economic agreements. I would much prefer that additional territory be acquired in Asia by Japan for her surplus population than have the flower of American and Japanese manhood sacrificed in a useless war, of which the winner would lose as much as the vanquished. If there is to be a racial war, let it take place in Asia and not among the islands of the Pacific. I do not desire to see England, United States and Japan being made the cat's paw for other nations.

In closing, I would add that when President Wilson was at the Peace Conference in Paris, he realized the possibilities of co-operation between Japan and the United States and sincerely hoped that the League of Nations would offer an avenue of success for the solution of perplexing questions of international importance such as are now arising in the Pacific.

When President Coolidge completed his tenure of office as Governor of Massachusetts, there was compiled a volume of his state papers entitled " Have Faith in Massachusetts." I am certain that when his presidential term of office has been concluded that the Japanese people will study his addresses and decisions with the firm conviction that they can " Have Faith in the United States." It must be the Japanese people among this faith is inspired, for with an increase of the Japanese electorate from three millions to twelve million voters, it is absolutely necessary from the aspect of international relations with us that their political education will be of such a character that their inclinations will be just as pacific towards the United States as is the ocean separating our shores.

The Village Grouch

IN a city in Japan, lives a grouchy foreigner who publishes a village scold. Everything is all wrong with the world. His particular *bête noire* is the country in which he lives and whose hospitality he enjoys—Japan. Everything in Japan and about Japan annoys this garrulous but dissatisfied person. Yet, he stays in the country, makes his money there, employs Japanese labor and makes his profits, if he has any, out of the Japanese. He cannot see the paradox of his position. It is difficult to understand why one who hates a country as much as this editor does, stays there. There are other places but he does not go to them. His own country, for instance, would probably not tolerate so vitriolic an anti-Japanese paper. He therefore remains in hospitable Japan where they let him talk to his heart's content.

The FAR EASTERN REVIEW recently published an editorial against the recrudescence of jingoism in the United States. The FAR EASTERN REVIEW expressed the hope that anti-Japonism would cease and that the American people would be more sensible than to go to war with Japan over nothing. It quoted editorials from some of the leading American newspapers in support of its ideas on the subject. Its appeal was to sanity.

The editorial was written by an American citizen but not by Mr. George Bronson Rea, publisher of the FAR EASTERN REVIEW. Mr. Rea was at the time in Japan gathering material for a series of articles on the reconstruction of Tokyo after the earthquake. The *Kobe Chronicle*, which apparently favors a war between Japan and the United States, although its editors are neither Americans nor Japanese, turned its toy artillery on the FAR EASTERN REVIEW and its publisher, producing the following diatribe :

" Some years ago, Mr. George Bronson Rea, editor of the FAR EASTERN REVIEW, Shanghai, used to be known for his ferocious anti-Japonism, and his championship of China. He went to Paris in 1919 on behalf, as it was understood, of China, and at any rate in close association with the Chinese delegation. In Paris, however, he saw a great light, and began to belabour the Chinese with the same undiscriminating vigor that he had belabored the Japanese while he took an entirely new view of Japan's aims and actions. In his paper lately he printed a long article consisting almost entirely of extracts from various American papers deprecating the anti-Japonism which he has, since his conversion, become so much afraid might lead to war between America and Japan."

It is the misfortune of the fanatic that he seldom knows his facts. He prates in pedestrian lingo on his favorite subject with little rhyme and less reason. THE FAR EASTERN REVIEW has never been anti-Chinese. It has never attacked China or the Chinese people. It simply called attention to the fact that the position of China was being endangered by a campaign of anti-Japonism, which was engineered by a group of Anglo-Saxon adventurers, who hoped to see a war between the United States and Japan in which China would be a cat's paw and would ultimately be destroyed. It called attention to the fact that China's international position would be seriously endangered by breaches of treaty and agreement. It pointed out that playing one foreign power against another was a dangerous game in which China was bound to lose when the powers got together.

Since the Versailles Conference, much water has passed under the bridges. The policy of the FAR EASTERN REVIEW has been altogether justified by the facts of the situation. The Washington Conference brought about a change in the relations between China and Japan, such a change that Chinese officials, who in 1920, we driven out of office on the assumption that they were pro-Japanese, are now in office brought in on a wave of national reaction to all the blatant bunk advocated by the self-appointed anti-Japanese propagandists.

And the argument that a treaty is a treaty, and an agreement is an agreement, whether signed by a popular or an unpopular government, has been taken up by all the powers, particularly Great Britain and the United States, which are vehemently protesting against China's misconduct in these respects. The little villager says nothing about British and American protests against China's breaches of treaties, because he knows that the protests are justified. He only shrieks when Japan protests or when the FAR EASTERN REVIEW supports the Japanese protests. He accuses the publisher of this paper of corruption when we support the Japanese protest. But he is silent when we support the British and American protest. In a word, the little thing is so anti-Japanese that it sees red whenever anyone says there is anything good in Japan. Yet, its editor remains in Japan and makes his living among the people he hates so ferociously.

The Consortium Again

Attacks on Banking Group by Chinese Writer and a Peking Newspaper

A CHINESE in England, Mr. L. T. T'ang recently attacked the Banking Consortium in rather unmeasured terms. The gist of his argument can be put down in four questions :

(1) Does China require foreign loans ?
(2) Did the foreign loans benefit China as a whole ?
(3) Are the foreign loans unfair ?
(4) Is unfair diplomatic pressure used in connection with these loans ?

Mr. T'ang's attacks have been seconded by similar ones made in a Peking newspaper, whose editor has consistently opposed the Consortium, favored a free hand for all in the financing of China, and who has severely taken to task the diplomats and foreign powers which have supported the Consortium program.

In two editorials on the subject, the *Far Eastern Times* takes the Consortium to task. In one published on April 14, it argues that the Consortium ought not to be supported because the Chinese will have nothing to do with it. The Chinese do not want the Consortium, will not do business with it and therefore the foreigners ought to discountenance it. In a previous editorial on Dr. Schurman's retirement from China, the same newspaper published the following :—

American policy in China so universally receives the approbation of the Chinese themselves that it is difficult to understand how it is that the American authorities should so long have been blind to the fact that there is one aspect of that policy that most violently antagonizes the best Chinese sentiment, and that aspect is the whole principle of the New Consortium. The New Consortium was conceived by American financiers at a time when it was believed that, by reason of the impoverishment of the War, European financial interests would be incapable of carrying into effect the undertakings for which they had obtained concessions, and that therefore a good opening offered itself for a fuller participation of American capital in the development of this country. European finance had perforce to accept, practically without suggestion of modification, the terms on which American finance came to its help, and the result was the New Consortium Agreement, made by the bankers and endorsed by their respective governments. The high hopes then formed have proved entirely illusory. The New Consortium has done not a single cent's worth of business in this country. It has not even been within sight of doing any business. The truth is that the whole conception of a monopoly, which the New Consortium essentially is, creates both antagonism and distrust in the Chinese mind. The first foreign wars of China were fought to maintain a similar monopoly, that of the Co-Hong at Canton, and of Canton itself ; and on the foreign side the issue was joined in order to break down that monopoly. Now, three-quarters of a century later, we find the tables turned, China solidly opposed to the monopoly principle and the foreign Powers committed to it. The Old Consortium was not loved, for it claimed a monopoly of general loans and frequently exacted as a part of such accommodation terms which limited the freedom of action of the Chinese Government. The New Consortium is still less loved, because it carries the same principle from the sphere of administrative loans to that of industrial, constructive and economic activity. It is true that by verbal subtleties the members of the New Consortium may convince themselves that this is an entirely wrong idea of its purpose and functions, but self-conviction does not convince others, and the Chinese view, in spite of abundant propaganda, remains unchanged.

The New Consortium Agreement has still and only eight months to run. Dr. Schurman must be aware what Chinese feeling is on this matter. He must know what is holding up all railway construction in this country ; and he must realize that even were the country tranquillized to-morrow the New Consortium would not have a host of a chance of doing business. He could render immense service to this country by speaking very frankly to President Coolidge on this matter. The jettisoning of the Lamont Doctrine, which is the basis of the New Consortium Agreement, would immediately liquidate resources and energies now hopelessly immobilized. The first fruit of liquidation would be the formulation of terms on which the Hankow-Canton and the Hankow-Szechuan lines would be carried to completion, and thereafter might well follow a general resumption of constructional undertakings, as well as the highly necessary re-conditioning of the existing railways, all of which demands a very considerable expenditure of capital, which demands a very considerable expenditure of capital, which the Chinese treasuries cannot supply. These things, and their consequences, need to be brought home to the American Government and if the departing American Minister could drive them home to his superiors in Washington he would render both his own people and the people of this country an inestimable service.

It is necessary perhaps to point to the principal Chinese objection to the Consortium in answer to this argument. The Chinese oppose the Consortium because *they object to any form of foreign supervision of the expenditure of the loans.* The official of the various Chinese governments which have been in power during the past decade have utilized foreign as well as domestic loans and governmental receipts for purely political purposes, although they can point to such a constructive efforts as the Peking-Suiyuan line, which is rather the exception that proves the rule. On the whole, the Chinese people have had no return from their government either for the amounts they have paid in taxes or for the national indebtedness which has been growing by leaps and bounds.

The Consortium raised the point in its negotiations with the Chinese Government that under present conditions, the banks would not feel justified in encouraging the purchase of Chinese bonds and that, in view of the lack of governmental authority, the constant civil wars, the dissipation of resources, the unpaid foreign obligations, it would be difficult under any circumstances to dispose of such obligations on foreign markets. The peculiar conduct of the Chinese Government with regard to the Hukuang Bonds has done much to damage China's credit on all markets.

As much as we sympathize with China in her transitional period, we cannot but appreciate the importance of the banker's point of view. The bankers want to do business with China and would grant China easier terms if they thought it a safe investment to do so. Their classification of China as a bad risk, is not done for political purposes but is based on business considerations. Were China a good risk, the bankers would flock to the country with the world's surplus money. The bankers must have realized earlier than those who live in China did, just how bad financial conditions in China were. To take the railroads of the country as an example! During the last war, the damage done to the railroads was so great, that it is estimated that China cannot of her own resources remedy the loss in ten years. Who is to pay the loss ? What are the foreign bond-holders going to receive during those ten years ? Who is to recompense them for their losses ? Of course, when a man buys a bond he takes a certain risk, but once bitten twice shy.

A full reply to the arguments against the Consortium was published in the *Financial News* of which we quote as follows :

China and Foreign Capital

According to the author there is sufficient capital in China to enable the country to develop gradually without the aid of foreign capital. He does not attempt to make any forecast as to the period which would be required for such a gradual evolution. Yet, in the view of those possessing a thorough knowledge of conditions in China, it may take centuries to reach an advanced stage of economic development if she is left to her own resources. The question is whether it is to the interest of the Chinese nation

to remain for another few centuries at the backward economic stage where she has been for several thousand years, or whether is would be desirable to follow Japan's example in becoming modernised in a few decades.

In our view, it is of extreme importance for the great majority of the Chinese people to adopt modern economic methods as soon as possible. Being an overpopulated country, the bulk of its population is condemned to terrible sufferings, as compared to which the inconveniences caused by foreign interference are negligible. The only way to salvation is the utilization of the country's enormous natural wealth, which, properly administered, would secure a decent existence to millions of human beings who are permanently on the verge of starvation. The wealthy classes of the big cities can well afford to wait rather than admit foreign capital on "humiliating" terms. Yet, if a plebiscite could be arranged, and if the population could be made to understand what both alternatives mean to them, there is hardly any doubt that over 99 per cent. would vote for the admission of foreign capital.

How the Funds were Used

Mr. T'ang would have a strong case as far as the second question is concerned if he had not weakened it by overstating it. As a matter of fact, a substantial portion of the loans obtained by the successive Chinese Governments was wasted. But Mr. T'ang, when attempting to put the blame for this on the foreign banks, is rather inconsistent, for, in the very same article, he attacks the lenders for enforcing the strictest possible control in order that the loan should be spent for the purpose it was raised. If every loan had been accompanied by the same extent of control as the railway loans, so as to compel the Chinese Government to spend their total yield on the improvement of the nation's welfare and intellectual level, there would be no ground for attacks regarding the unproductive use of the loans, but, at the same time, the interference of foreign interests in China's financial administration would have been regarded as even more "humiliating." On the other hand, if the industrial loans had been abandoned to the mercy of the Chinese Administration, the accusation of excessive interference would not have arisen, but, at the same time, the outcry against the unproductive use of the funds would have been stronger, for there is no doubt that but for the strict control these amounts would have also been squandered. As it is, a substantial part of the foreign capital has been invested in useful enterprises and contributed to increase China's national wealth.

Are the Terms Unfair?

It is alleged in the article in question that the terms of the loans are unfair. Among others, it is objected that they carry with them a specific guarantee and the right of control over certain revenue services. Even if such clauses appeared humiliating before the war, since then European nations at a very advanced stage of development have had to accept them. Moreover, the present political chaos has supplied ample justification for those terms, as it is now evident that, but for the control over pledged revenue, thousands of bond-holders would suffer in consequence of the seizure of receipts by local military despots.

Mr. T'ang criticises the clauses which debar the Chinese Government from the right to increase the amortisation of the loan or to convent or redeem the loan during a given period. However, the same rules are applied to practically every Government issue, none of which can be repaid at the discretion of the borrower. Apart from this, if the Chinese Government wished to repay its loans before they fall due, and possessed the funds for that purpose, it is at liberty to repurchase them in the open market, which would be all the more profitable from a Chinese standpoint, as all Chinese Government loans are below par. Yet, considering that at present the Chinese Government is hardly able to raise funds for current expenditure, the repayment of loans is out of the question.

"Diplomatic Blackmail"

It would be useless to deny that finance and diplomacy have proceeded hand in hand in China. However, there is nothing infamous in that, and if a foreign Government applies diplomatic pressure in the financial interest of its citizens it certainly does not justify the strong term of "diplomatic blackmail" used by Mr. T'ang. In fact, that is one of the principal tasks of the Governments in international relations, and it is by no means confined to backward countries. As to the rôle of the Consortium, it was established mainly to protect China from the improper influence of any of the great powers.

The foreign influence in Chinese economic life is bound to be temporary, for the utilization of the country's natural resources tends to accelerate the accumulation of native capital, which will gradually substitute foreign capital. This was the case, among others, in the United States. Should that country, in its early stage of development, have followed the same anti-foreign policy suggested for China it would be still a primitive agricultural State, with insufficient means of communication and without sufficient capital, instead of being the world's creditor. If the Chinese intellectuals would concentrate their energies to bringing about the elimination of civil war and corruption from China, instead of leading a crusade against foreign capital, which they require, they would certainly render a more useful service to their country.

Labor in China

THE growth of labor unions in China and the increasing number of strikes is causing anxiety among the investors in the many industries in the large cities of China. The labor movement is a result of the influx of foreign ideas along with the industrialization of industry, but it is impossible to attribute the development of this tendency to any one foreign country. The Chinese worker as he becomes urbanized comes in contact with European and American ideas and seeks a standard of living and a return on his labor closer to what the European and American worker is getting for the same labor.

Two errors are apparent in the situation : the first is that the Chinese laborer is on the whole not as efficient as the European and American laborer and therefore his capacity for production is less. If he is to be paid an increased wage without an increased production, the industry will be seriously damaged. When leads to the second important error in the situation, namely that most of China's industries are still infantile. Few of them are profitable. Practically all of the cotton mills, for instance, which were organized by Chinese have gone into bankruptcy because of under capitalization and the incapacity of the promoters and directors to manage huge industries in the interests of the shareholders. Most of these mills have passed to foreigners or are shut down. To increase the wages of the workers, to shorter their hours, to effect similar betterments will result in the complete annihilation of the industries and will discourage foreign capital from coming into the country for industrial purposes. In such a reactionary tendency the laborer in China will suffer as much as the capitalist, as he will find himself without work. It is not usual for labor anywhere to think in national terms or even to be far-sighted. The worker usually fights for his own full stomach. Nevertheless, the situation does hold elements which it would benefit him to consider seriously from his own standpoint. If he kills the industry which is feeding him he will have to go back to the overpopulated villages in the interior from whence he came. And there is this very definite possibility, for the Chinese themselves are unused to investing their surplus capital in industrial enterprises and a continuation of failures of the companies which have been started with so much hardship, will frighten investors away from them, just as they have been frightened away from stock exchanges during the past few years.

The association of the labor union with politics naturally gives them a bad reputation in a country where politics is anything but savoury. In Canton, the labor unions have been the mainstay of the Bolshevik government established there and have been utilizing their political power to harass and annoy the merchant class until the better elements have left the city and have taken their goods elsewhere. In Hankow and Wuchang, the labor unions have instigated an anti-foreign movement and have endangered their own standing by the constant annoyance to business because of their political activities. In Shantung, particularly in Tsingtao and Tsinanfu, the labor unions have associated themselves with a local political movement which has for its object the embarrassment of the present Peking government and have created such disturbances that capital is regarding this province as an unsafe risk. So it goes everywhere.

In China, as the world over, when the laborer is asking for better conditions for himself even the most hardened capitalist often sympathizes with him and the public generally will seek to assist him. But the moment organized labor utilizes its power to disturb social and economic conditions in the interest of any political group, a reaction sets in unfavorable to labor and from which he usually suffers. That is exactly what is happening in China to-day. Whereas when the laborers started their campaign for the improvement of their condition, much sympathy was extended on them, to-day the general public is worried over the possibilities of such a movement synchronizing with political tendencies of a doubtful or even harmful character. The laborer is losing the goodwill of the public and as he is in a minority in the country, which is largely agricultural, he will suffer from this revulsion of public feeling.

Another labor movement has appeared in Shanghai and is supported principally by the proprietors of the industries and public spirited men and women. This is the movement for the partial abolition of child labor in the International Settlement. A year ago, the Shanghai Municipal Council appointed a commission to investigate the conditions of Child Labor in Shanghai. This commission prepared a report which was published. At the last Ratepayers' Meeting, the recommendations of the commission, which were very liberal, were defeated by the absence of a quorum. A movement is now on foot to call another special ratepayers's meeting for the purpose of enacting these regulations. The British Consul-General has sponsored such a public expression of opposition to child labor and it is more than likely that the new regulations will be passed. In that case, no child under ten will be permitted to work in mills, factories, etc., in the International Settlement, but it does not mean that children will not be permitted to work in mills and factories in other parts of Shanghai under Chinese or French jurisdiction. That will, of course, be the next endeavor of those who are sponsoring this plan. The Chinese themselves are not interested in the abolition of child labor and are not supporting this movement. It has been pointed out that if the new regulations are passed the International Settlement will have to obligate itself to care for the children and perhaps to educate them. It is understood that the authorities are prepared to undertake such measures.

China's Tribute to Cement

IN the course of an address in celebration of the invention of cement, Mr. Lu Mo-tsai, a Director of the Chee Hsin Cement Company said :

One hundred years ago, an insignificant brick mason in Leeds who was experimenting with limestone taken off the roads in order to produce something which can stand the weathering action of water and scorching test of fire. After overcoming baffling difficulties, trials and disappointments he finally succeeded in his effect.

To-day engineers and architects all over the world have bowed down their heads before Aspdin, to pay him their warmest tribute for this epoch-making discovery which has not only resolutionized the living conditions of the people in the West but also influenced the thoughts and habits of the inhabitants in the Orient to a considerable degree. It is only fitting and proper that both Chinese and foreign engineers, architects, and contractors, cement producers should assemble somewhere to celebrate the century of the invention of cement.

As the pioneer and the largest cement producer in China, it is a very pleasant task dwelt on us to invite all the leading engineers, architects, contractors all over the nation and the delegates from the Engineering bodies such as the Chinese Engineering Society, The Chinese Society of Chemical Industry, etc., represented in this important gathering, to register our most hearty appreciation of Aspdin's efforts, to review the most modern engineering achievements which are only made possible through the application of cement and the status of cement industry in the world and especially that in China. Judging from the attendance to-night we are very grateful for your hearty response to come to this convention. On behalf of the Board of Directors and all the staff members of the Chee Hsin Cement Co., we bid you our most cordial welcome. We welcome you, because a number of you are early pioneers in advocating the use of cement in construction materials and in popularizing its application to all sorts of industries. We welcome you, because you are the missionary crusaders to preach the usefulness of the reinforced concrete construction for factories, godowns, mills, etc. We welcome you, because you always advocate the use of the highest grade cement in order to make your work lasting and enduring. We wish to take the opportunity to thank you for your uninterrupted and constant patronage of our Company's products which are best obtainable in China. We solicit your generous and continuous co-operation in the years to come.

The romance of the development of cement industry in the world is interesting indeed, yet the romance of the growth of our Company is more romantic. This modern constructional material—cement, made its first appearance in 1886 at Tangshan Cement Factory which met its failure immediately. Then our Managing Director, Mr. Chow Chih-Chi stepped in and reorganized the whole company. In his new undertaking he met difficulties and disappointments, but he has conquerred them all. The public was indifferent to the use of cement, yet he faced this cold indifference with optimism and harder efforts on his own part. The first output in 1886 was only 26,000 barrels a year. Now it gradually increase to 2,200,000 barrels almost 100 times fold. Forty years ago we used the old crude, costly and time-wasting brick kilns. At present we have installed the most modern rotary kilns. This progress and this growth we attribute to your co-operative effort and your unfailing patronage.

However, if we attempt to compare the production of cement in the world with that of China, we are lagging behind. In the United States there are 115 cement plants, producing 145,000,000 barrels, the consumption of cement per capita is 450 lbs. Even in Japan they have 24 plants, producing 9,000,000 barrels. The consumption per capita is 83 lbs. While in China where we have the largest and most numerous population, the number of cement plants is only 5, producing 3,000,000 barrels a year. The consumption of cement per capita is only 3 lbs. This will clearly show the undeveloped and deplorable state of cement industry in China which should invite your most serious consideration. May we hope that through this convention the Chinese business men will be more interested in the development of cement industry. All the efforts should be crystallized in the more universal use and application of cement throughout China. May we also hope that through this convention government counsel and public opinion shall be crystallized on and directed at the dire need of better highways and other means of communications and transportation which and which alone shall open up China's vast hidden treasure and resources for the benefit of our people as well as that of humanity.

Edgar Allen Steel Foundry Book

An interesting and profusedly illustrated Steel Foundry Book has been issued by Edgar Allen & Co., Ltd., of Sheffield. The book not only is a catalogue of steel castings but gives full data with regard to the service provided by the manufacturers. The methods of production and testing are discussed at some length. The foundry book might well be on the desk of everyone interesting in steel castings.

The Pao Hsing Yung Coal Mining Co., Ltd., owning coal mining rights at Kinghsien, Anhwei province, is to increase its capital to $1,000,000. Its capital at present is $500,000. The increase will make possible installation of modern mining machinery. The Shanghai office is at 68 Rue de Ningpo, French Concession.

History of Mining in the Philippine Islands

By Warren D. Smith

In the course of a very valuable volume of the "Geology and Mineral Resources of the Philipping Islands" by Warren D. Smith, published by the Bureau of Printing, Manila, the following interesting article appears.

THE history of mining in the Philippines, until within the last few years, has been in the main a long record of failures, and at the present time there are only perhaps a half mines that are earning sufficient profits to make the ventures worthwhile. One of these is the Philippine Dredges Company, an Australian and New Zealand company, with a fleet of four dredges on Paracale River, only one of which is active. Other successful mines and mining companies are the Syndicate and the Colorado, two quartz properties on Masbate ; the Benguet Consolidated Mining Company, Near Baguio ; the Philippine Coal Mining Company, on Batan Island ; and the group of crude iron furnaces owned and operated by Filipinos in Bulacan Province, Luzon. The Benguet Consolidated is the most successful of these. Mining in the Philippines has been more successful since 1898 than in all the centuries preceding.

Gold

Probably the earliest operations in these Islands, as elsewhere, were on placers ; the work consisted of more or less haphazard and desultory washing of the sands and gravels in the various streams. There are numerous traditions relating to the early visits of the Chinese to the Islands, who came to seek gold treasure, and the raids of the Moros into the northern provinces where gold was known to exist.

In the Chronicles of the Franciscan Order in the Philippines Father San Antonio refers to the word *mait* as the Chinese name for Mindoro. It seems that *mait* in Chinese stands for "gold." It may also refer to Masbate where there are remains of old Chinese workings near Aroroy. Whether these represent the activities of Chinese before the Spanish Conquest or are of a later period cannot be definitely ascertained ; but it is claimed, in support of the theory of ancient workings, that pieces of Chinese pottery older than the Ming Dynasty have been found near the old tunnels and open cuts. There is very little definite information in regard to these remote times and operations, and the details are not essential now. Suffice it to say that gold has been and can be panned from streams from one end of the Archipelago to the other.

The First and Second Chiefs of the Philippine Mining Bureau: Mr. H. D. McCaskey Seated on the Left; Lieut. Charles H. Burritt Seated on the Right

I am indebted to Prof. H. Otley Beyer for the following memorandum :

"Some years ago there was found in a tributary of the Agusan River near Esperanza, Mindanao, a massive golden image which for historians, archeologists, and miners is of great interest. The image was of twenty-one carat gold and weighed about 1,790 grams, the color of the gold being very pure yellow. The figure of the statuette 8 to 9 inches was of a Buddhist deity and the style of art was very like that of the Ngandjuk Period in Javanese art."

The image, according to Professor Beyer, clearly was not made in Java since the workmanship is cruder than that of the Javanese and the gold is of a distinctly different color and quality from that employed in such work in Java. Professor Beyer's opinion is that Javanese miners worked the Mindanao gold deposits as early as 1350.

The most talked-of district for the last three centuries, perhaps, is the Paracale-Mambulao district in Camarines Norte. The history of placer mining in the Philippine Islands is in large part the history of this district. The first operations here were those carried on by Filipinos with the *batea*, a wooden pan. Then there came into use a small dipper dredge, with a treadmill device for raising the dipper (Plate 24), capable of handling only 2 or 3 cubic meters per day. The third stage in the development of the industry came with the installation of three medium-sized but modern dredges on separate properties. Two of these were New Zealand types and one a California model. The fourth stage, which has already been entered, is the consolidation of properties and the utilization of large capacity dredges, capable of handling from 2,000 to 3,000 cubic yards per day.

In the early days, long before American occupation, Mambulao, which is now a mere collection of shacks, was a city of much importance due to the flourishing gold mining and the fact that the Spanish galleons from Mexico sometimes stopped there. I recently saw some Spanish silver coins dredged up near this town, bearing the date of 1739.

Concurrently with the crude attempts at dredging in the days before American occupation over a score of arrastress of the Mexican type were in use in the hills surrounding Paracale and Mambulao. Today only one of these can be seen, and it is no longer in use.

The year 1894 is an important one in the history of this district. It is known as the *prohibition*, when the Spanish government prohibited the Filipinos from engaging in the mining industry.

At the present time this district, which was again flourishing during the decade from 1905 to 1915, is almost dead. The banner

year in this district was 1915 when there were nine dredges, all told, operating in Paracale, Gumaus, and Malaguit Rivers.

In quartz mining the first step was marked by the use of the mortar and pestle, a universal device among primitive people. This was succeeded by the arrastre, which apparatus was introduced by the Spaniards from Mexico into the Mambulao district. Then came the stamp mill, erected by the Philippines Mineral Syndicate, which company came to grief, however, as a result of the insuraction of 1896, before producing anything. With American occupation came the floating of two quartz mining companies, the Tumbaga and the San Mauricio, which used still more up-to-date machinery. In 1910, however, both of these shut down, and there are practically no operations on quartz lodes worthy of mention in this district at the present time.

The history of operations in Masbate and Benguet has been similar in many respects, but with the difference that those two districts are better adapted to quartz mining. All attempts at dredging in Masbate have so far proved futile; while the Benguet country never was adapted to this class of mining.

The chief events in the history of Benguet are the erection of Hartwell's 3-stamp mill in 1903; the beginning of operations by the Benguet Consolidated Mining Company in 1907; the typhoon of October, 1909, which severely crippled the plants of the largest two mines; and the beginning of operations on the headquarters property in June, 1911. In 1914 the Benguet Consolidated plant was rehabilitated, and to-day it is the greatest gold producer in the Philippines.

In Masbate there have been many ups and downs also, but at present there are two successful mines in operation on lodes, the Colorado and the Syndicate.

Coal

Coal in the Philippine Islands was discovered by Europeans, in 1827, on Cebu, and on Batan Island in Albay Province in 1842. The first coal entries were made on Batan Island in 1847, and the first concession on Cebu was given in 1853. Very little mining was done until after 1890. The two most important properties were the Bilbao and Chifladura mines on Batan, operated by the Minas de Batan Company, and the Compostela and the Camansi mines consolidated by Enrique Spitt, on Cebu. These failed and have done nothing since the insurrection. A very comprehensive plan for mining operations on the part of the government with Enrique Abella, chief of the mining bureau, in charge, was about to be consummated when the insurrection broke out in 1896. In 1904, the United States Army began exploring Batan Island, but never accomplished much, and in 1910, operations ceased by order of the Secretary of War. In 1907, the East Batan Coal Company began operations and did fairly well until 1911, when it went into the hands of a receiver and was bid in by the government to satisfy its preferred indebtedness. With the coming of the World War and the need for coal at any price the Philippine Coal Mining Company began operations near the old site of the East Batan Company mine, and in 1921, this was the largest coal mine in the Islands. In 1918, the National Coal Company was formed. Its career has been a checkered one, but now, at the end of 1922, it has reached the production stage.

Iron

The earliest record contained in the archives of the Bureau of Science with reference to iron mining bears the date, December 12, 1781, and this is an order of instructions to the Governor of Angat, Bulacan, Luzon, through the Governor of Bulacan, from the Superior Government of Manila to render every possible assistance to Chaplain Juan Belli of the Armada in the working of his mine. However, very little was accomplished in this undertaking owing to "the indolence and repugnance with which the natives assisted in the labor of the works."

The next that we learn in chronological order is that Santiago Hison, past captain of the Guild of Mestizos of Angat, makes a petition to the Governor of Angat asking that he be declared the discoverer of the mine Sapang Bacal. The entire history dimensions, and production of this mine are not known. After passing from one owner to another, and ownership being contested several times, the mine at last came into the possession of Mrs. Maria Altesa Fernando, one of the most interesting personalities in the mining industry in the Archipelago. Several other *mines* in Bulacan have crude furnaces erected near them, but Mrs. Fernando has perhaps made the greatest success of the business. There are now on her property several crude furnaces which turn out approximately 150 tons of iron a year; the iron is made into plowwhares and sold in Bulacan and neighboring provinces.

In 1917, a Japanese company leased the property on Calambayanga Island in Mambulao Bay, Camarines Norte, and until the close of the World War mined and exported ore from that place.

Early in 1920, a furnace was erected at Limay, on Manila Bay, to treat briquetted magnetic sands, but this has not attained success.

Perhaps the most important event in the iron industry in the Philippine Islands was the discovery, about 1912, of a large deposit of lateritic iron ore by Mr. H. F. Cameron, a government civil engineer, in Surigao, Mindanao. The government has since reserved this deposit. The National Iron Company was soon after organized to exploit it, but nothing has been done by this company in the field.

Copper

The Spanish mining engineer Santos, (538) in his report of 1862, says: Even in some of the most ancient history of these Islands copper is cited among other metals as one of the products which nature affords with considerable abundance, the natives of the mountains utilizing it for arms, ornaments, and in a profitable business, but the most noteworthy document which claims attention by its official character and in the exactness as later verified, is the communication to the Governor, His Excellency the Captain Sr. Don Pascual Enrile of 1833, in which he states that the utensils that the Igorots of the rugged mountain ranges which separate the province of Cagayan from that of Ilocos, made of the copper from the mines, have been known for several centuries. With this communication were sent numerous spikes of the metal mentioned, which, assayed in the Direccion General de Minas, gave such good values that not only was it recommended that mines be opened for the exploitation of so much mineral, but it gave rise to the creation of the inspection of 1838 and the mining law of 1846.

In 1850, a military expedition was sent to this region (near Mankayan in Lepanto, Mountain Province, Luzon) to make an investigation. Antonio Hernandez, a government engineer, went with the expedition and made maps, collected specimens, etc. He found that the Igorots had made a number of small pits and shelves, dug out the high-grade ore, and afterward smelted it in a crude way which has been fully outlined in Santos's report. A translation of this report is included in a paper by Eveland (236). The report of Hernandez awakened considerable interest, and the governor took steps to carry on mining and smelting on an improved basis. However, it was not until 1856 that an exploration for demarcation of the property was made. Finally an agreement was made with the Igorots of that section by which 500 pesos were paid to the government for the concession. The Igorots were guaranteed employment in the mines, a stock company was formed under the leadership of Mr. Babbas, which laid out two pertenencias of 83,000 square meters each, and preliminary work was begun. The company operating here was called the Cantabro-Filipino Company.

The year, 1860, marks the first actual production, and in 1861, about 25 pounds of copper were produced; in 1862, 1,800 tons of ore; and in 1866, about 234,807 pounds. Up to 1874, the total output was about 2,500,000 pounds of copper. In 1875, this company suspended work. The cessation of work was probably due to the death of Santos, which occurred in that year. From that time the mines have remained idle, except for the crude operations of Igorots and Chinese, and the prospecting and development work done by Americans.

All attempts to float the property have been unsuccessful. This is the only part of the Philippines where a commercial deposit of copper has been discovered.

Petroleum

The first mention in geologic literature of gas or petroleum in the Philippines, so far as is known, is found in the description of Panay, by Abella, 1890.

In 1896, an oil well was being bored on the estate of Smith Bell & Co., near Toledo, on the west Coast of Cebu. In that year an insurrection broke out against Spanish rule and the dillers (Americans) were driven from the well, which has remained idle ever since. It is now choked with rubbish.

About 1910, a number of Americans became interested in petroleum seeps, long known to the Filipinos to occur on Bondoc Peninsula in Tayabas Province, Luzon, but apparently unknown to the Spaniards. Two shallow wells were dug near those seeps and some oil was pumped, but nothing of any great importance has been done since then except to keep up assessment work on the properties. However, several foreign petroleum companies have from time to time made surveys of this and other fields.

About the end of 1917, there was considerable excitement over the discovery of oil in the Cotabato region of Mindanao. In 1919, Act 2841 was passed, providing for the creation of the National Petroleum Company, but this company has done no active field work.

In August, 1920, the Philippine Legislature passed an act " to provide for the exploration, location, and lease of lands, containing petroleum and other mineral oils and gas in the Philippine Islands," and rules governing the same were made by the Secretary of Agriculture and Natural Resources. In November, 1920, ground on Bondoc Peninsula, Tayabas Province, Luzon, was leased to the Richmond Petroleum Company, a subsidiary of the Standard Oil Company of California and in March, 1921, drilling was begun.

History of Mining Legislation in the Philippine Islands

Paralleling the history of active mining operations in the Archipelago is the history of mining legislation, which may be divided into four distinct periods.

The period of Spanish legislation.—The period from 1846 to 1896 was not marked by any conspicuous successes and it is more than likely that the type of legislation was largely to blame for this condition. The Spaniard, like other peoples of Latin origin, strongly favors regulations ; his mining operations have been so fettered by the red tape of regulations that he often overlooked the main business in hand. The Royal Decree of 1846 is theoretically a masterpiece, but practically of little use, judging by results. However, this was the great period of discovery, if not of recovery. During the insurrection (1896 to 1900) there was an unproductive interval of several years. Everything was in a state of transition and uncertainty. It was a bad time for such a sensitive business as mining.

The period of American legislation.—With the coming of stable conditions, new blood, and the passage of the Act of Congress of July, 1902, began the Anglo-Saxon period, in both mining and legislation. With few changes, the basic principles of the American mining law were adopted, thus vastly stimulating the industry, and American prospectors, mostly discharged soldiers, swept over the Archipelago, visiting every island. Notwithstanding this invasion, very few deposits of mineral not known before were brought to light during this period, though several mining ventures were started. It was a period of active and successful mining.

The period of Filipino-American legislation.—In this period, beginning in 1913 and continuing to 1921, the principal thing to be noted is the transition from the old freehold basis to the leasehold for coal and petroleum. The acts bringing about this condition were passed by the Philippine Legislature. There is a partial return to the principles underlying the earlier Spanish codes, the dominant feature of those being the assertion of the Regalian doctrine ; that is, that the state and not the individual is the owner of the minerals. This is the period of nationalization and experimentation.

The period of Filipino legislation.—The fourth period has not yet begun, but will be entered upon with the passage of a complete new mining act and the organization of a mining bureau to administer its provisions.

This brief history of mining in the Philippines would be incomplete and inconsiderate were it to contain no reference to the practical mining men who have worked hard and long to wrest the treasures from Nature. I have already mentioned the most conspicuous names of the practical miners and engineers of Spanish times, and shall now devote attention to that band of hardy Americans, New Zealanders, and Australians who have been working well during the two decades and more of American occupation.

It will be impossible to mention all of these men, but without meaning to indulge in invidious comparisons (for all have contributed some noteworthy share to the work) a few of the most conspicuous must be named.

Among the earliest prospectors in the gold fields were Messrs. A. Heise, Herbet, Edelmeir, and Berkenkotter in Masbate. Either Mr. Heise or Mr. Herbet was the first to locate claims now owned by the Colorado Mining Company, and Mr. Berkenkotter, those upon which the Syndicate mill is operating. Mr. Edelmeir has the distinction of being the first American to prospect for lodes on Masbate Island, and I am indebted to him for much information concerning the early history of mining in that region. Indelibly connected with the later history of Masbate, and with the mining industry in general, is the name of Colonel H. B. McCoy, one of the most constructive active of the Americans who remained in the Philippines after the Volunteer Army of 1898 was disbanded.

In Benguet, we note first the name of Jack Hartwell, who built the first stamp mill in that region. Hartwell died of cholera in Baguio in the early days, and his little 3-stamp mill has long since been dismantled.

In 1902, Mr. H. Clay Clyde, an American prospector, discovered the Benguet Consolidated lode in Antamok Creek, which is the bonanza, of the Far East. Mr. Nels Peterson and Mr. M. A. Clarke, with Mr. Clyde, organized this company. Mr. C. M. Eye, mining engineer, and Mr. A. W. Beam, to-day the president of the company, have done perhaps more than any others to develop the property to its present secure place. Mr. O. L. Kettenbach is the present able superintendent.

Another noteworthy prospector, of the district is John ("Tex") Reavis, who is to-day one of the best-known men in the mining fraternity in the Philippines.

One name, that of H. Phelps Whitmarsh, a leading business man of Baguio to-day and long a mining promoter, will always be mentioned in connection with this district. Mr. Whitmarsh, who got his first mining experience as a mere boy in Australia, has done perhaps more than anyone else to fight the uphill battles of mining in this region and is now engaged in promoting still larger schemes for developing this field.

In the Paracale field there is a host of names, all deserving of mention. Of these, the most conspicuous is that of Judge Frank B. Ingersoll who has done more than anyone else to promote the interests of this district, and who has been active in connection with the industry in general for nearly twenty years.

In the practical operations Messrs. Kane and Telford, New Zealand dredge masters, are perhaps the best known.

In lode mining in this district, Mr. A. C. Cavender and Mr. John Moissan have perhaps been the most active. Mr. John Mueller's name is the one most associated with mining exploration on Marinduque, but that of Mr. E. E. Calvin is almost as well known.

In the Tayabas oil field Mr. E. W. McDaniels has been the longest identified with the slow developments of that region. In connection with the "asphalt" deposits of Leyte Wm. H. Anderson deserves special mention.

In the coal fields many persons have been active, but ex-Governor A. U. Betts, of Albay Province, has the distinction of having been longer connected with the industry than any other, and he has been the most successful. He is the original promoter of the East Batan coal mine and is interested in the present Philippine Coal Mining Company, near the site of the old mine.

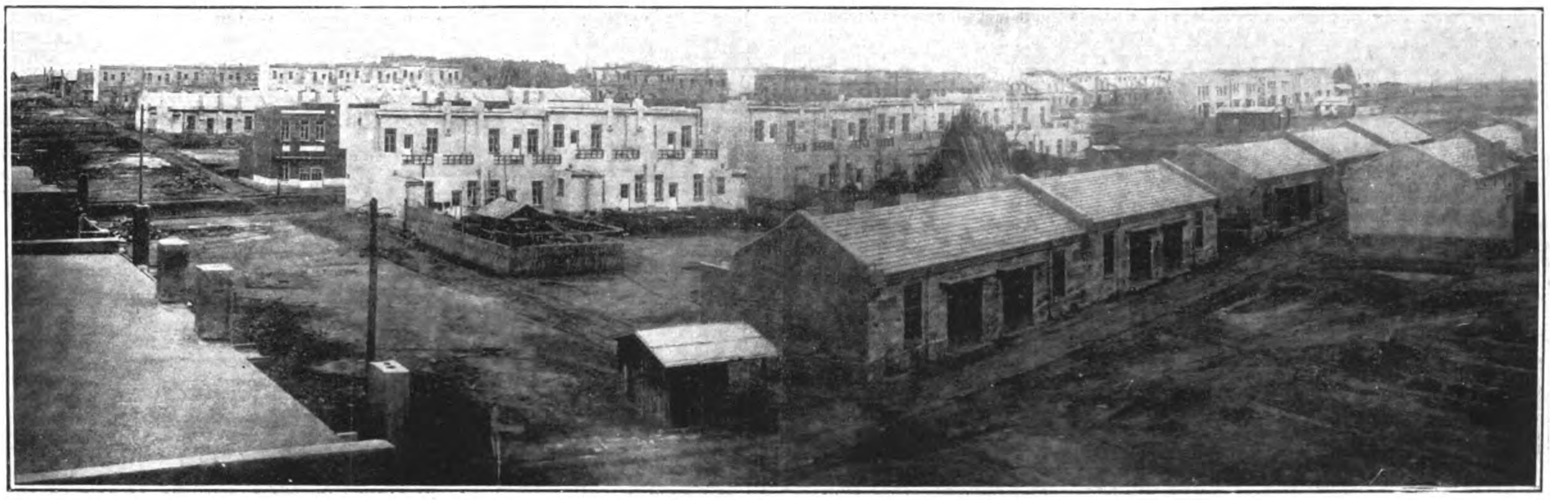
One of the most picturesque, if not successful, figures among the old-timers in the Philippines was " Al " Wright, a former color sergeant with the Rough Riders under Roosevelt in Cuba. Wright's Philippine activities were confined largely to the Mankayan-Suyoc district in the highlands of Luzon.

In mentioning exploration work in Mindoro, Panaon, and other less well known localities the name of Mr. Villager is always heard. He is one of the oldest and hardiest of this band of prospectors.

In the early days of American occupation there was a small army of prospectors let loose upon the country, many of whom did yeomen's work in opening up the wilderness. Most of these have gone ; some have died, others simply left disheartened, as they were given little or no encouragement, and the country has lost a valuable asset, since there are none to take their places.

Prospecting is peculiarly an American profession, and as yet the Filipino shows little capacity or desire for this sort of hard, active, free life. It has been suggested by a Filipino mining engineer

(*Continued on page 242.*)



Residences Erected by the Shotoku Society at Dairen

The Oriental Development Company in Korea

THE object of the Oriental Development Co., Ltd., which was established in December, 1908, is to finance various enterprises for the development of Korea and to manage colonization projects in Asiatic countries. The company is capitalized at Y. 50,000,000 of which Y. 35,000,000 was paid up, and has been granted the privilege of the issuing debentures up to ten times its paid-up capital, the debentures issued up to date amounting to over Y. 140,000,000.

The following summarizes the various enterprises in Korea in which the company is interested, although, the undertakings now embrace Manchuria, Mongolia, Siberia, Central China and the South Sea Islands.

The following shows the area of the land in Korea owned by the company.

Paddy-field	44,332 *cho* 6 *tan* 6 *se*
Field	20,429 ,, 3 ,, 9 ,,
Forest	9,475 ,,
The Others	9,933 ,, 3 ,, 2 ,,
Total	84,170 ,, 3 ,, 7 ,,

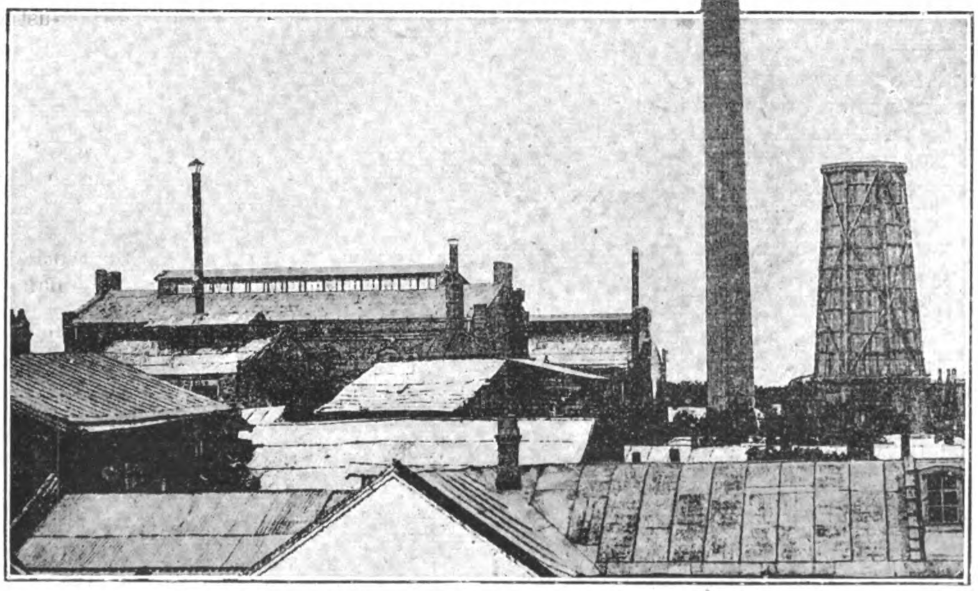
With the exception of the land under the company's direct control the fields are being worked by more than 100,000 Koreans, and the total amount of rice (rough) made over to the company as rent reaches over 300,000 *koku* annually. In 1909, when the company started its agricultural enterprise, the industry in Korea was only in its infancy, and there were few men who could utilize modern methods.

Thereupon, according to the administrative policy of the government, the company, devoted itself to the improvement of agriculture. The Korean farmers of those days, however, were so conservative that they clung doggedly to the old farming methods. It was a very hard task to instil the idea of agricultural improvement into the farmers, but the company continued to exert their efforts in guidance and encouragement. As a consequence, those who adopt improved agricultural, methods have increased yearly. In view of the trend of times the company planned to adopt intensive methods in place of uniform methods of cultivation, according to the local conditions. In some districts the company's experts, who are leading the farmers to effect the improvement, gratifying results are being obtained, though the plan has been in force for a very short time.

The Improvement of Rice

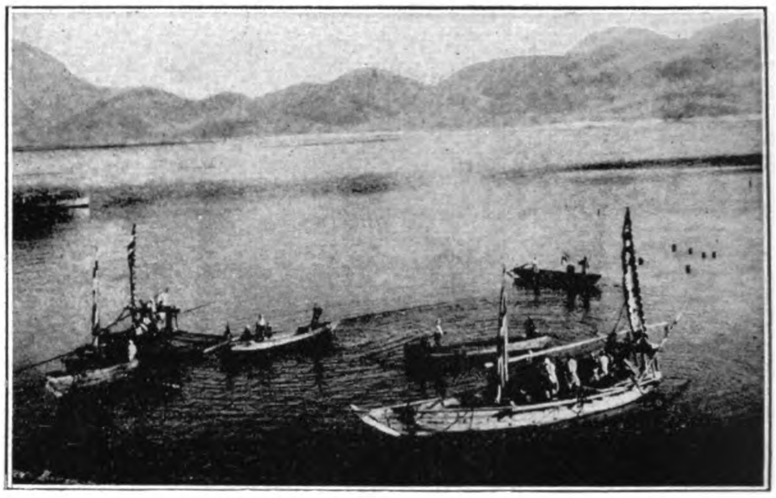
When the enterprise was started by the company, it was considered most important to distribute the improved variety of rice, and for this purpose, they made an effort, in co-operation with the government authorities. In 1910, seed fields were established in principal districts, and the seed-rice produced have continued, to date, to be distributed among the company's colonists and tenant-farmers. Eighty per cent. of the tenant-fields to the south of Keijo (Seoul) use these seeds, while over 30 per cent. of the fields in the Western Korea use them. In some parts of the Western Korea, there are fields, soil of which is not adaptable to the improved variety. For this kind of field, the ordinary variety of the superior quality is used. However, it is a matter for regret that there are still many Korean tenant-farmers who are indifferent to agricultural improvement. Fearing that conditions will degenerate if left to the farmers alone, the company has distributed the seed rice and has continued to maintain its improvement, aiming at the enhancement of the reputation of Korea-grown rice. Every attention is being paid by the resident experts in various places who manage the fields. The total amount of seed-rice distributed by the company reaches 15,000 *koku* annually.

In the fields of Korea, which have long been employing crude



Power House of North Manchuria Electric Co.

Headquarters of the Union of Financial Associations



The Return of the Sardine Fleet

fertilizing methods, the application of artificial fertilizer together with irrigation is most important in bringing an increase to rice crop. But most of the farmers were not accustomed to the use of the modern fertilizers. In the beginning, the company used to distribute the fertilizers only to their colonists and the tenant-farmers, but since 1919, they began to distribute the article to all the farmers. During the past five years, the company has distributed over 1,300,000 pieces of bean-cake, a large quantity of superphosphate of lime and oil-cake amounting altogether to about Y. 5,000,000. To-day, Korean farmers who use the fertilizer are yearly increasing in number with growing demand.

The improvement of the Korea-grown rice is now fairly effected and the quality is almost not inferior to that of home-grown rice. However, the defective points of the former are that they are not properly dried and prepared, particularly suffering from small stones being mixed in it. To remedy this condition the company has loaned rice-threshers, straw mats and winnowers so that the farmers can sift the mixtures. As regards the betterment of drying and preparation, the company is now encouraging the farmers by means of prizes and by other methods. To effect the improvement, it is necessary to let land-owners and tenant-farmers realize their own advantage. The company yearly exports a considerable amount of rice to Japan, and in both eastern and western markets the improvement of Korean rice has been recognized.

The resident experts show the farmers the methods of selecting variety, rice planting, manuring, weeding, etc., and the company commends publicly those who have shown good results in cultivation. In case of drought or flood, the farm-rent is decreased or they are exempted according to the degree of damages suffered. The tenant-farmers are hired for engineering work of the company. In 1918, when there was a heavy drought, the company loaned the seed of home-grown potatoes to the tenant-farmers and the peasants in the company's district to provide against the calamity. In 1922, when several places north of Keiki-Do, particularly the direction of Kokai-Do were visited by flood, the company contributed a large amount of money for the maintenance of the cultivated lands in these districts, besides donating money and cereals to the sufferers.

The company, from time to time, hold lecture meeting on agricultural affairs and exhibitions of agricultural products. Besides giving practical guidance, the agricultural experts make every effort for promoting the industry.

Tenant-troubles which are increasing in Japan now occur also in Korea, although not so frequently. According to the investigation made by the government, there have been only 71 cases during the past three years, the figures corresponding to about one-thirtieth of Japan. The troubles generally originate in the request for lessening of farm rent, or cancellation of tenant-rights, or a demand that land tax should be paid by the land-owners. But the fundamental cause is, on the whole, the fact that the farmers are in straightened circumstances. In view of this fact, the company is trying to elevate their economic condition, encouraging the improvement of cultivating methods and the provision of some occupation in addition to farming.

The Improvement of the Variety of Soya-Beans

The climate and soil of Korea are adaptable to the cultivation of soya-bean, but the farmers do not care much about this crop. With a view of improving the quality and standardizing the varieties, the company established a soya-bean nursery and is distributing the seeds gathered to its tenant-farmers.

As the paddy-fields of Korea mostly depend upon rain-water, the annual amount of crops differs according to the seasonable condition of the year. Even such fields, if equipped with irrigation and well managed, may be converted into fine ripe fields. There are many barren lands almost everywhere. Particularly in the whole region along the Yellow Sea, beaches are found here and there awaiting the reclamation. It is pressing need to improve or reclaim those lands from the view of management of land and also of the solution of the food problem. The company will finance such enterprise and also undertake the survey. The following show the irrigation and reclamation works completed and under construction:

Irrigation Undertakings

The works completed under the company's direct management

Description	Location	When Completed	Irrig'd Area *chobu*
Pumping irrigation works Kiusan-men	Rashu-Gun, Zenra-Nando	Dec., 1916	270
Land-improvement work at Josei-Men	Ryosan-Gun, Keisho-Nando	June, 1917	80
Pond-reclamation work at Hochu	Rashu-Gun, Zenra-Nando	Aug., 1917	12
Construction of a reservoir and a water-way at Saishi-Men	do.	Aug., 1919	315
Land-improvement work at Daichi-Ri	do.	July, 1919	7
Irrigation-improvement work at Unkoku-Ri	do.	June, 1922	21
		Total *chobu*	705

The organization of irrigation associations was mainly due to the company's efforts. To-day, there exist 55 associations, the irrigated area of which aggregating to about 117,030 *chobu*. Of the total acreage, nearly one-half is being improved into excellent well-irrigated fields. The company owns fields of 14,217 *chobu* in area out of the total irrigated acreage:

(*a*) Irrigation Associations organized

Name	District	When Completed	Total Irrig'd Area *chobu*	Irrig'd Area of land owned by the Company *chobu*
Kanan	Kaya, Hoshu, Daisan, Kanan-Gun, Keisho-Nando	Mar. 31, 1922	1,269	34
Kato	Kato-Men, Kinkai-Gun Kanan-Gun, (Keisho-Nando)	Mar. 31, 1921	699	65
Taisan	Taisan-To-Men, Shogen-Gun (same as above)	Oct. 10, 1921	1,224	112.4
Jonan	Jonan-Men, Mitsuyo-Gun (same as above) ...	Sept., 1918	240	6

Name	District	When Completed	Total Irrig'd Area chobu	Irrig'd Area of land owned by the Company chobu
Kinkai	Kinkai, Garaku-Men (same as above) ...	May 11, 1916	1,997	198.1318
Taisha	Taisha-Men, Kinkai-Gun (same as above) ...	July 30, 1917	1,868	236
Tosen	Tosen-Men, Shonei-Gun (same as above) ...	Aug. 31, 1921	147	.7
Mitsuyo	Jonan-Men, Mitsuyo-Gun (same as above) ...	Nov., 1906	642	6
Ryosan	Toryosan, Joseimen, Ryosan-Gun (same as above)	June, 1923	1,170	170
Tomen	To-Men, Shogen-Gun, (Keisho-Nando) ...	Nov., 1922	986.69	5
Shodo	Shodo-Men, Mitsuyo-Gun (same as above) ...	Mar., 1923	431	2
Geinichi	Ennichi, Taisho, Keisan-Men, Geinichi-Gun (Keisho-Hokudo) ...	Aug., 1916	1,411	65.5
Fumon	Naito, Keishu-Men, Keishu-Gun, (same as above)	July, 1922	381.0808	61
Ekiyoku	Sanrei, Zenshu-Gun, Ekisan, Gosan, Ekisan-Gun, Taiya, Kaisei, Gyokusan, Bei, Kyuyu, Yokuko-Gun (Zenra-Hokudo)	One part on April, 1915 One part on July, 1914	9,000	785
Rineki	Kotohokuichi, Ekisan-Gun, Zuisuirinpa, Taiya-Men, (same as above)	May 30, 1911	3,326.5927	204.9026
Zeneki	Shunpo, Ekisangun, Sanrei-Men, Zenshu-Gun (same as above) ...	Feb. 28, 1911	1,445.80	22.8113
Kofu	Kotoku, Seinai, Kosho-Gun Kofu, Eigen, Seiyu-Gun Hoan, Kansen, Shusan, Funei, Toshin, Hakusan, Fuan-Gun (same as above) ...	April, 1919	4,000	1,113.4703
Ryushin	Ryushin-Men, Zenshu-Gun Enchu, Ryuko, Unkokuri, Zenra-Hokudo	1924	170	3.5014
Yokuko-Seibu	Bei-Men, Yokuko-Gun Zenra-Hokudo ...	Mar., 1908	460	6.0622
Bakyuhei	Tenseki-Men, Ronsan-Gun, Chusei-Nando ...	Aug. 31, 1909	320.6408	24.2008
Meigantei	Shishu-Men, Seishu-Gun, Chusei-Hokudo	July 28, 1920	164.8709	3.3019
Girinchitei	Teisen-Men, Teisen-Gun Chusei-Hokudo	Dec. 20, 1915	291	28.9309
Ankaku	Kakujo-Men, Anso-Men, Anpen-Gun, Kankyo-Hokudo	May, 1923	900	35.800
Choshitei	Usan, Suigen-Gun, Keikido	Mar., 1919	64.0813	3.7425
Reika	(same as above) ...	Dec. 20, 1919	245.2614	64.1306
Oun	Heiko-Gun, Tetsugen-Gun, Kogendo ...	June, 1921	557	9.6314
Chuo	(same as above) ...	in 1924	8,630	57.8728
Fuhei	Fuhei-Gun, Kimpo-Gun, Keikido	Expected to be completed by April, 1925	3,601.2522	52.9828
Dojin	Taiden-Men, Teishu-Gun, Sei-Men, Hakusen-Gun, Heian-hokudo ...	Mar., 1923	4,000	46.1521
Taisho	Gaika-Men, Ryusen-Gun, Heian-Hokudo ...	Oct., 1917	5,989	30.8600
Hakusen	Kanan-Men, Hakusen-Gun, Heian-Hokudo ...	Expected to be completed by Dec., 1927	2,928.6	7.2
Total 31 Associations		chobu	58,560.8911	3,462.3413

(*b*) Irrigation Associations Under Organization

Name	District	Probable Date of Completion	Total Irrigated Area chobu	Area of land owned by the Co. chobu
No. 2	Kanan Kanan-Gun, Keisho-Nando ...	—	596	23.6
Kanan	Mitsuyo-Gun, Keisho-Nando	—	1,852.6	80
Tokuto	Kinkai-Gun, Keisho-Nando	—	890	85
Senshinju	Kato-Gun, Keisho-Nando	—	308	150
Nihoku	Kinkai-Gun, Keisho-Nando	—	600	9
Reinan	Shonei-Gun „	—	1,050	20
Jujo-Men	Tatsujo-Gun, Keisho-Hokudo	Aug., 1923	400	35
Josen	Josen-Gun, Chusei-Nando	—	3,100	425.5617
Togantei	Seishu-Gun, „	—	229	5.75
Kiganmen	Fuso-Gun, „	—	205	22
Shunryu	Teihei-Gun, Kankyo-Nando	—	1,000	23.3
Rankoku	Waiyo-Gun, Kogendo...	—	500	50
Ichisan	Koyo-Gun, Keikido ...	—	2,360	68.8329
Suiryu	Suigen-Gun, Ryujin-Gun, Keikido	—	819	69.3419
Yuishiton	Hozan-Gun, Koshu-Gun, Kokaido ...	—	.4,650	1,171.7516
Enkai	Enpaku-Gun, Kaishu-Gun, Kokaido ...	—	10,260	2,128.8623
Keiyukyu	Tainei-Gun, Kokaido...	—	4,000	2,090
Shinsen	Shinsen-Gun, Tainei-Gun Kokaido	—	6,000	1,420
Junnan	Junsen-Gun, Heian-Nando	—	2,000	34.4525
Kosei	Kosei-Gun, „	By Mar., 1927	1,290	13.5204
Toshinko	Seiyu-Gun, Zenra-Hokudo	—	1,200	2,191
Kogen	Kogen-Gun, Kankyo-Nando	—	1,213	500
Gishu	Gishu-Gun, Heian-Hokudo	—	2,350	38
Jotomen	Ronsan-Gun, Chusei-nando	—	800	100
Total 24 Associations		chobu	58,472.6	10,755.0012

(*c*) Irrigation Work done Under the Direct Management of the Company

Name	Location	When Completed	Irrigated Area chobu
Taisen	Kijogun, Taisen, Heian-Hokudo...	Oct., 1916	973

WORKS COMPLETED

Name	District	When Completed	Area chobu
Choanhei	Koyo-Gun, Keikido	June, 1915	371
Raganri	Ekisan-Gun, Zenra-Hokudo	Sept., 1916	149
Sujimmen	Koyo-Gun, Keikido	May, 1919	6
Ryuko	Ryuko-Gun, Heian-Nando	May, 1921	141
		Total *chobu*	667

WORKS UNDER CONSTRUCTION

Name	District	When Completed	Area chobu
Jiboho	Muan-Gun, Zenra-Nando	Expected by the end of 1923	266

WORKS FOR WHICH SURVEY AND DESIGN HAVE BEEN MADE

Name	District		Area chobu
Reigan	Reigan-Gun, Zenra-Nando	—	838
Ranpo	Ranpo-Gun, Chusei-Nando	—	318
Koyo	Koyo-Gun, Junten-Gun, Zenra-Nando	—	535
Kaigetsu	Enpaku-Gun, Kokaido	—	2
Kotomen	„ „	—	1,175
Tensenri	Zuisan-Gun, Chusei-Nando	—	435
		Total *chobu*	3,303

In addition, there are seven more places under application, the total area being 8,481 *chobu*. For the men of enterprise who have not sufficient funds or who can not carry out their scheme themselves, the company is ready to do every thing to help them.

THE MANAGEMENT OF FORESTS

The company observed that the improvement of forest and river in the peninsular is very important from the standpoint of its industrial expansion. Besides planting trees, they started an investigation into the plantation districts. In March, 1911, the company could loan a part of state-owned forest and bought up several privately-owned forests. Since then, steady extension has been made. The total area of the forest managed by the company to-day reaches over 61,934 *chobu*. A description follows :

Name of Do	Total Area *chobu*	State-owned forest rented by the Co. *chobu*	Forest bought up by the Co. *chobu*
Keiki ...	10,986.8629	7.2100	10,979.6529
Kogen ...	1,198.9126	270.	928.9126
Kankyo-Nan	22,339.3226	22,310.2509	29.0717
Kankyo-Hoku	6,773.0900	—	6,773.0900
Kokaido ...	18,349.7220	16,651.6000	1,698.1220
Heian-Nan	61.2916	—	61.2916
Heian-Hoku	75.1200	—	75.1200
Keisho-Nan	876.4004	—	876.4004
Keisho-Hoku	142.5708	—	142.5708
Zenra-Nan ...	1,112.4208	—	1,112.4028
Zenra-Hoku	—	—	—
Chusei-Nan...	15.3420	—	15.3420
Chusei-Hoku	3.1521	—	3.1521
Total *chobu*	61,934.2318	39,239.0609	22,695.1709

In principal forestry districts are the company's men who watch and protect, while the local men of influence also take care of the forest in co-operation with them.

In 1910, the company first had nurseries in the six districts namely, Tokugen, Bunsen and Anpen Guns of Kankyo-Nando, Joshin-Gun of Kankyo-Hokudo, Yohei-Gun of Keikido and Hozan-Gun of Kokaido, the total area being 19,027 *tsubo*. In the spring of 1923, the number of nursery trees produced aggregated to 868,540, and after 1924, it is expected to obtain there annually more than 1,100,000 even which number is not sufficient to meet with demands.

Besides nursing natural young trees, the districts are artificially afforestated. Up to the spring of 1923, the districts covering an area of over 7,066 *chobu* which have been planted with trees numbering 19,220,000. Below is given the variety of the trees planted :

Name	Area of Nursery *chobu*	Number of Trees planted
Sawshaped Oak ...	2,248.2519	7,422,969
" Nise-Acassia " ...	174.4903	760,430
Alder ...	2.7705	8,325
Chestnut ...	657.3300	1,354,930
Larch-tree ...	3,306.7000	8,201,065
" Keyaki " ...	84.5000	93,976
" Akamatsu " ...	583.0500	1,357,170
" Kuromatsu " ...	3.4400	10,200
Walnut ...	5.6400	6,455
Total *chobu*	7,066.1727	19,215,520

Of these, sawshaped oaks have been planted mainly in the Kokaido districts, while the regions in Kankyo-Nando have had larch-trees planted, the total number of trees planted amounting to over 5,357,000. As the company was a pioneer in forestry in Korea, they are now experienced in afforestation. Their success was recognized by the government who have transferred forest covering 865 *chobu* in area to them. As most of the trees planted are to-day 8 or 9 years old, afforestation efforts will be completed in the near future. In view of the increase of forest areas and also of the result in afforestation, they are planning to manage the undertaking more economically, while they are carrying out a scheme newly drawn up to meet with the requirements.

The soil of Southern Korea is suitable for the growth of bamboo. Nevertheless, there are few who adequately manage the groves, with the result that they are wasted. The companies, therefore, encourages the local people to improve the condition. To increase the amount of production to meet with commercial demands and also to promote industry in this direction, they took over bamboo groves in the districts of both Keisho-Nando and Zenra-Nando. Since 1911, the groves under the company's management have increased in area which now covers 281 *chobu*, the work so far being carried out very successfully.

Colonization Enterprises

The company invite colonists for the development of agriculture in Korea. The colonists are divided into the two classes: the first being the independent farmer, who cultivates fields covering less than two *chobu* transferred to him by the company, while the second is the land-owning farmer who has a ripe-field covering less than 10 *chobu* in area transferred by the company and who lets the fields to the farmer-tenants except one part which he cultivates himself. In addition, though not a large number, there are colonists who cultivate fields while they fish, these belonging to the first class mentioned above. The company used to encourage both classes of colonists, but since 1921, they stopped to receive application for the first class colonists, as the people of this class are apt to threaten the tenant-right of Korean farmers. They are now encouraging the immigration of the so-called land-owning farmers to each of whom about 5 *chobu* area of field is transferred by the company. It is the principle of the company to invite colonists of good character rather than to have larger numbers of them. The following shows the number of houses of the colonists with its population :

Name of Do	Farmer or Fisher	Classes	March 1920 Number of Houses	1920 Pop.	March 1921 Number of Houses	1921 Pop.	March 1922 Number of Houses	1922 Pop.
		1st	602		616		593	
Keiki	Farmer ...			2753		2825		2800
		2nd	16		19		34	
		1st	17		16		16	
Chusei-Hoku	Farmer ...			63		70		67
		2nd	3		3		1	
		1st	316		322		289	
Chusei-Nan	Farmer ..			1290		1225		1321
		2nd	11		16		21	
		1st	589		568		537	
Zenra-Hoku	Farmer ..			2475		2185		2547
		2nd	23		33		37	
		1st	657		681		651	
Zenra-Nan	Farmer ...			3120		2377		3367
		2nd	20		31		47	
Zenra-Nan	Semi-farmer							
do.	Semi-fisher	1st	46	239	44	208	44	208
		1st	457		467		450	
Keisho-Hoku,	Farmer			2118		2235		2273
		2nd	13		18		21	
		1st	595		604		589	
Keisho-Nan,	Farmer ...			2903		2997		3121
		2nd	14		20		36	
do.	Semi-farmer							
do.	Semi-fisher	1st	85	338	85	365	85	370
		1st	438		456		443	
Kokai,	Farmer ..			1848		1669		1632
		2nd	15		25		36	
Heian-Nan,	Farmer ..	1st	8	32	7	27	—	—
Heian-Hoku,	Farmer ...	1st	6	28	6	28	6	27
		1st	10		12		11	
Kankyo-Nan,	Farmer ...			58		64		64
		2nd	1		1		1	

The majority of the colonists cultivate rice fields but in some district, they cultivate fruit and vegetables. As to the land transferred, the first class colonists have a field with the area of about 1 *cho* 8 *se* and a farm of 1 or 2 *tan* on both of which they work themselves. To the second class of independent farmers, the land of no more than 10 *chobu* is transferred, besides which they can have the allottment of a field of about 8 *cho* 5 *tan* and a farm of about 8 *tan*. The second class of colonists have an allotment of a field of about 4 *cho* 6 *tan* area and farm of about 5 *tan* area. There are now about 4,000 houses of colonists who are showing good results, though some of them lose because of climatic conditions. Among the first class colonists, there are some who are idle but live at ease, letting the Korean tenant-farmers work on their own fields. Against such people, the company takes steps to cancel their contract. At the agricultural shows held in various places, many of the colonists have been awarded prizes. Most of the second class colonists are farmers of the propertied class or intelligent class who take the lead among the farmers of their district. The colonists, half-farmer and half-fisherman are found only in Keisho-Nando and Zenra-Nando. In Kosanson, Keisho-Nando and other places, there are good fishing villages, but the inhabitants rather take to agriculture as their occupation than fishery, as larger funds are needed for the equipment for the latter. In recent years, most of the farmers have begun to have some occupation subsidiary to farming. They manufacture ropes and straw-bags.

Financing the Business of the Company

Up to 1916, the company made loans amounting to about Y. 5,000,000.00, but since the fiscal year of 1921, a steady growth has been made, reaching over Y. 44,000,000. The figures correspond to about 200 times as against Y.220,000 which they loaned they started. The following table shows the amount of loans accommodated by the company up to the end of March, 1922 :

(*Continued on page 242*)

Commercial School, Eastern Railway Guard, Harbin

North Manchuria Electricity Co., Harbin

Manufacturing Industries of North Manchuria

LONG before the advent of the Russians, prior to the construction of the Chinese Eastern Railway, raw materials were worked in North Manchurian manufacturing enterprises, and the production of articles of food occupied then, as it does now, the most important place. Small flour mills, hanshin distilleries, beer breweries, vermicelli plants, bean oil mills—these almost exhaust the list of native industries in North Manchuria, unless mention be made of home industries and handicrafts.

The above branches of industry were also the first, and continue to be the main undertakings in which enterprising Russians are engaged. These Russians constructed roller mills, distilleries, and a number of other enterprises, with the native end in view of preparing local raw materials for the consumption of the local market.

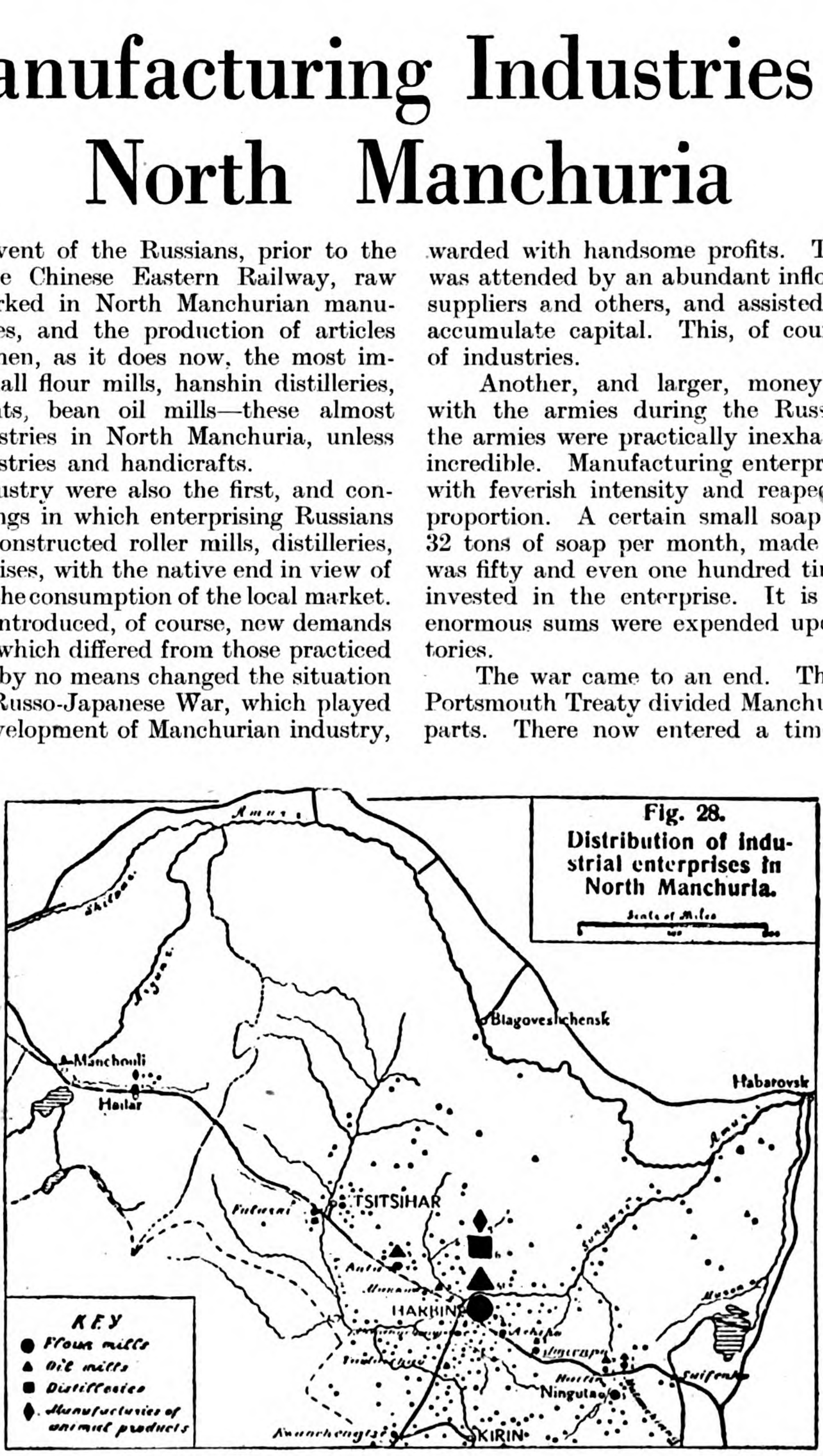
The arrival of the Russians introduced, of course, new demands and new methods of production which differed from those practiced by the natives. This, however, by no means changed the situation as described by us. Even the Russo-Japanese War, which played a most important role in the development of Manchurian industry, was not able to change it. The Russian troops had only a quantitative influence upon the market, the character of which had already been determined by the railway population.

The construction of the railway, and the influx of a permanent Russian population, were, no doubt, the primary causes for the introduction of manufacturing industries of European type.

In the undeveloped and desolate country this new population could find but little which in its native form was satisfactory to a European palate. The Russians, at first by necessity compelled to consume Chinese flour and Chinese spirits, soon organized their own enterprises, and, as is always the case with pioneers, once the difficulties of the beginning are overcome, were rewarded with handsome profits. The construction of the railway was attended by an abundant inflow of money paid to contractors, suppliers and others, and assisted settlers in the railway zone to accumulate capital. This, of course, facilitated the development of industries.

Another, and larger, money wave rushed into Manchuria with the armies during the Russo-Japanese War. Demands of the armies were practically inexhaustible, and prices charged were incredible. Manufacturing enterprises existing at the time worked with feverish intensity and reaped profits which were out of all proportion. A certain small soap factory, producing from 24 to 32 tons of soap per month, made a net profit in one year which was fifty and even one hundred times above the capital originally invested in the enterprise. It is not surprising, therefore, that enormous sums were expended upon the construction of new factories.

The war came to an end. The armies were evacuated. The Portsmouth Treaty divided Manchuria into two practically separate parts. There now entered a time of a severe crisis, a difficult and protracted period of adjustment to new conditions.

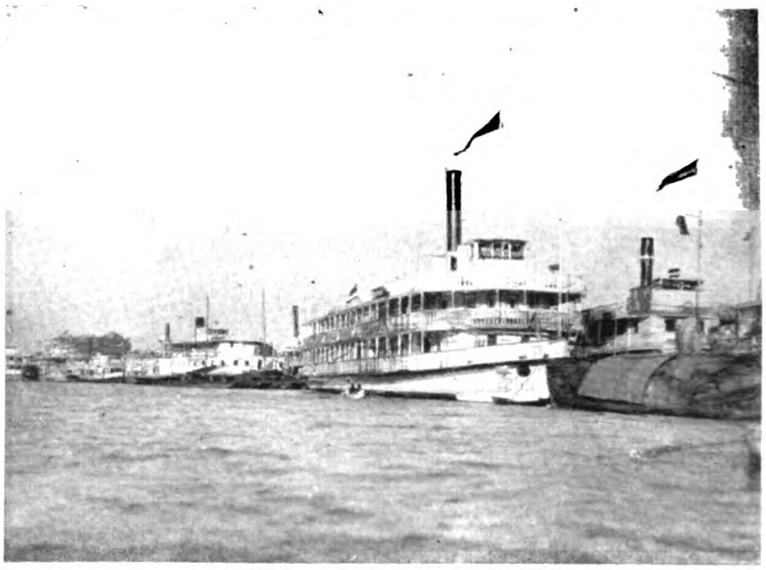


Distribution of Industries, etc.

An epidemic of bankruptcies broke out, alarming even those who succeeded in coming out more happily from the fray. Many sold all their movable property, and left the country in the wake of the armies, carrying with them their accumulated capital. Manufacturing plants were of necessity forced to remain behind. These now became subject to the struggle for adjustment.

It immediately became evident that the local market could not absorb the entire output of existing plants. Fall in prices made it essential that industries be reorganized, and that running expenses be brought down to a normal level. In the general confusion brought on by the crisis, and because bills were not paid, working capital

Firewood Boats in the Sungari



Along the Sungari, Harbin

disappeared. Finally, and this is perhaps the most important consideration, local raw materials, upon which these industries depended, became articles of export to the world markets. Prices on these raw materials, which the war had caused to rise, therefore fell to a lesser degree than did prices on manufactured articles. The gap between these two narrowed. The unhealthy crisis brought on by the ending of the war thus assumed a long drawn out, chronic character, and is known as the second phase in the development of manufacturing industries in North Manchuria.

The period already described, covering the time from the establishment of the first enterprise of European type to the end of the Russo-Japanese War, may be referred to as the first phase. This is the period when Manchurian economy maintained an isolated position, and when manufacturers monopolized not only the market of raw materials but of the finished products as well. The extreme moment of this first phase, although accidental in nature, was the war, which made it possible for manufacturers to take the greatest possible advantage of their position.

The characteristic trait of the second phase, as differing from the first, is the establishment of a permanent and solid connection between North Manchuria and the world markets. Manchurian raw materials, which previously had been at the exclusive disposal of local manufacturers, now emerged from under the monopolistic influence of the latter, and, primarily, became articles of export. The priority in the establishment of prices was transferred to the principal centres of world commerce, but this, neverthless, did not bring firm prices to Manchuria. As a new country it remains subject to every chance, and exercises an influence over its own economic life which in countries that are stronger financially and economically more developed is not observed and even unknown. Political events, currency rates, brigand attacks on trade routes, harvests, fluctuation in taxes and dues, individual transactions of large exports—all these influence local prices and local commerce, to a degree which is out of all proportion to the actual cause. The spirit of speculation brought on everywhere by the world war, and the germ of which has always been present in Manchuria, made itself felt. There is no doubt but that this was harmful to the development of industries. This speculative tendency became particularly evident in the transactions of exporters of raw materials. Exporters, who operate with large capital, principally foreign, and supported by foreign banks, have always occupied a commanding position on the local raw materials market. Export transactions upset the calculations of manufacturers, and they introduced into the distinct, methodical and permanent struture of manufacturing an element of speculation and stock-broking which is foreign to the same.

Hongkong and Shanghai Bank, Harbin

Manufacturers, on their part, endeavored to fight as best they could, but victory remains even at the present time for them an alluring hope for the future only. There was much lacking, even as there is now, in the essentials of success for them. There did not and does not exist among them the necessary solidarity which is the result of a consolidation of interests. There were to be found none of those manufacturers' associations so common in Europe and America, which unite enterprises according to the nature of their products. There was, consequently, no possibility of concerted action.

The Harbin Exchange, founded in 1907, filled this want only in part. It is true that the Harbin Exchange Committee often defended the interests of Harbin industries before the Administration of the Railway, but it at the same time also defended the contrary interests of exporters. Representatives of North Manchurian industries at one time argued at Petrograd that the fundamental economic policy in Manchuria must be the encouragement of the development and strengthening of the local manufacturing industry, and that, on the other hand, support for the export of raw materials was premature.

Petrograd at times responded more or less sympathetically to these declarations. In the final analysis, however, the basic contours of the program introduced in Manchuria were drawn without regard to the interests as formulated by Manchurian manufacturers, and even without regard to the economic life of the zone of the C. E. R. as a whole, becoming merely part of the large and complicated governmental policy of the Empire.

In the meantime the process of the economic development of North Manchuria proceeded along its course, and the export of cereals grew to imposing dimensions.

The manufacturer was compelled to have large funds available in order at the proper time, and at prices which were favorable, to acquire raw material for the manufacturing period. After the Russo-Japanese War, however, the majority did not possess such funds. Flour millers, for instance, appealed to the government for loans to carry them over the period of preparation for the season. Efforts were make to make credit available for North Manchuria. This lack of credit may be considered an old disease of the manufacturing and commercial life in the C. E. R. Zone.

This direct reason, as well as the generally unfavorable situation, made it impossible for individual manufacturers in many instances to retain the enterprise in their own hands. The short history of North Manchurian manufacturing industries therefore, records many cases of enterprises passing from hand to hand. With a few exceptions, not one of them is at present owned by the original founder. Many have changed hands several times.

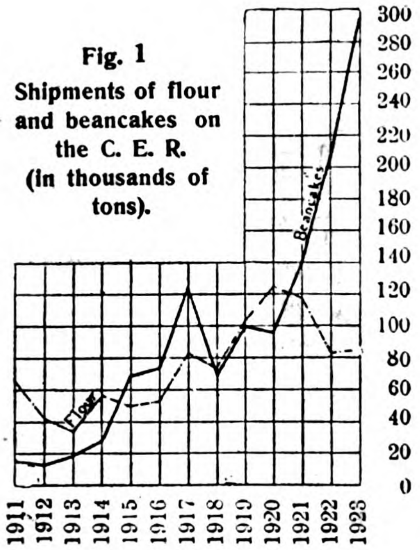


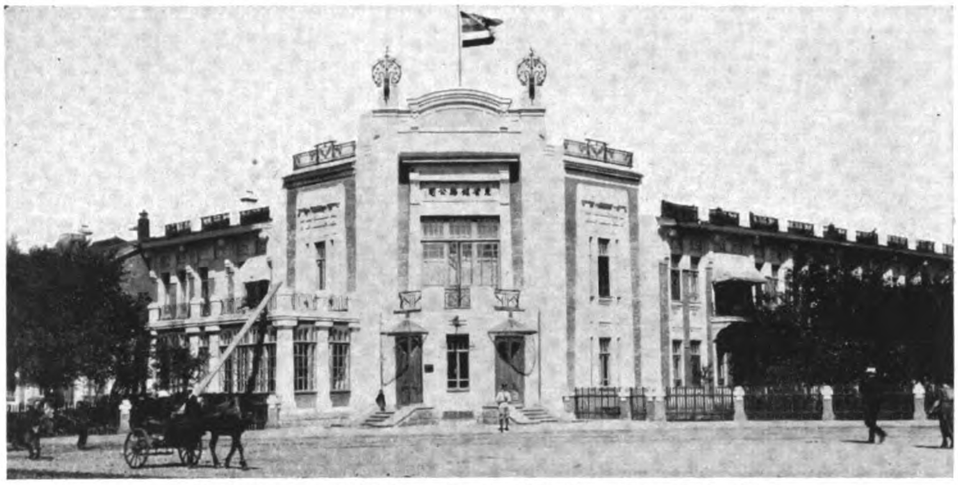
Fig. 1
Shipments of flour and beancakes on the C. E. R. (In thousands of tons).

Generally speaking, the sale of a manufacturing enterprise was as a rule accompanied by an improvement in its financial condition because of the capital invested in the same by the new owner. This, however, could not radically change conditions under which industry labored, and the new owner often went through the experience of his predecessor, ending, as he had done, with a sale of the enterprise.

A more effective means was the combination of several similar enterprises into one, which was achieved either through the purchase by one person or through consolidation.

During the last three decades there have been many cases of such consolidation. Some of these have proved sufficiently solid, and are in existence even at the present time, while others were ephemeral and disappeared without leaving a trace. Others still are being established at present, and the future will show what their fate will be and the influence they will have on their respective branches of industry.

Among cases of transfer of manufacturing enterpriess from one owner to another, those are particularly interesting which record the acquisition of an industry by a dealer in or exporter of the corresponding product. The contrary interests represented by trade in raw materials and the export thereof thus become one with those of the manufacturer; otherwise these interests would have been forced to find a peaceful solution outside the firm. The resulting natural endeavor has been to exchange the exporta-tion of raw materials for export of the finished product.


Head Quarter of Chinese Eastern Railway Guard, Harbin

The export of finished products may be regarded as the third phase in the development of Manchurian manufacturing industries. This phase appears to us to be the natural end for the development of the entire economy of North Manchuria as a whole.

It should here be remarked that the division into three phases established by us refers only to the interior organic process of industrial evolution in North Manchuria. Like every other scheme, it differs by its apparent simplicity to a certain degree from actual conditions. The history of the growth of the various branches of manufacturing industries, as a matter of fact, presents rather a complicated picture, rich in important changes and deviations from the main road, which will be noticed when each of them is treated separately.

It would appear that if the export of finished products of North Manchurian industry were placed on a permanent and solid footing this would mean that it had reached its highest degree of development, where it was on a level with industries in other parts of the world. Rather it would only be necessary for this industry not to lag behind in technical progress and to improve the economic organization of the industry, while it at the same time would have the advantage of an abundance of labor, the lack of which is the greatest handicap to European and American industries.

North Manchurian manufacturing industries, however, have not attained this high level, and it is doubtful whether this will be reached in the near future.

Manchuria in general and North Manchuria in particular, is predestined to play a subordinate role with relation to the world market, as a more or less important base of supplies. Manchuria is primarily an agricultural country, and for this reason fitted for its role of a granary.

The manufacturing industries of North Manchuria are of dual importance to the world market. First, they supply local requirements, thereby impeding the importation of manufactured articles from abroad. Secondly, Manchurian manufactured articles in the world market have up to the present time been an improved method of transporting the finished product rather than the raw material, and they have by no means constituted any successful competitor to world industries. It is worthy of note that up to the present time flour mills and bean oil mills, the most important industries in North Manchuria, are enjoying in their export transactions the benefit of lower freight rates on the C. E. R., than those granted to exporters of wheat and beans.

The exportation to Europe of bean oil or flour, for instance, may be looked upon as a less expensive means of transporting beans or wheat.

The World War

The world war proved this trait of Manchurian industrial export with particular clearness. Even as in Russia, where an unusual demand for manufactured articles during the war required manufacturers to remove from their warehouses, where useless junk was kept, machinery which had already outlived its time and once more put the same to work on an equal footing with equipment of modern pattern, so the war forced countries to step out into the industrial arena which under normal conditions, because of the standard of their technical development, could not even have thought thereof. The deciding factor was not the perfection of the product, but conditions of transportation. For this reason Japanese piece goods conquered the entire Asiatic market; they reached as far as the Ural, and, as military goods, to the very city of Lodz. For the same reasons there was created an export of bean oil from Manchuria to Europe and America, Manchurian flour was sold in the market places of Irkutsk, and so forth. The world war brought back to Manchurian manufacturing industries a revival of the glorious period of the Russio-Japanese War, with the only difference that the same was played on a broader field and ended with complete ruin for individual manufacturers.

It is a well known fact that one of the principal reasons for the local industrial catastrophe was the rapid depreciation of Russian banknotes, as a result of which manufacturers, similarly to other holders of Russian paper currency, found themselves without funds. It is natural that the collapse of the Russian currency was a particularly hard blow to enterprisers of Russian nationality. Many of them were forced to sell their manufactories to their more fortunate foreign competitors. The depreciation of the rouble

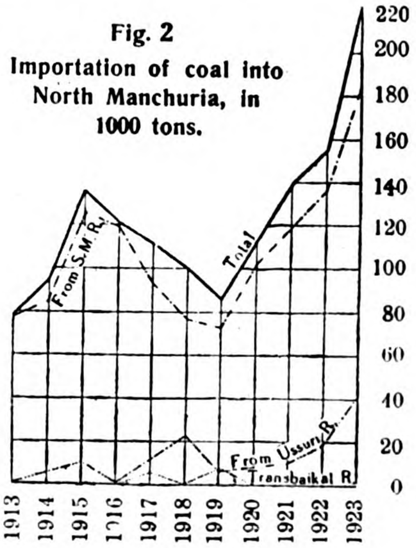
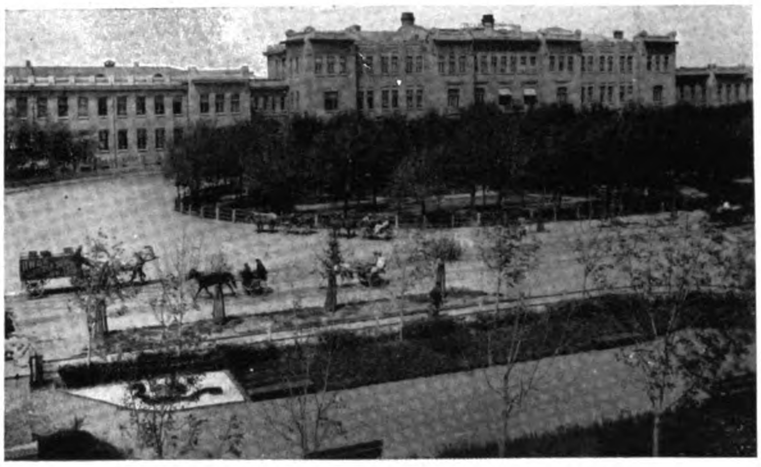


Fig. 2
Importation of coal into North Manchuria, in 1000 tons.



General Office of Chinese Eastern Railway, Harbin

Scene of New Street in Fuchiatien (Chinese Quarter of Harbin)

resulted in the fall of Russian industry from its recent dominating position in North Manchuria. At the present time Japanese or Chinese undertakings are equal, and even larger, in number. These latter, who work on a Mexican dollar basis, in their turn suffered serious losses through the fall in the silver exchange.

The entire manufacturing industry in the country became aware, with the end of the great war, that the basis upon which future successes of the export of finished products from North Manchuria was built, was not sufficiently solid. With the return of normal conditions of transportation and the gradual return to pre-war prices, North Manchuria once more had the opportunity to realize that the potential productivity of its manufactories was considerably in excess of the consumptive capacity of markets available to the same.

The last three years may be characterized as a period of acute crisis for the manufacturing industry in the Railway Zone, a crisis which is not as yet entirely past. This crisis indicates that the cycle of industrial development in North Manchuria is far from completed. On the one hand, the principal existing industries (flour milling, bean oil milling and distilleries) have not as yet found a proper means of exporting their products, and suffer from over production. On the other hand, the manufacturing industry has not as yet come to include all of the raw materials available in the country, and the latter are exported from Manchuria in order later to return in the form of finished products (cloth made from Mongolian wool, matches from local aspen, etc.). In the meantime Tientsin and, particularly, Shanghai, have proved the possibility of satisfactory working even with imported raw materials.

It may be expected that new branches of manufacturing will be created when, with the passing of the present crisis, there will be a return to intensive manufacturing activity, when an accumulation of capital has become possible, when there is available a supply of trained industrial workers, when connection has been established by manufacturers with foreign markets, and when a closer acquaintance has been gained with products made abroad.

In this connection the establishment of large industrial centres is of extreme importance.

Manufacturing Centres

A manufacturing enterprise creates others in close proximity, partly of the same kind, partly dependent upon or assisting the former. Near flour mills, for instance, there appear foundries, mechanical workshops, bag factories, and others. The growing center, with its increasing population, at the same time begins itself to play the role of an important market for fundameantal articles of manufacture, and serves as a motive for the establishment of new manufactories, small at first, rather in the form of workshops, but later growing into larger enterprises, in both cases conforming with local demand.

In the C. E. R. Zone, Harbin, with the adjoining Fuchiatien and suburbs, is the largest and most important centre of this kind. All of the large firms engaged in the export of North Manchurian products make their headquarters here. Harbin also includes the greatest number of flour mills, bean oil mills, distilleries, mineral water plants, soap factories, etc.

Compared with Harbin, all other points in the C. E. R. Zone, are, industrially speaking almost negligible.

Kwanchengtze may be considered among the larger of these, if Changchun be included in this point. In fact, however, Kwanchengtze-Changchun is less the terminal station of the C. E. R. than the beginning of the South Manchuria Railway.

Among industrial centres actually within the zone of the C. E. R., besides Harbin, station Anta attracts the greatest attention. Within recent years, in spite of unfavorable freight rates, there have been constructed at this station two flour mills, and six bean oil mills, while other similar enterprises are planned.

Industrial points which recently have come into existence, are, among others, station Mankow with two bean oil mills, Mutanchiang and Makiaoho, where, in addition to bean oil mills already operating, it is planned to construct flour mills.

Other points, such as Fularki (Fuliaerhti), Ashiho, Imienpo, Harbin, and Shwangchengpu, are older . These already have an industrial history, with periods of prosperity and of decline. Flour mills operated here as early as in 1903-1904. Here are also bean oil mills, distilleries, and mineral water plants (Fularki), beet sugar and refined sugar factories (Ashiho) and a brewery (Imienpo).

A general characteristic of the above points is that they are all engaged in the preparation of farm products : beans, wheat, barley, kaoliang, corn, beetroots, etc.

An unimportant exception is the glass factory at station Imienppo.

The most western points of the C. E. R., such as Manchouli and Hailar, are centres for the preparation of animal preducts : lard, hides and wool.

At Manchouli station there are two soap factories, and a tannery was opened in 1920.

At Hailar, in addition to soap factories, there are tallow melting and casing plants. There is under construction a comparatively large tannery, together with a sheepskin coat and feltboot factory. At Hailar also, as the centre of the wool trade in the C. E. R. Zone, there operate periodically seven wool washing plants.

Station Suifenho (Pogranichnaia), the most easterly point on the C. E. R., does not shine by its industrial development. Besides a small flour mill, industry is here represented by a brewery, a mineral water plant and two kwass breweries.

Compared with the insignificant industries along the line of the C. E. R., the Harbin centre appears enormous. With the only exception of wool washing plants, there are representatives in Harbin of all branches of industry existing along the line, and Harbin also overshadows the industry along the line with repect to the number of enterprises and their output.

For illustrative purposes we give below data concerning the more important industries.

There exist at present :

	In Harbin.		Along the line.		Total.	
Flour mills	26	68%	12	32%	38	100%
Bean Oil mills	45	75%	15	25%	60	100%
Distilleries	6	75%	2	25%	8	100%

The importance of the different points with regard to the flour milling industry and figures below relative to shipments of

flour on the railway during the period from 1911 to 1923 (in tons) are interesting:

	Fularki	Tsitsihar	Anta	Harbin Junction	Ashiho	Imienpo	Hailin	Mutran-chiang	Shwang-chengpu	Other Stations	Total
1911 ..	15,350	—	—	36,500	0,710	0,400	5,600	0,940	4,870	1,100	65,470
1912 ..	0,770	—	—	33,310	0,480	0,050	5,130	0,890	0,400	1,260	42,290
1913 ..	10,660	—	—	18,980	0,270	0,050	4,560	0,160	0,100	1,310	36,090
1914 ..	21,060	—	—	30,060	0,530	0,180	3,650	0,450	0,050	1,240	57,220
1915 ..	11,450	—	—	33,110	0,030	0,320	2,890	0,920	—	1,290	50,010
Average per year	11,860	—	—	30,390	0,400	0,200	4,370	0,670	1,080	1,240	50,210
1916 ..	0,520	0,050	0,020	41,730	1,520	2,240	2,680	0,680	1,920	0,790	52,150
1917 ..	1,240	0,500	0,050	61,260	1,450	2,050	5,290	2,290	6,630	0,870	81,630
1918 ..	1,270	0,550	0,050	50,920	1,560	0,550	6,550	3,890	7,680	1,150	74,170
1919 ..	0,740	0,550	2,730	80,340	1,710	0,050	6,000	3,410	5,560	2,060	103 150
1920 ..	1,020	0,890	2,320	100,890	2,210	0,450	5,850	2,420	7,240	2,370	125,660
Average per year	0,960	0,510	1,030	67,030	1,690	1,070	5,270	2,540	5,800	1,450	87,350
1921 ..	0,420	0,580	0,520	101,240	0,790	0,160	6,060	1,080	4,970	2,240	118,060
1922 ..	0,750	1,300	0,710	69,920	0,170	0,370	4,240	0,650	3,400	0,780	82,290
1923 ..	0,600	2,150	0,240	71,810	0,020	0,620	3,470	1,500	3,380	1,280	85,070

Beside Harbin, Hailin shows more or less important shipments. The adjoining station, Mutanchiang, shipped flour emanating from the city of Ninguta, which comes within the sphere of influence of this station and which includes up to five Chinese mills.

The general growth of the industry during the different years beginning with 1911, is indicated in Fig. 1 showing the shipments of flour and beancakes during a number of years.

This diagram together with the below data relative to shipments of beancakes on the C. E. R., serve to illustrate the situation of the bean oil industry along the line of the Railway:

Tons

	Tsitsihar	Anta	Mankow	Harbin Junction	Ashiho	Imienpo	Hailin	Mutan-chiang	Other Stations	Total
1911	—	—	—	1,320	7,710	0,160	0,730	2,150	3,810	15 880
1912	—	—	—	3,610	5,810	0,100	0,480	1,500	1,730	13,230
1913	—	—	—	9,100	4,230	0,100	0,730	1,420	2,770	18,350
1914	—	—	—	15,370	5,500	0,110	0,450	1,370	3,890	26,690
1915	—	—	—	51,030	6,610	0,270	2,620	4,290	4,080	68,900
Average per year ..	—	—	—	16,080	5,970	0,150	1,000	2,150	3,260	28,610
1916	—	—	1,180	59,240	7,230	0,240	1,740	2,470	0,900	73,000
1917	0,050	0,030	0,770	111,450	7,060	0,520	1,260	1,870	1,230	124,240
1918	—	—	2,450	66,230	1,760	0,650	0,760	1,770	0,390	74,010
1919	—	0,110	2,060	82,920	2,480	1,180	4,270	5,770	0,730	99,520
1920	0,210	1,000	2,400	81,240	0,840	0,790	2,370	5,600	3,230	96,710
Average per year ..	0,060	0,230	1,770	80,210	3,870	0,680	2,080	3,500	1,100	93,500
1921	0,920	9,600	2,630	115,270	1,470	2,210	0,950	5,600	1,210	139,850
1922	0,490	13,790	0,740	180,890	5,250	1,160	0,390	3,480	1,500	207,580
1923	3,490	17,690	1,080	49,470	6,140	1,880	0,680	4,550	12,570	297,560

Shipments of beancakes from Harbin, similarly to shipments of flour, consequently represent more than 80 per cent. of the aggregate shipments of these products.

There is no necessity for discussing the reasons for Harbin's industrial growth. The central situation of the city at the intersection of railroads, and the availability of water routes (the Sungari River) to enormous farming districts which harvest many millions of tons of beans and wheat, and the large population creating local demand, are sufficient causes therefor.

The reasons for the poor development of industries along the line of the Railway, on the other hand, present a greater interest. Enterprises there, no less than at Harbin, are at the very point of supply of the corresponding raw material (grain), which is the principal reason for their having been located there. What then is the reason for the unfavorable situation of industry along the line, and what is the obstacle to its growth?

The answer is to be found, first of all, in the conditions accompanying the disposal of the products.

Beancakes are almost exclusively an article of export. During the years of the war, when the bean oil industry really grew up, the export along the C. E. R. moved in a southerly direction. Harbin, thus, found itself closer to markets than did the western and eastern sections of the Railway, and it was found more profitable to erect factories at Harbin than along the line.

The principal market for flour, again, is South Manchuria, and also in this case Harbin has the advantage of cheaper delivery.

Harbin itself is the principal market for other articles of manufacture.

Another question of very definite importance when the matter of the locality for manufacturies along the line is considered is that of fuel.

Fuel Supply

The question of fuel supply is a very difficult one for manufacturing industries in North Manchuria.

In spite of the abundance of forests in the country, and in spite of the existence of coal fuel mines and still untouched deposits, North Manchurian manufactories work largely not on local fuel but on fuel imported from South Manchuria, namely Fushun coal. The industrial enterprises at Shwangchengpu, Harbin, Ashiho and Anta are tireless vassals of Fushun, and they represent nine-tenths of all North Manchurian industries. The balance principally burn wood and, in less degree, in the west, Chalainor and imported Transbaikal coal, and in the east, Ussuri and Suchan coal.

The below table gives an idea of the quantity of coal consumed by private enterprises at the Harbin junction (in tons):

Coal Received at Harbin Station (in tons)

In 1906 ...	2,100	In 191 ..	49,790	In 1916 ..	103,660
,, 1907 ..	0,760	,, 1912 ..	67,180	,, 9 7 ..	118,180
,, 1908 ..	6,920	,, 1913 ..	64,440	,, 1918 ..	100,970
,, 1909 ..	14,270	,, 1914 ..	76,160	,, 1919 ..	87,520
,, 1910 ..	31,240	,, 1915 ..	115,220	,, 1920 ..	91,350
Average per year ...	11,060		74,560		100,340
In 1921 ...	117,060	,, 1922 ...	138,210	,, 1923 ...	168,580

In order to judge of the importance of these figures they are compared below with the total cartages of coal on the C. E. R. according to the commercial tariff:

Average per year during 5-year period.	Total carried Tons	Of this there was received at Harbin Tons	% of total
1906—1910	14,060	11,060	79%
1911—1915	110,060	74,560	68%
1916—1920	135,020	100,340	74%
In 1921	147,320	117,060	79%
,, 1922	190,590	138,210	72%
,, 1923	264,750	168,580	68%

Finally, the origin of the coal is seen from the below data which give the import into North Manchuria of coal for the private market as carried on the C. E. R. in tons (Fig. 2):

	Total imported	From the Ussuri Rway	From the Trans-baikal Rway	From the South Manchuria Rway	
1913	78,760	0,190	0,180	78,390	99,5%
1914	91,200	5,130	0,180	85,890	90,4%
1915	136,846	10,110	0,770	125,966	92%
1916	120,726	1,400	—	119,326	99%
1917	113,459	11,310	5,400	96,749	85%
1918	100,990	23,190	0,190	77,610	77%
1919	87,860	5,810	7,080	74,970	85%
1920	111,375	8,710	0,020	102,645	92%
1921	129,470	10,020	—	119,450	92%
1922	157,930	18,040	—	139,890	89%
1923	225,144	40,190	—	184,954	82%

Fushun coal, imported via the South Manchuria Railway, on an average during the period from 1913 to 1923 represented 71 per cent. of the total quantity of coal carried on the C. E. R. and 96 per cent. of the consumption of Harbin.

Before the war Fushun coal was sold at Harbin at the rate of from $4.30 to $4.05 per ton. Judging from quotations on the Harbin Exchange, however, the price of coal by 1920 had reached the unbelievable figure of $30 per ton.

Beginning with the month of January, 1920 the price gradually dropped until it finally became firm, and remained at that level for two years, at about $10 per ton, which nevertheless is more than double the prewar price.

Prices of Fushun coal (2nd grade) at Harbin according to quotations of the Harbin Exchange (in Dollars per ton):

Average during	1920	1921	1922
January—March	26.04	12.40	11.47
April—June	20.15	11.47	10.89
July—September	15.19	9.22	10.40
October—December	14.88	9.92	10.40

It is, therefore, not surprising that Harbin mills and other manufactories, burn, beside refuse of their own production, bran or beancakes under their boilers depending upon the price of the one or the other.

Since the second-half of 1921 Harbin has in increasing measure turned to Suchan coal. This coal, the better grades of which

have heating properties which exceed the Fushun coal by from 16 to 18 per cent. might, if imported in sufficient quantities, cause serious competition to Fushun and deprive the latter of its monopolizing domination. However, the general unsatisfactory condition of industries of every kind in the Maritime Province of Siberia has up to the present time acted as a deterrent to the development of such import.

Insofar as local industries in the C. E. R. zone disposing of their products on the local market are safeguarded, by high railway freight rates, against articles from abroad, the cost of fuel remains immaterial to local manufacturers. This is a matter of greater interest to the consumer of the manufactured articles, who is compelled to cover the superfluous cost of production from his own pocket.

In the case of export, on the other hand, the low cost of fuel becomes one of the essential conditions of success. In any event, the bean oil and flour milling industries suffer from the competition of these industries in South Manchuria very largely because of the fact that the latter have the advantage of cheaper fuel.

In reverting to the distribution of industries along the line of the railway, it should be noted that the cost of fuel is highest at the largest grain centres. Anta, for instance, which ships from one-quarter to one-third of the total quantity of wheat transported on the C. E. R., and one-seventh to one-eighth of the total quantity of beans, receives its coal from Fushun, and pays for the transportation thereof about 90 gold cents per ton more than does Harbin.

There is, however, a still greater difficulty which confronts the manufacturer along the railway line—and that is the supply of labor.

Labor

The enterprises operating along the railway line are in a worse position than those at Harbin also as regards the labor question. The above mentioned Anta enterprises, for instance, are at times obliged to contract for labor in the south of Manchuria, and to assume the cost of transporting such laborers from Yingkow and Dairen and back, which is very burdensome in view of the non-permanent character of the work. Harbin, on the contrary, has an abundant supply of coal labor, and the manufacturer here is subject to no long lasting obligations.

The principal contingent of laborers, naturally, is composed of Chinese. In enterprises belonging to Chinese they also occupy the places of employees, and it is only as an exception, particularly when a new enterprise is organized or for the sake of interior relations, that Russians are engaged. In enterprises of mixed ownership and those of purely Russian ownership, the majority of employees holding responsible position are Russians.

At the introduction of the manufacturing era the question of a supply of skilled labor was rather acute. Such workmen demanded high wages and were rare.

Now, because of the adaptability of the Chinese to new forms of labor and, partly, because of the Russian refugees, the situation has changed, and there is a plentiful supply of workmen and employees of every specialty in the market.

In the different industries and professions, and even in separate manufactories of similar nature, the wage scale is on an unequal basis.

As an example of the difference in wages paid at the flour mills in the C. E. R. zone we give the following figures covering regions where labor is paid comparatively well and where it is comparatively poorly paid (wages per month):—

	High	Low		High	Low
Miller...	$150	$62.5	Roller	$ 15	$ 8.5
Machinist	150	30.0	Oiler	15	8.5
Machinist's helper ...	75	17.5	Stoker	15	8.5
Thresher	20	17.5	Metal worker's helper	7.5	5.0
Packer	20	8.5			

It is possible, nevertheless, to establish a certain average of pay for unskilled labor. In Harbin this ranges from 4 to 8 dollars per month, including board and lodging, while it averages as high as from 10 to 15 dollars per month without board or lodging.

With the exception of certain Russian enterprises, the employer assumes no additional expenditures, such as medical assistance, insurance, etc.

The relation between workmen and employers may be characterized as one of absolute non-interference. With the exception of certain measures taken by the City Council relative to public sanitation, the situation of the workmen is regulated by no rules or standards. Besides, under the conditions surrounding the present legal status of the C. E. R. zone, the introduction of labor laws of any kind whatsover would meet with invincible difficulties.

The curious trait of Chinese organizations whereby employees share in the profits, in a measure counteracts the lack of regulations and makes the interest of the employer also the personal interest of the employee.

Generally speaking, manufacturing enterprises are operated continuously, according to the Chinese calendar cycle, without closing down even for Sundays. If stoppages for repairs, cleaning of boilers, and holidays are deducted, the working year contains approximately 300 working days. (In Chinese enterprises up to 350 days, if account is not taken of stoppages due to purely technical reasons.)

The work is performed by double shifts of laborers relieving each other every eight hours. The working day of the individual laborer thus includes 8 hours one day and 16 hours the next. In general it consists of 12 full working hours.

Actually, however, manufactories have within recent times been operated with frequent interruptions and often closed down entirely due to the unsatisfactory general situation. The manufacturer is nevertheless subject to the payment of certain overhead charges even during the time his plant is closed down, inasmuch as he is forced to carry part of his staff on his payroll, while the workman, on the other hand, is never sure of permanent employment.

Inasmuch as we have dealt with the legal status of the workmen, which, from a European point of view is quite abnormal but yet natural because of conditions existing in China, it is not possible to pass by in silence the question of the legal status of the industries themselves.

The Legal Status

The basic and most characteristic peculiarity of the present state of affairs is instability and the resulting uncertainty as to the future and lack of faith in the same. The railway zone reflects all of the complicated international relations. The situation here is affected in the same measure by an edict from Peking and by resolutions of the Washington Conference. The very land upon which flour millers and manufacturers have erected capital buildings is not permanent property, but is registered in the name of owners with the proviso that it may be leased to other persons should circumstances so require.

Another, no less harmful characteristic of local conditions for the development of industry, is the unequal right enjoyed by the different nationals. While the Japanese and other foreigners are subject to the laws of their respective governments, Chinese, and now also Russian manufacturers, are subject to local laws. Definite civil procedure is the fundamental condition of all industrial activity. Without this there can only be a question of speculation. Inequality with regard to the legal status of manufacturers has a direct effect upon the cost of production, and for this reason it places the different industries upon unequitable bases of competition. While Russian enterprises within the limits of Harbin pay taxes to the city, the Chinese, in addition, pay taxes also to the Chinese Government, but, non-Russian foreigners refuse to pay any taxes whatsoever, with the exception of Customs duties.

The manufacturing industry has nevertheless succeeded in becoming an important factor in the economy of North Manchuria. The value of the aggregate annual output of manufactories of European type amounts to 25 million dollars. They throw yearly upon the home market and for export hundreds of tons of flour, beancakes, oil and other products, which, next to cereals, are the most important classes of freight carried by the Chinese-Eastern Railway.

New Motorship for Deli-Straits-China Line

The Netherlands Royal Packet Company have ordered from The Netherland Shipbuilding Company a twin-screw cargo and passenger motorship, of about 4,650 gross tons and 8,050 tons displacement on a mean draft of 20-ft. to be propelled by Workspoor Diesel engines of about 4,660 i.h.p.; also a smaller ship, to be fitted with Schelde-Sulzer Diesel engines and to be built by the Schelde Royal Shipbuilding Company. The ships have been specially designed for the owners' Deli-Straits China service, and will be of 390-ft. length, 52-ft. beam, with 27-ft. 6-inches depth.

Forests of the Russian Far East

By Ivan Bushkoff

AMONG the numerous natural resources of the Russian Far East one of the most prominent places is held by the enormous reserves of extremely varied and valuable lumber. According to data supplied by the Russian Far Eastern Forestry Department the following are the areas covered with forests :—

Province :	Total Area In Dessiatines *	Area Suitable for Exploitation
Maritime	40,904,000	26,467,500
Amur	34,841,000	11,792,500
Kamchatka ...	10,000,000	487,000
Saghalien ...	2,500,000	2,500,000
Total	88,295,000	41,247,000

These figures do not include the forests of the Transbaikal and the Yakutsk region and those along the whole coast of the Okhotsk and Behring seas of an area of about 200,000,000 dessiatines.

Aside from these forests there are those which before the revolution were assigned to the Cossacks and to emigrants from European Russia. They cover an area of about 10,000,000 dessiatines. The greater part of these forests are also suitable for exploitation. Little information is available with regard to them as well as about the free forests † in the Amur province.

It should be mentioned here that the former Russian Government as a rule allotted land to emigrants from European Russia along the valleys of rivers, narrow valleys and gulleys being condemned for purposes of settlement. So far emigrants have not penetrated into the northern districts of the Amur and Maritime provinces and the forests there are in their primitive state and in future will yield the bulk of exportable timber.

Until 1920 the selective method of cutting lumber was largely used in the Russian Far East, i.e. the lumberman would cut only such trees as he required, leaving the other trees to grow.

There are considerable areas covered with virgin forests in that country, it is only necessary to find adequate means of transportation and to exploit the resources judiciously.

The principal forests are situated in the basin of the river Amur and along the Sikhota Alin mountains.

The forests in the Russian Far East are mixed, abietic species predominating in some parts, while in other districts leafy species form the bulk of the trees. The principal trees of the abietic species are cedar, larch, fir, spruce and pine, and the leafy species are represented by oak, ash, linden, aspen, birch, walnut, maple and velvet-oak.

In view of the incomplete survey of the forests in the regions adjoining the Amur river these cannot be divided into definite forest zones, it is only possible to discuss the forests in the following principal areas :—

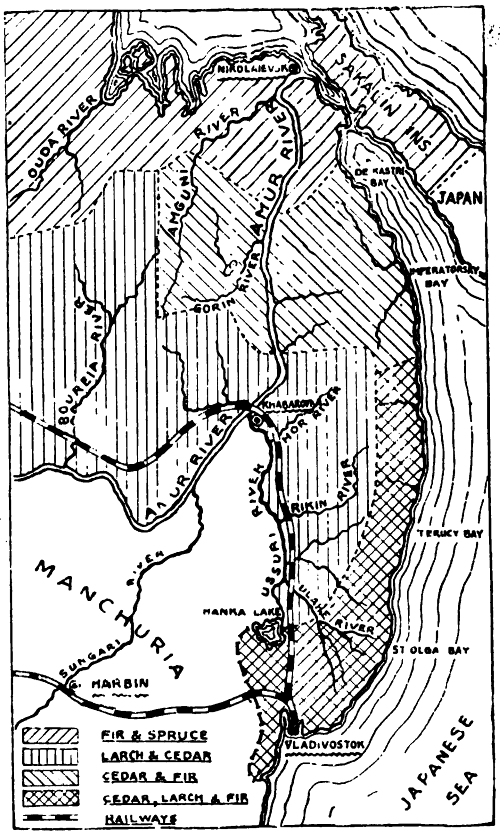
(1) The Lower Amur and its tributaries,
(2) The coast of the Russian Far East, and
(3) The South Usuri district.

The forests in the Lower Amur are situated between the 49° and 54° northern lattitude and the 133° and 144° eastern longitude. They are bordered from the north and the north-east by the Gulf of Tartary and the Okhotsk Sea, from the east by the Sikhota Alin mountains, from the South by the divides of the rivers Nemptu, Onnoy, Kura and Gorin, and by the Little Khingan and the Dusse Alin mountains from the west.

The principal species in the Okhotsk and Kamchatka provinces along the coast of the Russian Far East are fir, spruce, and larch, then comes birch, aspen, ash and oak, whereas in the Nikolaevsk and adjacent districts the dominant species are fir and spruce. The trees are from 150 to 200 years old and one dessiatine contains upward to 40 cubic sajene ‡ of timber.

Owing to a considerable density of the foliage in these forests the sun does not penetrate to the undergrowth of young fir and spruce and consequently it grows very slowly and the trees reach a diameter of 8 inches about 20-ft. from the ground only after, say, 150 years.

Spruce is somewhat inferior to fir. It often decays and healthy trees with a diameter of 10 to 12 inches about 4-ft. from the ground are rather scarce.



These forests cover about 75 per cent. of the whole area.

With the rise of the level of the ground the fir and spruce forests begin to change in their character. The effect of the winds begins to tell, the trees do not grow very tall and the tops are frequently bent.

Lower down in the marshy plants fir and spruce are replaced by larch and sometimes one finds large tracts of land covered with abietic species which, although growing slowly, are quite healthy. Mixed growths of fir, spruce and larch, the latter predominating, occupy the northern slopes of the low mountain ridges. There one finds almost exclusively larch with a sprinkling of fir and spruce. Larch grows rather slow and reaches the thickness of 8 inches about 24-ft. from the ground after 120 years.

The average quantity of timber on one dessiatine of larch is about 45 cub. sajene. The trees look very good, they are healthy and the trunks are clear of branches, the age varies from 150 to 200 years. In places where the soil consists of clay one finds growths of larch. The trees are from 250 to 300 years old and one dessiatine would yield about 30 cub. sajene of timber.

Some areas are covered exclusively with birch with fir and spruce here and there. The age varies between 100 and 140 years and one dessiatine would yield about 25 cub. sajene. Clean growths of aspen are also found covering vast areas. This tree would yield about 30 cub. sajene of timber per dessiatine. The age is between 100 and 150 years, the trunks are quite clear and are 10 to 14 inches thick about 4-ft. from the ground. Aspen which grows in the mountains is of inferior quality and not suitable for commercial purposes.

Oak is very scarce owing to adverse climatic conditions. It is to be found only in small quantities on the southern slopes of the mountains and one dessiatine does not yield more than 5 cub. sajene of timber.

This about completes the description of the forests in the Lower Amur. Further, beginning from the basin of the river Gorin,

* One Dessiatine is equal to about 2. 7 acres.

† Forests which were controlled by the Department of Government Lands, but were available Free to any Russian requiring timber for his private use.

‡ In Russia a distinction is made between a cubic sajene of timber and a cubic sajene of firewood, the former being 220 cub. feet and the latter representing a stack of 343 cub. feet.

which passes through the northern boundary of the distribution of cedar, other species of trees are to be found.

The river Gorin is one of the largest tributaries of the Lower Amur. Up to some 40 miles from its confluence with the Amur the river flows to the north-west, but at its confluence with the river Bakhtar she strikes a western course. The forests along the lower course of the Gorin are formed principally of cedar between 250 and 300 years old yielding about 45 cub. sajene of timber to the dessiatine. The cedar forests along the southern section of the basin of the river Gorin make a very favorable impression. Some trees are upward to 120-ft. tall and have a mean diameter of 20 inches 4-ft. from the ground. Cedar here grows on the southern slopes of the hills and is intermixed with fir and spruce.

Fir in the basin of the river Gorin is much better than in the Okhotsk-Kamchatka region. The trees are fuller and the trunks are clear from branches. A sprinkling of cedar is always to be found in these fir forests. The age of fir here is between 150 and 200 years and one dessiatine would yield about 45 cub. sajene of timber. Fir predominates over a vast area, although one finds cedar and spruce, the latter yielding much better timber than spruce of the Okhotsk-Kamchatka region. At higher altitudes and towards the Sikhota Alin mountains the proportion of spruce increases considerably.

Firewood Market, Harbin

Further down south the character of the forests changes and among cedar growths one finds ash, velvet-oak and birch.

Larch is to be found everywhere in growths of fir and spruce. Its age ranges from 200 to 250 years. In valleys one finds areas covered exclusively with larch 150 to 200 years old with an average yield of 30 cub. sajene to the dessiatine. The summits of mountains are covered with spruce, fir, cedar and larch 200 to 250 years old.

The banks of the larger rivers are covered with abietic species among which ash, elm and birch predominate. Now and again one finds there cedar, fir aspen and poplar. These forests could yield an average of 40 cub. sajene of timber to the dessiatine.

The forests along the Russian Far Eastern coast, extending from Imperatorski Bay to Vostok Bay and inland as far as the Sikhota Alin mountains, may be devided into three zones :

(1) The northern zone, extending from Imperatorski Bay to Ternei Bay, in which fir and larch predominate,
(2) The central zone, extending from Ternei Bay to Olga Bay, in which cedar and fir predominate, and
(3) The southern zone, from Olga Bay till Vostok Bay, in which abietic species predominate.

In the northern zone the Sikhota Alin mountains are further inland than in the south and the whole coastal zone is intersected by low ridges and broad valleys. The coast and the low hills are covered with spruce with a small proportion of fir. Further inland one finds fir and certain abietic species.

Fir is usually to be found on the slopes of mountains. The average age of the trees is from 150 to 175 years and one dessiatine could yield about 30 to 35 cub. sajene of timber.

Larch grows in the hills. There is always a certain proportion of fir and spruce growing there as well. The reserve of timber is about 35 to 40 cub. sajene per dessiatine. The forests of this zone remind one of the taiga in northern Siberia.

Further to the south the country is more intersected on account of the Sikhota Alin mountains running closer to the coast. Here fir and spruce forests extend further inland as far as the slopes of the Sikhota Alin mountains. Larch here covers only small patches nearer the water divide. The valleys are covered with mixed cedar and fir, but one also finds considerable areas on which cedar alone grows. The valleys of the rivers are covered with abietic species, ash and birch predominating. A narrow strip along the coast is quite barren. Further inland come thick growths of aspen and birch with here and there an oak and cedar. In the valleys of the mountains and on the slopes one finds growths of oak 150 to 200 years old. Along the middle courses of rivers, in valleys and depressions, one finds the best mixed growths of cedar. The average cedar here is about 100-ft. tall with a diameter of 15 to 20 inches 4-ft. from the ground. The average yield per dessiatine being upward to 40 cub. sajene of timber.

The southern slopes of the Sikhota Alin mountains are covered with cedar, which yields the best timber available on this coast. Cedar here is from 250 to 300 years old, the trees reach from 100 to 130-ft. in height and have a diameter of 15 to 20 inches at the height of the chest. One dessiatine of cedar here could yield about 40 cub. sajene of timber.

Nearer to the divide fir predominates, but there is also a certain quantity of cedar and spruce to be found. Such forests grow on the higher altitudes of the mountains. In this area vast stretches of land, formerly covered with abietic species, have been destroyed by forest fires.

The southern part of the coastal area, extending from Olga Bay to Vostok Bay is covered with leafy species, however, abietic species are also to be found here further inland and nearer to the mountains. Cedar, with an admixture of about 20 per cent. of fir, grows in patches here and there. The valley' of the rivers are covered with various abietic species with a predominance of ash and linden.

Further inland one finds excellent cedar forests with trees about 175 to 250 years old. The mountains are covered with spruce. Behind the mountains extend the steppes of the Usuri district.

The forests in the South Usuri district contain both abietic and leafy species. Cedar is the principal among the abietic species, then comes fir, spruce and finally larch. Among the leafy species one finds oak, maple, birch, linden, aspen, ash, walnut, poplar and velvet-oak.

The first place among the trees enumerated above, as regards their commercial value, undoubtedly belongs to cedar ; then comes spruce, aspen and ash in the order given. However, these trees are not evenly distributed in this district. Most of the trees are at least 150 years old and about 90 per cent. of the trees are suitable for constructional purposes and may be classed as mature lumber, the remaining 10 per cent. of immature trees falling mostly on leafy species. Considerable areas, which had been devastated by forest fires or an which the trees had been cut, are covered with young growths.

Growths of aspen often contain a certain proportion of cedar, ash, birch and poplar. They contain about 25 cub. sajene of timber to the dessiatine.

One does not find here new growths of cedar in view of the fact that after cedar is cut the ground is usually quickly covered with dense scrub. Some hills on which forest fires had destroyed all the trees are at present covered with birth, but this tree is also to be found in the valleys on the north-eastern slopes of the mountains. Birch here is about 100 to 120 years old and could yield upward to 40 cub. sajene of timber to the dessiatine. A certain proportion of cedar, aspen and ash is also to be found in these birch forests.

Cedar here grows on excellent soil with the result that the trees are very tall and the trunks rather thick and clear of branches to a consideralbe height. They are from 150 to 200 years old, 70 to 90-ft. tall with a diameter ranging from 14 to 20-inches. at the height of the chest. These cedar forests may be divided into three cathegories :

(1) Forests consisting of cedar only. These have an enormous reserve of excellent timber—at least 60 cub. sajene to the dessiatine—about 80 per cent. of which is suitable for cabinet making.

(2) Cedar forests from 130 to 170 years old with an admixture of fir about 100 to 150 years old. The reserve is upward to 50 cub. sajene of timber to the dessiatine.

(3) Cedar forests about 150 to 200 years old with an undergrowth of cedar from 50 to 80 years old. The reserve of timber is upwards of 40 cub. sajene to the dessiatine. The trunks are quite straight and almost every tree could yield two logs 21-ft. long, the first 13 to 15-inches in diameter and the second 9 to 11-inches in diameter at the upper end.

Next in value and quantity comes fir. It covers vast areas nearer the summits of hills and the northern slopes of the mountains. The age of the trees varies from 100 to 150 years and one dessiatine would yield upwards of 50 cub. sajene of cut timber.

Larch grows in large quantities in the valleys of the rivers Iman and Hor. Growths of larch sometimes contain a certain proportion of fir. The average age of larch here is from 100 to 130 years and the reserve of cut timber upward to 50 cub. sajene to the dessiatine. The trunks are quite straight and some trees are 100-ft. tall with a diameter of 25-in. at the height of the chest.

These districts are also rich in leafy species such as oak, ash, aspen, birch, linden, walnut, velvet-oak and maple.

The southern slopes of the hills are covered with oak forests containing a certain proportion of aspen and birch. The age of oak here varies from 120 to 150 years, the trees are from 60 to 70-ft. tall and one dessiatine would yield from 25 to 30 cub. sajene of cut timber.

Different kinds of leafy species, mostly hardwood, cover the wide valleys of the rivers, however, ash is the tree most frequently met with. Its age varies from 100 to 150 years, the trees are 100 to 120-ft. tall and the reserve of cut timber is up to 70 cub. sajene to the dessiatine.

The valleys of the Usuri river and of its tributaries are covered with aspen from 80 to 100 years old with a reserve of upward to 60 cub. sajene of cut timber to the dessiatine. White birch is also to be found here either growing in separate pacthes or intermixed with aspen. The average age is about 100 years and the reserve about 40 cub. sajene to the dessiatine.

However, cedar is undoubtedly the most valuable tree in this region. It is to be found almost throughout the Maritime province with the exception of the Nikolaevsk district in the north. Sometimes one finds specimens 400 years old and 150 -ft. tall, but in general the age of cedar here varies from 250 to 350 years and the trees are from 100 to 130-ft. tall. The diameter is between 15 to 20-inches at the height of the chest. Cedar yields excellent timber and the trees are such that very logs may be obtained. Boards cut from cedar have a pinkish tinge, are easily worked, take paint well, are easily polished up and do not crack. It is excellent timber not only for building purposes but for cabinet making as well. Furthermore this timber is not subject to attacks by insects which is a very important factor in tropic countries. Messrs. Skidelsky Bros., at one time the most prominent timber merchants in the Maritime province, made in 1917 several shipments of cedar to London with very satisfactory results

Larch is to be found throughout the Russian Far East, especially in the northern districts of the Maritime province and in the Amur province. The average age is about 150 years, the trees are between 70 and 100-ft. tall with an average diameter of 12 inches at the height of the chest. Larch is very resinous and hard and is excellent timber for submerged constructions, also for railway sleepers, telegraph poles and piles.

Next in importance after cedar comes fir, which holds promises of a great future. It grows faster than cedar, but is never as tall and as thick. Fir here grows mostly with cedar and spruce.

About 84 per cent. of the whole area described, *i.e.*, 5,000,000 dessiatines, is covered with forests of which 3,500,000 dessiatines are covered with abietic species. The Iman district is richest in abietic species, which cover 73 per cent. of its area. Next comes the Habarovsk district with 58 per cent., then the Nikolsk Usuri district with 47 per cent. and finally the Olginski district with 44 per cent. The most important among the abietic species are cedar, fir and larch. The best and the most valuable cedar grows in the Iman and Nikolsk Usuri districts.

In 1917 the Forestry Department, which controlled the whole of the 5,300,000 dessiatines of these forests, made arrangements to select and cut cedar, fir and larch. It was estimated that upward to 2,000,000, logs could be cut in one year, representing bout 65,000,000 cub. feet of timber. However, the revolution and the civil war made it impossible to carry out this plan. The same reasons were responsible for the shelving of the project of granting concessions, which had been decided upon in 1913.

In 1914 concessions were granted to cut timber over an area of 10,000,000 dessiatines on the coast of the Gulf of Tartary and also on the lower course of the river Amur. The concessionnaires were authorised to cut yearly the following quantity of loge of abietic species :—

Cedar	325,000 logs
Fir and Spruce	900,000 „
Larch	500,000 „
Total	1,725,000 „

This quantity of logs is equal to roughly 40,000,000 cub. feet of timber.

In allowing the concessionnaires to cut this number of logs each year the Forestry Department had in view the preservation of the forests in the Russian Far East, although, strictly speaking, they could have easily made a much larger allowance in view of the fact that owing to favourable conditions the average yearly increase of timber per dessiatine is about 45 cub. feet. It is estimated that 360,000,000 cub. feet a year could be easily cut without in the least threatening the existance of these forests.

Aside from abietic species there are in the Lower Amur enormous reserves of valuable leafy species forming about 25 per cent. of the entire quantity of lumber.

The Provisional Amur Government was the first to take definite steps in 1920 towards grantong concessions. These concessions were in 15 separate lots and were set aside along the coast of the Guld of Tartary, extending from Cape Murashkin to Ternei Bay. The total area was 4,500.000 dessiatines, the allowance 30,000,000 cub. feet of timber a year and the price payable to the Government was fixed as follows :

Cedar	7 gold copeck per cub. foot
Larch	4½ „ „ „ „ „
Fir and Spruce	4 „ „ „ „ „
Firewood	1.50 gold rubles per cub. sajene.

In 1920 and 1921 the Provisional Amur Government succeeded in placing nine of these 15 lots with a total area of 2,600,000 dessiatines and with an estimated output of 17,000,000 cub. feet of timber a year. These lots were taken up by large Japanese concerns requiring wood-pulp for their paper mills. They agreed to pay a price of an average of 50 per cent. higher than was originally mixed by the Government. However, the political events in 1921 and 1922 forced the Japanese to curtail their work and finally to abandon it altogether.

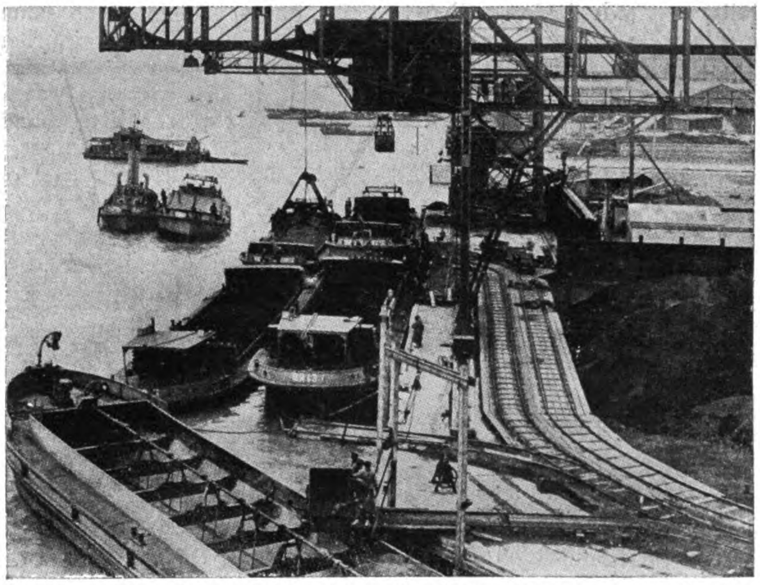
In spite of all the difficulties experienceed in the Maritime province during the recent years, the urgent demand from China and Japan for timber for paper mills and for match-wood as well as for railway sleepers and building materials forced these countries to enter into close commercial relations with the Maritime province. Others countries as well began to take an interest in Russian timber. Even before the war timber was being exported from the Maritime province to Australia, India, South Africa and Britain. Australia alone requires about 20,000,000 cub. feet of timber for cases and this quantity is bound to increase with the time.

The forests in the Russian Far East are especially favorably situated because of their proximity to the Pacific which serves as a connecting link with countries which are at present or at least are bound to become in the not too distant future, the biggest buyers or timber from the Russian Far East.

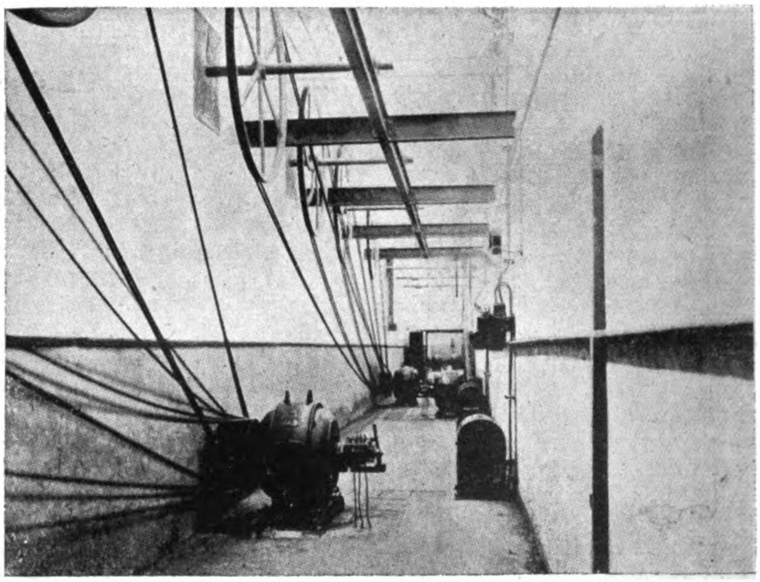
The forests in the Maritime and Saghalien provinces are more favorably situated than those on the Pacific coast of America, which are being rapidly exterminated. There is but little doubt that the time will come when the virgin forests of the Maritime province will play in important part on the world's timber market. Even before the war some of the biggest American lumber companies which are firmly established on the China market, began to realise that the time was not far away when they would have to turn to the vast reserves of lumber—some 100,000,000 dessiatines —of the Maritime, Amur, Saghalien and Kamchatka provinces.

The lower course of the Amur, about where Nikolaevsk is situated, is not accessible to sea-going craft. The river is very shallow and practically all cargo boats have to anchor in midstream and take their cargo from lighters, which makes loading

(Continued on page 224.)



Coaling Plant, Riverside Power Station



5-80 h.p. Motors Driving 1,000 in a Shanghai Cotton Mill Driven by Municipal Electricity Supply

Use of Electrical Machinery in China

G. C. Howard, Acting Trade Commissioner, Shanghai

PROBABLY 90 per cent. of the electric plants in China are used for lighting purposes, the only plants carrying power loads of any importance being located in treaty ports such as Shanghai, Tientsin, Hankow, Canton, and cities like Hongkong, Mukden, and others, where industrial development has made rapid strides and where the majority of China's large manufacturing plants are located.

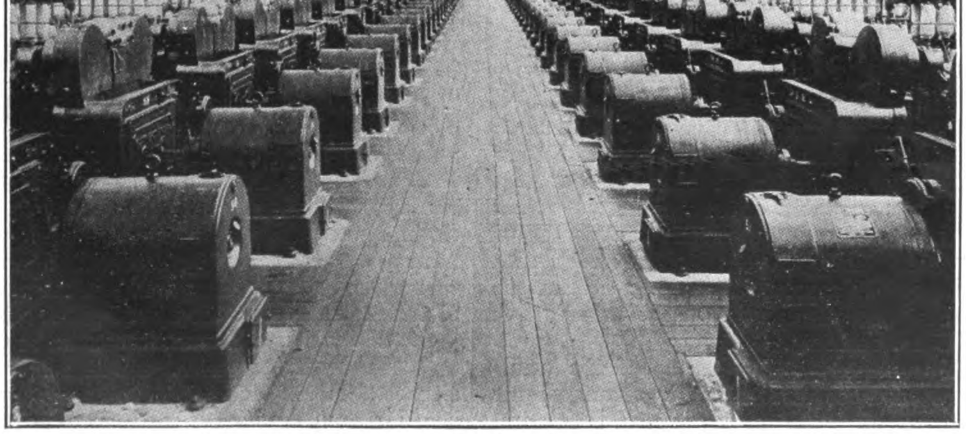
In China it is estimated that there are approximately 285 electric light and power plants with a total generating capacity of about 400,000 kilowatts.

The growth of electric generating plants in China was slow up to 1916. The industry during 1914 gave promise of rapid growth but this was delayed because of uncertainties arising out of the war. From 1916 to 1921, however, it was very marked and rapid. An instance in point is that of the Mukden Electric Light Works, which started 14 years ago with a 350-kilowatt unit, had increased to only 850 kilowatts in 1920, but now has a capacity of 4,000 kilowatts.

Growth of Demand for Electrical Equipment

Prior to 1910 the electric light and power industry in China was in an embryo stage. Practically all the plants which were supplied were of European manufacture and few, if any, turbo generators had been considered for China. In 1910 an American company sold a 350-kilowatt turbo generator to the Mukden Electric Light Co., the first to be supplied to China. Later, in the same year, an order was secured for a similar machine of 500-kilowatt capacity for the Changshun Electric Light Co. At the time of placing these orders they were considered revolutionary, as practically all previous plants installed had been driven by reciprocating engines.

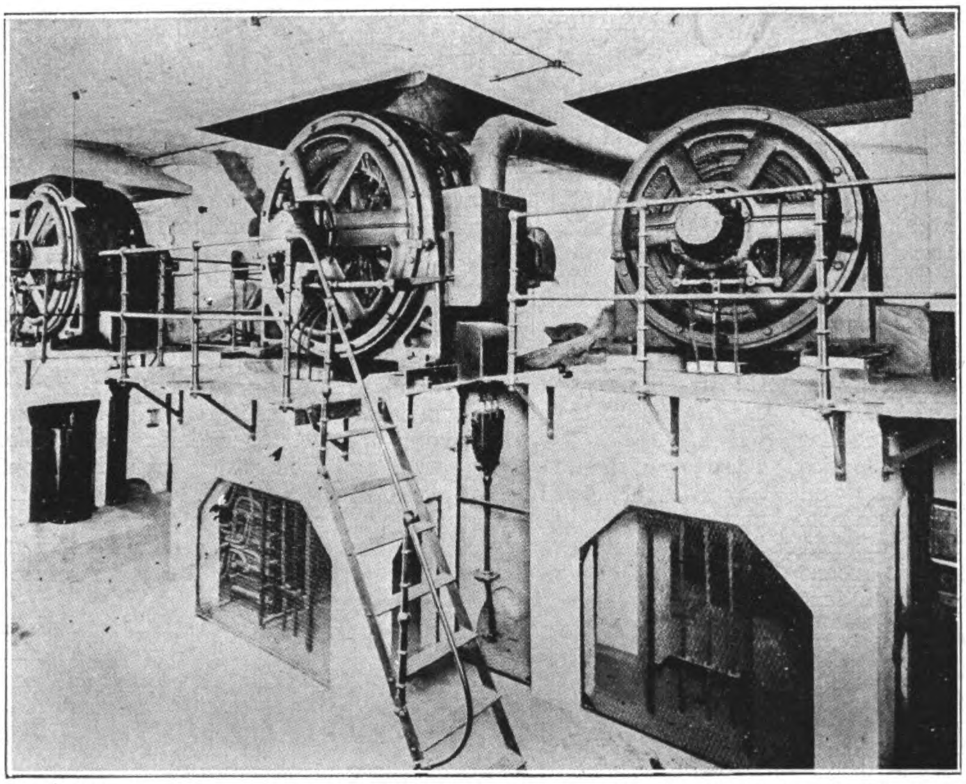
The greatest factor in the increase of electrical power plants has been the growing industrial enterprises in China, particularly for modern cotton spinning and weaving mills, flour mills, vegetable oil mills, and similar industrial plants. A very large part of the output of the Shanghai Municipal Council electrical undertaking is used by local manufacturing concerns. In other sections industrial enterprises have been responsible for the installation of power plants of their own, varying in capacity from 500 to 3,000 or 4,000 kilowatts.



A Shanghai Cotton Mill Showing 104-7½ h.p. Motors each Driving 400 Spindles, Aggregating 41,000 Spindles Driven by Municipal Electricity Supply

Cities Demand Electric Lights

Simultaneous with the demand for industrial machinery, and undoubtedly influenced by the electrical equipment installed in the spinning mills, there was a growth in the demand for electric lighting for cities, large and small, and while the manufacturing industries were confined to districts surrounding the large open



3-6000 volt Motors Aggregating 1,200 h.p. in a Shanghai Flour Mill Taking Municipal Electricity Supply

ports, lighting installations quickly spread over all parts of China from north to south. Electric lighting plants are now to be found in cities many days' journey from the nearest railways and waterways. In many cases these small plants have been sponsored by the local gentry, who, after having visited the outports, desire electric lights in their homes. As a result there are now very few cities or towns in China of any considerable population that are without electricity. A fair number of small units of from 2½ to 10 kilowatts are distributed in locations where central station power is not available.

Cheap Coal and High Power Rates Yield Profit

In most places in China cheap supplies of coal conveniently located are available. Much of the coal is of poor quality, but in spite of this, with anything approaching good management, these small lighting plants pay handsomely, as it is always possible to secure high rates for electric current. Even in locations where the cost of coal is high, many of the small plants are selling current to consumers on a flat rate basis ranging from $1 to $1.50 per 16 candle-power lamp per month.

Certain power plants in China are, however, unsatisfactory from a credit point of view. They are in many cases carrying heavy overloads without the opportunity of shutting down for periodic inspection and overhauling, and are, consequently, in rather poor condition.

In addition to turbo-generato units, a large number of generators, driven by steam and oil engines, ranging in size from a few kilowatts up to 300 kilowatts, are used. A few water turbines of small size are found, but this field is practically undeveloped.

German and Swiss Competition Pronounced

Beginning with 1921, European, particularly German and Swiss, competition began to show itself to a very appreciable degree, offering equipment which, although in many cases considered inferior to American manufacture, was acceptable to Chinese purchasers, particularly at the prices offered—50 to 75 per cent of the manufacturers' selling price of American makes. Swiss manufacturers have taken a very large number of contracts, and the equipment they have supplied appears to be first class in every respect. English manufacturers have supplied material which undoubtedly is first class and the criticism in regard to lower quality and efficiency is directed mostly against German equipment. European manufacturers, their agents and representatives, and particularly Germans, are very anxious to regain this class of business in China. This is evidenced by a large number of representatives now competing for power plant business here. This fact, coupled with the general falling off in demand, due in part to the fall in exchange, has made business for American electrical machinery show a very considerable decrease.

Imports of Generating Equipment Estimated at 50,000 Kilowatts

No definite import figures for the entire country are obtainable because the Chinese Maritime Customs statistics do not make a separate classification for the electric power plants and equipment. The statistics list complete cotton spinning plants, flour mills, and similar apparatus under their respective headings, including in the entry any electrical equipment which may form a part of the shipment. Estimates made from available individual port statistics and by importers place 1923 imports of electric generating equipment of all classes at a total of 50,000 kilowatts. In 1923, under the customs heading "Electrical Materials and Fittings," total gross imports were valued at 8,480,510 taels, of which the United States supplied 1,332,000 taels, Great Britain 1,244,510 taels, Germany 2,064,100 taels, and Japan 2,495,100 taels. (One tael in 1923 was worth $0.8231.)

Operating Practices Unsatisfactory

The upkeep of electric plants is most unsatisfactory from the point of view of efficiency and the manufacturers or their representatives in China encounter considerable difficulty in impressing upon their customers the necessity of making repairs when they become desirable, the tendency among the Chinese being to get along as best they can until they are compelled to make repairs in order to keep the plant in operation. The seller is then called upon to perform a rush job—often at far greater expense to the customers than would have been necessary had the repairs been made in time.

The majority of plants make no effort to secure an evenly distributed load, most of those in interior cities starting at dusk and running until daylight and closing down during daylight hours as no day load is available. Manufacturers are, however, endeavoring to show the operators the benefit of securing a 24-hour load. They have met with success in isolated cases, but the idea is very slow in spreading.

Market Prospects Favor Future Trade

While the continued widespread domestic uncertainty and low-priced European competition prevail, the prospects for any great increase in the sale of American electrical machinery in China can not be expected, but as soon as the unrest ends a considerable market should develop. There will, of course, even during the present period, be orders placed for additions to machinery already installed, which will be largely supplied by American firms, as in certain instances it is difficult for European manufacturers to match up this equipment, and when activity in the cotton spinning and weaving industry is renewed there will undoubtedly be opportunities for the sale, not only of American textile machinery, but of power plant equipment as well. It is usually the case that when the contract for a complete textile mill is taken the order for the power plant goes to the same supplier as does the order for the spinning and weaving machinery. American manufacturers encounter only British competition in this line.

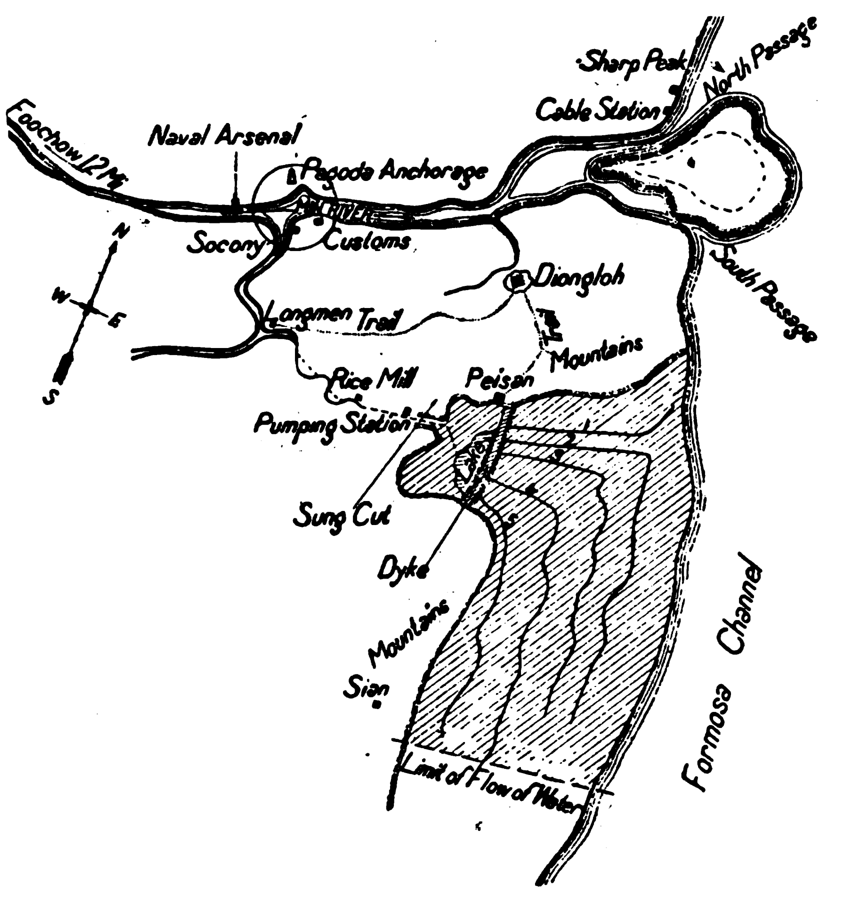
Irrigation in Fukien

In China, where rice has long been grown over a large part of the country, irrigation projects date back hundreds of years, although many of them, unfortunately, have long lapsed into desuetude. New projects and improvements to existing systems are promoted from time to time; hence the following details of a survey made of a district near Foochow by a civil engineer of Shanghai, Mr. E. T. Georges, at the invitation of the provincial authorities will be of interest, seeing that similar problems are encountered generally:

Records do not reach back to the time when this district, which is of 15,000 acres four miles south of Diongloh and 20 south-east of Foochow, was not irrigated. However, while there has been plenty of water available during the early part of the rice growing season, the second crop has seldom had sufficient water, and production in the district, which is one of the richest in the province, has been much less than the land should produce with sufficient water available during a longer period. With adequate means for making water available throughout the rice growing season, tens of thousands of dollars would be added yearly to the income of the inhabitants of the district. A wealthy Ling family in the district is partly responsible for the proposed project, which will be put through when conditions warrant.

The area to be irrigated lies between a range of mountains and the sea. The area is roughly L-shaped, the longer distance being parallel to the sea and the shorter distance terminating at the foot of the mountains at the village of Pehsan.

Practically all of this district is in rice. The area is covered by canals and ditches which are fed by leading to them the run-off from the mountain streams and by draining into them the run-off of excess ground and rain water from the rice fields. These canals are used as a storage basin against a dry period. The canals form a network over the entire area, except that part west of the Pehsan dike. This area is relatively small and is well watered by several streams and a small artificial lake at the outlet of the Shung Cut.



The Fukien Irrigation Scheme

The need of water is felt particularly during the second rice crop. If a fair amount of rain falls in August, and the canals and ponds are filled, something of a second crop is assured. Those fields along the edges and for a distance of about 500 yards from the foot of the hills always have sufficient water, as the run-off is enough for their needs. It is natural that these fields are served first; in time of a water shortage it is the fields farthest from the hills that suffer. Reference to the accompanying map shows that this condition was appreciated by those who built the various canals.

East of the Pehsan dike the water is controlled by an elaborate system of water gates, allowing the water in any one, or all, of the canals to be diverted to any particular area. The water is taken from the canals to the fields by foot pumps. This method is crude, but it is inexpensive and has the advantage, in this case especially, of insuring against wastage. It is the traditional method of irrigation in this district, and its continuance would not be undesirable.

The network of canals with which we can concern ourselves, says Mr. Georges' report, extends as far to the east as the sea and as far south as Sian. The water at this point can be diverted by means of existing canals a few miles farther to the south and east, if necessary. The area south and west of this point depends upon run off from natural streams and water impounded in a lake at Pekhu. Natural obstacles make the delivery of water of this point impracticable.

In designing a plan for use here, the stipulation was made that the work must not cost in excess of a fixed sum, and it was thus designed to meet a particular expenditure. The approach was that of the greatest amount of water for the money available. Considering the area to be served and the distance the area is from any available constant source of water, it was evident that if any design could be made within the limit of the available funds, it must be one in which the strictest economy of design dominated, and every advantage of natural and existing conditions and resources made use of.

At Longmen, located on a tidal tributary to the Min River, a small stream joins the river. This stream has its source at the Shung Cut. By deepening and widening this stream to the foot of the Shung Cut to Zero elevation, sufficient water can be obtained. From Longmen to the rice mill this stream is tidal. During the Sung dynasty the Shung Cut was attempted. This was to be a cut through the hill (see map). A considerable part of this work was completed and can be taken advantage of. From the pumping station to the top of the Shung Cut the water will have to be pumped through 2,500-ft. of pipe.

A number of trial designs, which after development proved impracticable, were considered. After consideration from all angles, this design is offered as the most practical, economical and foolproof. The river from Longmen (Station A) Elevation Zero to the rice mill (Station J) is fairly large and deep, the average width 75-ft. and the average depth from top of bank about 16-½-ft. (Elevation Zero is the height of lowest low tide water). From the rice mill to the pumping station between station O' and station P' practically an entirely new channel must be excavated. The entire channel from Longmen to the pumping station must have a depth at bottom equal to Elevation Zero and also must be wide enough to allow a small type of cargo junk to come to the station. A minimum bottom width of 10-ft. will be sufficient to accommodate this traffic. By cutting a new channel from station I to station O and station X to station J'., considerable distance will be saved. This will reduce the total number of yards to be excavated, as well as shorten the distance, compared with the length of the original channel. At the pumping station (between station O' and station T'), a pumping plant must be erected.

The pumping station must have a capacity of 30 cubic ft. per second. The plant should consist of three single-stage double suction centrifigal pumps, 14-in. suction, 12-in. outlet directly connected to steam turbines. These pumps should deliver 4,500

gallons per minute each, or a total of 13,500 g.p.m. This is equal to 30 cubic ft. per second or 714 acre-inches per 24 hours. With a combined static and friction head of 80-ft., and assuming 65 per cent. efficiency, the power required will be 497 h.p. This head is higher than is recommended, but these figures will serve as a basis for estimate. Turbine drive is proposed as being the least likely to cause mechanical trouble. The smaller units can be used, due to higher speed. Any increase in cost due to this form of drive would probably be offset by the ease of, and decrease in cost of, installation and transportation of pumping units as a whole. Two boilers are preferred, but one suitable boiler can be used, as there is no doubt but that ample time will be available for shut downs for cleaning and repairs. A 36-in. discharge pipe will be sufficient. Steam is proposed as being the most practical prime mover. It is the most economical power for this district, as coal is available nearby (Formosa) and easily transportable from Pagoda Anchorage to the pumping station *via* the proposed channel. Experienced steam operators are to be had in this vicinity.

From the pumping station to the top of the proposed grade at Elevation 50 (50-ft. above Elevation Zero) the pipe line passes through the Shung Cut. There is some hard rock to be removed. If this work is found too expensive a saving can be made by carrying the pipe line to Elevation 70. This saving will be equal to 7,750 cubic yards. This, however, is not recommended as the additional power required to carry the water over the 70-ft. elevation would be considerable.

From the top of the Shung Cut to the west end of Pehsan lake the water will follow a natural channel. There is a small amount of clearing of the channel to be done and a small foot bridge to be built. At the outlet of the Shung Cut at Pehsan there is an existing pond formed by a dike across the outlet. This pond supplies part of the necessary water to irrigate the area north of the Pehsan dike. By building a short dike, not over 100-ft. long and 5-ft. high, this pond can be retained. At a small expense water from the pipe line can be diverted into this pond. This expenditure does not seem desirable as this area is not in need of additional water. In the event of its being in need, water could be taken directly from the canal leading to the Pehsan dike.

There are four canals supplied by the water impounded at the Pehsan dike. These canals form the main laterals of the network of canals east and south of this point. The entrance of water to these laterals is now controlled by placing two rows of parallel planks in the stone abutments of the outlets and filling the space between them with clay. It is proposed to substitute a simple under-shot type of gate operated either by crank or lever and ratchet. The existing stone structures can be utilized. A magneto type of telephone connection between the pumping station and the dike would be necessary. This would complete the design.

The proposed design involves no serious, natural, or engineering difficulties. Use is made of all existing structures and natural aids. The formation of the district lends itself better to the existing type of distribution system than any other. The rice fields are levelled and terraced so that the water is drained from one field to another. Any other system would have to be designed to operate on the same general plan, as it would not be practicable to change the existing levels and terraces of the fields. The use of Chinese foot pumps is an advantage and insurance against wastage of water. Gravity flooding would tend to wastage of water, intentionally or through carelessness. The existing canals are not only conveyers of water but are storage basins as well. All run-off water from the surrounding mountains is led to them, and excess rainfall from the rice fields is returned to the canals by the existing system of ditches. The people who live in the district are familiar with the present methods and would not object to their being retained, but would probably resent any change in system or method. Finally, the available funds are not sufficient to warrant the building of any additional or different type of distribution system.

The excavation work from Longmen to the pumping station is recommended to be carried out by use of a scoop or bucket type of dredge. The stream from Longmen to the rice mill is tidal and any other method would involve the use of coffer dams and pumps. There is little doubt but that the Zero Elevation between the rice mill and the pumping station is below the surface water level. This is indicated by the many shallow wells in the district. Before making a final estimate on this section of the work it is advisable to have test drills made to the Zero Elevation along the line of the channel. The formation of the surrounding country is such that it would indicate the probability of hard rock ridges being encountered.

It will be difficult to get coolie labor in any large number. Labor, when it can be had, commands $9 a month, plus housing and firewood. This would be equivalent to $10 per month. During the harvest season coolies cannot be had. The stronger and better class of coolies during the slack seasons in the fields work in the quarries and on the river, where they earn 40 to 50 cents a day. Not more than from 500 to 800 coolies can be used to advantage at one time in this work. Authorities in the district have expressed themselves against bringing in outside labor.

The cost estimate is submitted in eleven budgets :

Budget No. 1 covers the channel from Longmen to the pumping station. There are 220,000 cubic yards of earth to be removed. It is assumed that this work can be done for 60 cents a cubic yard. These figures are about twice the amount of what similar work can be accomplished for in the United States. This budget is for $132,000.

Budget No. 2 covers the mechanical equipment used in the pumping station. There are many types and styles of equipment which could be used satisfactorily, and it is believed that if a thorough search in the new and second-hand market were made, the figure of $112,000 could be reduced.

Budget No. 3 covers the purchase cost and laying of a discharge pipe 2,500-ft. long from the pumping station to the top of the Shung Cut. This is to be of 36-in. riveted pipe. The figures given are equal to the cost of material, labor, excavating and laying of cast iron water pipe in the States. In this case there would be considerable leeway, as the excavation is covered in Budget No. 5, and riveted pipe is from 25 to 30 per cent. cheaper per linear foot than cast iron, and there is a considerable saving in the number and costs of joints. This is for $37,000.

Budget No. 4 covers the building of the power house foundations and pump well. The most expensive part of this item is the building of foundations of the pump well. This cost will depend on the type of prime mover used. A reciprocating type of prime mover occupies greater space than that of a turbine. The building and foundations should be made of native stone or brick, which is reasonably cheap. The amount estimated should cover this expense. This budget calls for $19,000.

Budget No. 5 covers the reduction of the Shung Cut to Elevation 50. Approximately 12,000 cubic yards of rock are to be removed. These figures are based on an average width of cut of ten feet. If it is practicable to narrow this width, as aving can be made. As most of this rock is very hard, the removal will necessitate the use of explosives. One dollar per yard is estimated to be a safe figure. This budget calls for $12,000.

Budget No. 6 covers the excavation of approximately 1,300 yards of ditch from the Shung Cut outlet to the lake at the Pehsan dike ; 2,000 cubic yards of soft material is to be removed. It is estimated that 36 cents per cubic yard will amply cover the excavation and trimming of this work. This budget calls for $720.

Budget No. 7 covers fixtures and work. This budget is estimated arbitrarily and is to be used for miscellaneous fixtures and work. It would cover the building of new water gates at the Pehsan dike, a 100-ft. dike at the Shung Cut outlet, the material for an installation of a telephone system between the dike and the pumping station and other unforeseen work and structures. This budget calls for $15,000.

Budget No. 8 covers the foreign and Chinese non-productive help and expense. It covers subsistence, transportation and wages. The amount estimated is two-thirds of the total expenses providing the entire staff were used during the entire construction period. The amount of this is $20,000.

Budget No. 9 covers expendible and new equipment, such as tools, explosives, rope, lumber and nails. There will be some salvage of this equipment upon completion of the project, but this has not been taken into consideration. The amount of this budget is $15,500.

Budget No. 10 covers repairs and buildings at headquarters, storage sheds and other small buildings. This also has a salvage value which is not taken into consideration. This budget is $5,000.

Budget No. 11 covers miscellaneous expenses, such as medical attention, printing, liability claims and other miscellaneous expenditures of a similar nature. This budget is for $6,000.

This makes a total of $374,220. It was estimated that the larger yield would in ten years pay for the cost of the work plus interest and upkeep during that period.

Dutch East India Railroads

OF the Islands of the Dutch East Indian Archipelago, Java (with Madura) has the most extensive railway and tramway system viz. 5.339 k.m.; Sumatra follows with 1.531 k.m. and Celebes closes with a tram line of 47 k.m. length.

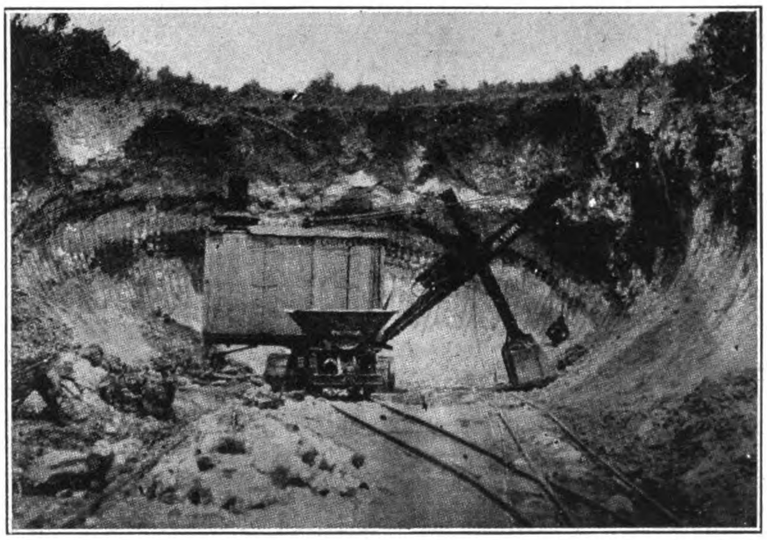
In Java and Sumatra, part of the railways are run by the Government and another part by private companies; the tramway in Celebes is run by the Government.

The dense population, the great number of estates and industrial concerns and also the presence of ports with modern appliances, accessible to ocean steamers with heavy draught, are factors, for Java which have caused the speedy development of the railroad traffic.

For the through passenger traffic between East, Central and West Java express and fast trains with mail type bogie passenger carriages and dining car are daily running over two routes, a mountain route, offering beautiful scenery and a shorter route over the plains, but less interesting from a scenic point of view.

For passenger traffic on short distances ordinary passenger and mixed trains are running. Goods are transported by mixed and goods trains.

The chief traffic centres in Java are the coastal towns Batavia and Sourabaya, which now have modern ocean harbors, through which passes the bulk of the import and export trade, and Samarang. Of less importance are Tjilatjap Djocjakarta and Bandung.



American-made Steam Shovel Cutting a Path through the Sumatra Jungle. The Baldwin Locomotive Works Supplied this Shovel

The length of the State Railways in Java at the end of 1922 amounted to 2.839 k.m., of which 2.719 k.m. with the usual Java gauge of 1.067 m. and 120 k.m. narrow gauge railways with a width of 0.60 m.

At the end of 1923, 4,033 kilometers or about 2,500 miles of state railways and 2,908 k.m. or 1810 miles of private railways were opened to traffic, of which 5,317 k.m. in Java, 1,577 k.m. in Sumatra and 47 k.m. only in Calebes.

Dutch Borneo has no railways as yet although a big railway scheme has been Contemplated for some years, and several railway concessions have been granted to private companies.

The financial results of the working of the state railways over 1922 and 1923 were as follows:

		1922	1923
Lengths of lines open	kms.	3,978	4,033
Capital Outlay in Guilders		463,476,384	492,353,622
,, ,, per kilometer		116,500	122,100
Gross Earnings	gld.	74,574,405	69,041,260
Working Expenses	,,	66,630,292	53,312,167
Renovations and Depreciation ..	,,	3,044,271	3,306,107
Pensions and Miscellaneous ..	,,	2,843,010	3,795,383
Net Earnings	,,	2,056,832	8,627,603

	1922	1923
Percentage of working expenses to gross earnings	89%	76.5%
Percentage of net earnings to capital ..	0.43%	1.75%

Although the gross earnings in 1923 were less than in 1922 by 5.5 million guilders the net earnings were much more in 1923 owing to the great reduction in the working expenses.

As the accounts of the 2,284 kms. state railways in Java are kept apart from the so-called tramways in Java and in the other islands, the undermentioned figures concern only the working of this 2,284 kms. in 1922.

The rolling stock consisted of 552 locomotives, 1,347 luggage and passenger cars and 14,587 goods wagons.

The amount of passengers carried was 59,159,024 and of passenger kilometers 1,628,726,439, 51,528 tons of luggage and 5,963,044 tons of goods. Total ton milometers were 540,370,044 with an average receipt per ton k.m. of 0,053 guilders.

The number of train kilometers were 15,197,115 and 342,949 tons of coal were used, which amounts to 16,459 kilogram per engine kilometer and 22,491 kilogram per train kilometer or the same as about 80 lbs. per train mile.

Under more normal conditions the net earnings should amount to 6 to 8% of the total capital outlay and in order to increase the receipts it was some years ago decided to use electric traction on the lines, where the traffic was going to be too heavy to deal with in the ordinary way. This scheme has been delayed very much but in the course of 1925 it is hoped much will be done. Brick Construction, it is expected, will be started on a few short lines out of Batavia. The hydro-power stations are nearly finished and some of the electric motor cars have arrived from Europe.

The construction of new railway lines has almost come to a standstill. The big scheme of the building of a total of some 3,000 kms. of new lines in Sumatra, Borneo and Selebes has to be abandoned owing to the general decrease in trade and consequent failure of the revenues of the government.

At the present time there is only about 100 k.m. new line under construction in Sumatra, the last link of the line Telpkbelong-Palembang.

Forests of the Russian Far East

(*Continued from page 219*)

a very costly operation. Furthermore the estuary of the Amur is blocked by a sandbar with only two channels, (A) the southern channel, opposite Cape Pronge, with a depth of 12-ft. (14-ft. at flood tide) and (B) the northern channel, some 18-ft. deep, so that sea-going craft with a draft of 24-ft. are unable to enter the Amur.

All this reflects very unfavorably on Nikolaevsk as a sea-port for the basin of the Amur river and the prospective concessionaire will have to look for another port for the export of his timber. This he will probably find in the De Castries Bay which, at an enormous cost to him, he could connect by rail with Sofiisk. The construction of a harbour there will also cost quite a tidy sum, but then, aside from obtaining a very convenient and safe harbour, the concessionnaire will save some 300 miles, *i.e.*, the distance between De Castries Bay and Nikolaevsk.

Another advantage offered by a harbour at De Castries Bay lies in the fact that this bay is in close proximity to the Nikolaevsk, Lower-Amur and Kut-Urmiiski concessions with an aggregate area of 1,000,000 dessiatines of forests and an average yearly yield of 20,000,000 cub. feet of timber. A saw-mill at De Castries Bay could cut this amount of timber from the said concessions and even double this output. All this timber would find a good market in China and Japan.

The most important factor in the restoration and further development of the timber industry in the Russian Far East is the participation of foreign capital, preferably American capital, which could obtain all the timber it might require for export to Australia, Japan and China from the basin of the river Amur.

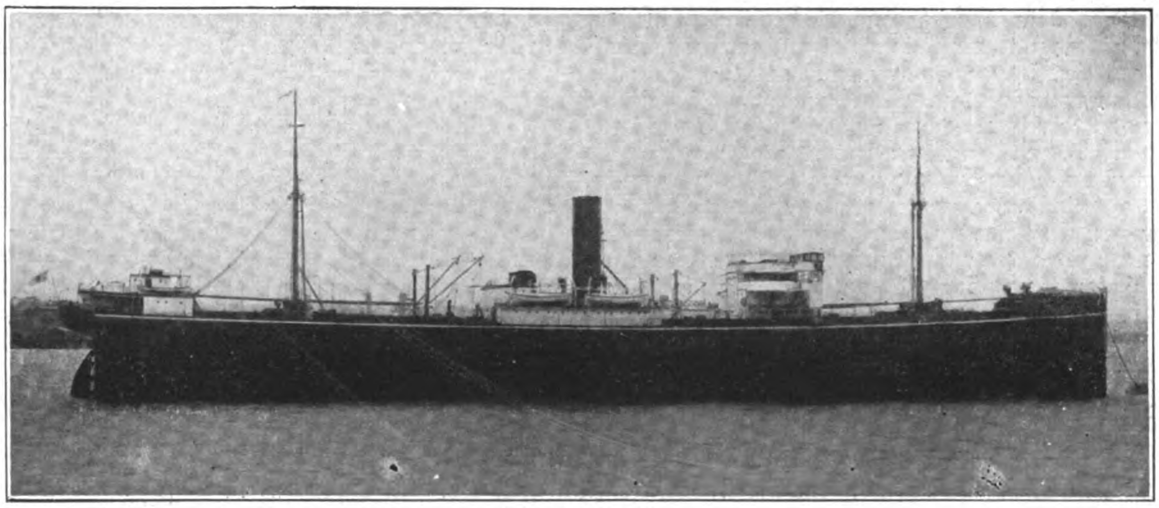
The "Atago Maru" and the "Asuka Maru"

THE *Atago Maru* and the *Asuka Maru* represent the first large ocean-going oil-engined craft to sail under the Japanese flag, and, apart from this, great interest centres in the fact that the hulls are identical in size, were built to the same plans, have equal machinery power, but are equipped respectively with Sulzer two-stroke and Harland and Wolff—B. and W.—four-stroke machinery. They form modern examples of two-stroke and four-stroke-engined vessels, so that the most exact comparisons may be made between the commercial advantages of the two classes of plant, more particularly as each is provided with a thoroughly comprehensive all-electric auxiliary equipment. The *Asuka Maru* was built by Messrs. D. and W. Henderson, and the *Atago Maru* by Messrs. Lithgows, Ltd. Messrs. Harland and Wolff supplied the engines for the former and Messrs. Sulzer Bros. for the latter, in which the installation was carried out by Messrs. David Rowan & Co.

The following are the main particulars of the vessels :—

Length b.p.	440-ft.
Beam	57-ft.
Moulded depth	38-ft. 6-in.
Loaded draught	28-ft. 3-in.
Total deadweight capacity..	10,500 tons
Fuel oil carried, about	2,000 tons
Machinery power	4,000 s.h.p.
Sea speed	12 knots
Daily fuel consumption about	17 tons

The vessels are very high-class cargo boats of the shelter-deck type, having accommodation for the crew in a top-gallant forecastle forward and in deck houses aft, the officers and engineers being berthed in well-fitted accommodation in deck houses amidships.


"Atago Maru"

There are seven watertight bulkheads extending to the shelter deck, and a deep tank, having two watertight hatches and fitted for the carriage of cargo oil or water ballast, is placed aft of the engineroom bulkhead. These bulkheads divide the ship so that there are three holds forward and two aft of the engine-room, making five large holds in all, exclusive of the deep tank. The shelter deck is, of course, steel throughout and sheathed in wood amidships, and there is a main deck, also of steel, extending fore and aft, forming five large 'tween decks exclusive of the spaces in way of the fore and after peaks. In way of No. 1 and No. 3 holds, a third deck of steel has been fitted, forming double 'tween decks in these spaces. There are five big hatches to the holds and a smaller hatch in way of the deep tank. These hatches are unusually large, No. 2 and No. 4 being 35-ft. and 32-ft. long, respectively. The double bottom is constructed for about 1,200 tons of fuel oil or water ballast, and in addition the deep tank and fore and after peak tanks hold about 1,250 tons water ballast.

A prominent feature of each vessel is the complete installation of cargo-handling gear. There are 18 electric-driven winches distributed as follows :—

At No. 1 hatch..	3 winches	of 3 tons.
,, ,, 2 ,, ...	3 ,,	,, 3 ,,
,, ,, 2 ,, ...	2 ,,	,, 7 ,,
At No. 3 hatch..	2 winches	of 3 tons.
,, ,, 4 ,, ...	2 ,,	,, 3 ,,
,, ,, 5 ,, ...	2 ,,	,, 5 ,,
,, ,, 5 ,, ...	1 ,,	,, 3 ,,
,, ,, 6 ,, ...	3 ,,	,, 3 ,,

There is also an electrically driven five-ton winch in the steering house aft, which is required for warping and can be adapted for steering in the event of the steering gear breaking down. The arrangement of the 20 cargo derricks which are fitted is as follows :—

At No. 1 hatch..	3	of	6 tons.
,, ,, 2 ,, ...	3	,,	10 ,,
,, ,, 2 ,, ...	2	,,	3 ,,
,, ,, 3 ,, ...	2	,,	3 ,,
,, ,, 4 ,, ...	2	,,	3 ,,
,, ,, 5 ,, ...	3	,,	10 ,,
,, ,, 6 ,, ...	3	,,	6 ,,

In addition there is a 40-ton derrick at No. 2 hatch and a 20-ton derrick at No. 5 hatch.

The steering gear, fitted by Messrs. Caldwell & Co., is of the Hele-Shaw electric hydraulic type with telemotor control from the bridge amidships and also having a control on the docking bridge aft. Each vessel is fitted with a funnel placed amidships and this has been utilized for holding the main silencers, donkey boiler uptake, auxiliary Diesel silencers, exhaust pipes, a hot-water tank, etc.

Hot salt-water and cold fresh-water have been laid on the accommodation fore and aft, and with ample electric lighting throughout it may be said that the vessels have been finished in a very complete and up-to-date fashion. A wireless installation, supplied from Japan by the owners, has been fitted in each case.

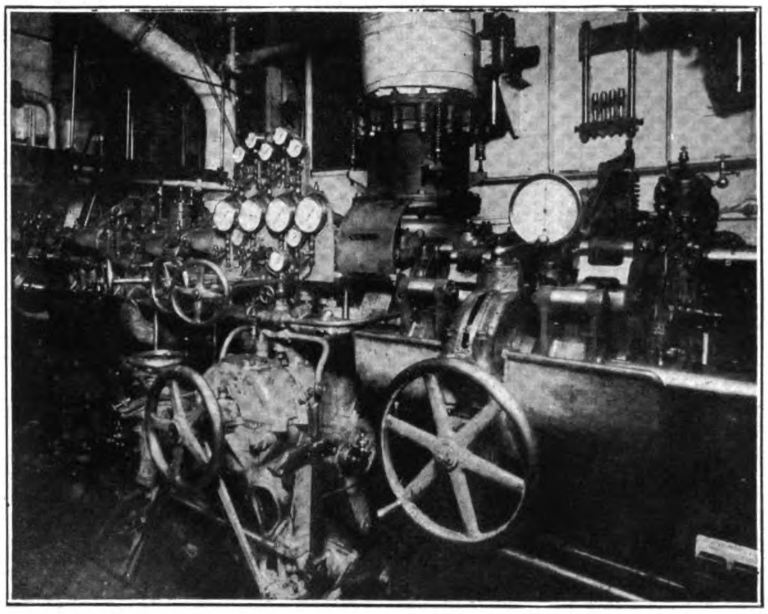
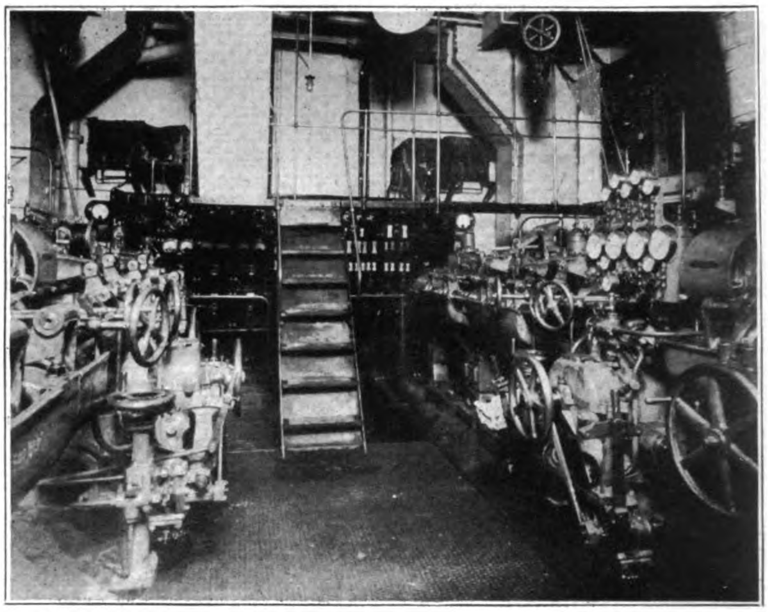
The winches, although equal in number and designed for the same service, are of different types, those on the *Asuka Maru* being the new Laurence Scott worm-gear-driven type and those on the *Atago Maru* manufactured by the Sunderland Forge and Engineering Co. The usual contactor houses are provided.

We may now deal with the respective machinery arrangements, and reference in this connection may be made to the engine-room plans attached hereto.

M.S. "Asuka Maru"

The 2,000 b.h.p. engines of this ship are eight-cylinder sets with a bore of 680 mm. ($26\frac{3}{4}$-in.) and a stroke of 1,100 mm. ($43\frac{1}{4}$-in.) the normal speed for full power being 125 r.p.m. They have twin compressors driven off the forward end of the crankshaft and the only difference we noted from the earlier standard Harland and Wolff engine was a mechanism for altering the lift of the fuel valves for slow running, to economize blast air.

The large horizontal handwheel seen at the control station gives a slight turning movement to a horizontal shaft—the whole length of the engine—and this shaft has levers attached to it which at their upper ends are fixed to the bosses on which the fuel valve levers are pivoted. If the handwheel is turned, therefore, the lift of all the

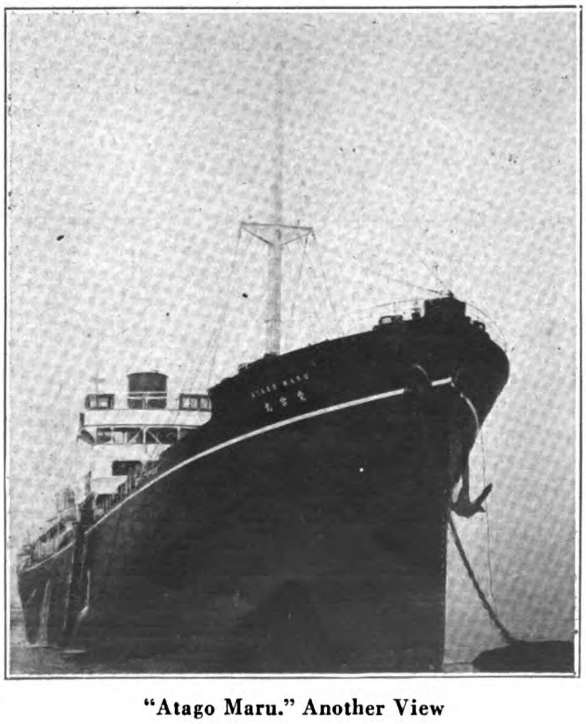
Engine Room of the "Atago Maru"

valves is increased or decreased as desired, and we were informed that with this arrangement it is possible for the engines to be kept turning at a minimum of 22 r.p.m. This method has, of course, frequently been adopted with long-stroke engines on single-screw ships, but we understand it is now standard on all Harland and Wolff twin-screw vessels. In addition to economizing blast air, it is of obvious value in circumstances where reduced speed is called for over a period of several hours, as, for instance, when, in approaching port, it is found that there is no object in arriving before a certain time.

A new measuring instrument has been added to the engines for ascertaining the lubricating oil temperature at any moment. It is manufactured by the Fox Instrument Co., and consists of a tube which is full of mercury and is immersed in the lubricating-oil pipe leading from the sump to the oil cooler, *i.e.*, when the oil is at the highest temperature. To read the temperature the circuit of the instrument is pumped up by hand to a pressure of 10-lb. per sq. in. and the temperature is indicated on a mercury thermometer.

The usual arrangements are made for heating the circulating water in the cylinder before starting up, if desired, and steam pipes are led to the cylinder covers for this purpose. The cylinders, covers and compressors are sea-water cooled, but a closed fresh-water circuit is provided for the pistons with a water cooler in the engine-room, where is also located the lubricating oil cooler, with a surface of 200 sq. ft. The circulating pumps draw water from the sea, delivering it first to the lubricating oil cooler, next to the pistoncooling water cooler and then to the engines, where it can either pass first through the compressor cylinders and intercoolers, or in parallel to compressors and cylinders. These circulating pumps also supply the cooling water to the auxiliary Diesel engines, although, when in port, water can, if desired, be obtained from the boiler feed water pump.

The three Diesel-driven generating plants of 100 kw. each are located in line on the port side of the engine-room. The engines, of 150 b.h.p., have three cylinders, 325 mm. bore with a stroke of 350 mm. and the speed is 300 r.p.m. The voltage is 220 and this is used throughout the ship for lighting as well as power. One plant will be in operation at sea, and two in port when cargo is being handled. Between the two propelling engines is a 20-ton motor-driven gear pump, drawing oil from the double bottom and delivering it to the two 10½-ton settling tanks and also to the galley, which is oil-fired. Aft, and also centrally placed, are three lubricating oil pumps similar to that for fuel. Usually, when the oil is thick, one will suffice for both engines, but when the oil is hot two will be required.



"Atago Maru." Another View

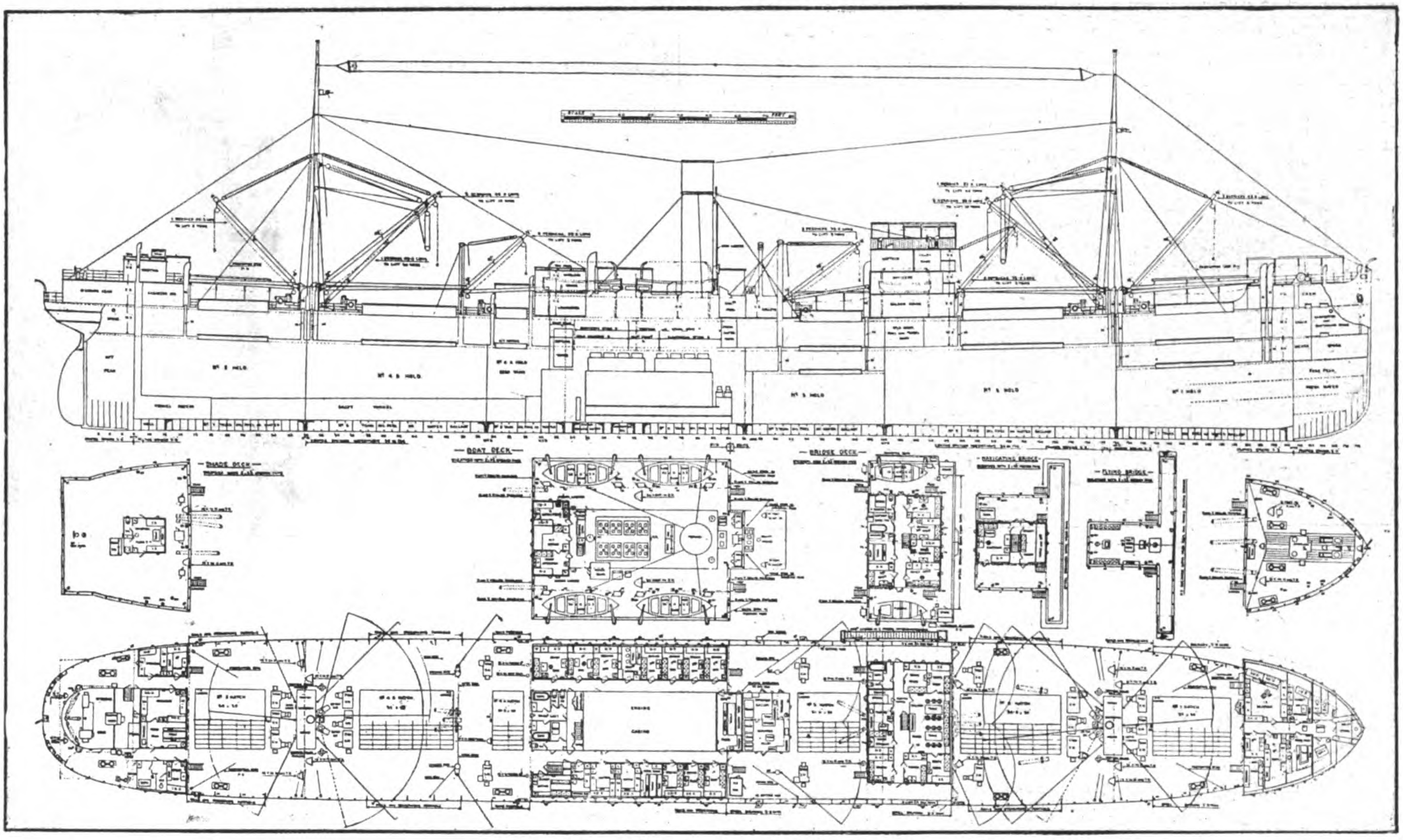
On the starboard side of the engine-room is most of the remaining auxiliary equipment; the two-stage Harland and Wolff air compressor compressing up to 25 atmospheres, or 360-lb. per sq. in., is driven by an Allen motor of 180 b.h.p. This charges three 530 cub. ft. cylindrical receivers, and there is a small emergency steam-driven compressor which can supply sufficient air at 1,000-lb. per sq. in. to charge one injection air reservoir in one hour. The ballast pump, of 200 tons hourly capacity, is of the Carruthers plunger type, driven by a 22 h.p. motor, and a duplicate is provided for discharging cargo oil from the deep tank.

The two sea-water circulating pumps, to which reference has already been made, are centrifugal machines of 180 tons output per hour, directly driven by 23 h.p. motors, but the duplicate piston-cooling pumps are of the Carruthers plunger pattern, each capable of delivering 40 tons of fresh-water per hour at a higher pressure than that of the sea-water circulation. A 100-ton vertical Carruthers bilge pump is installed and a multi-stage centrifugal fire-service pump delivering 30 tons per hour at 100-lb. per sq. in. The lubricating oil can be purified by a De Laval centrifugal separator. In the double bottom is a 25-ton lubricating oil tank, as well as one of 30 tons capacity for fresh-water for piston cooling. A vertical Cochran boiler with a heating surface on 200 sq. ft. is fitted at the forward end of the engine-room, mainly for scouring out tanks, since the accommodation is heated by Electro-vapour radiators.

The "Atago Maru"

The two Sulzer engines in the *Atago Maru* are designed to develop their output of 2,000 b.h.p. each at the lower speed of 100 r.p.m., and they have four cylinders, curiously enough with the same diameter as those in the other vessel, namely, 680 mm., but with a stroke of 1,200 mm., thus giving a piston speed of 807-ft. per min., against 902-ft. per min. with the four-cycle engines. They are completely standard motors with the new automatic disc-type scavenging valves, adopted, we believe, for the first time in this ship.

The controls, as is usual with this class of machinery, are all at the top of the engines and differ in no respect from the arrangement which have already



Plans of the 10,500 Ton M. S. "Asuka Maru"

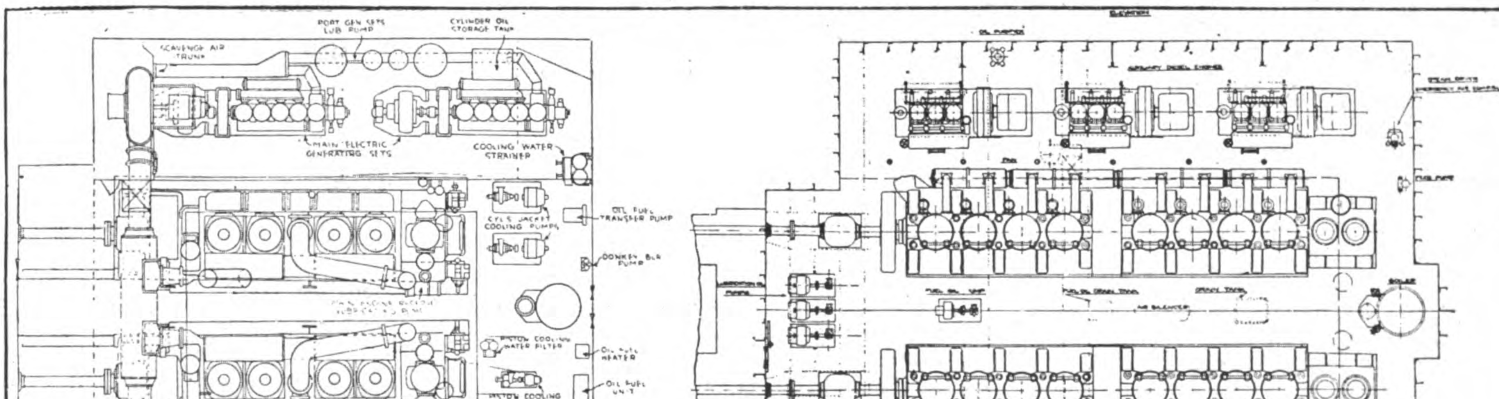
been described. Each engine has but one injection air compressor, driven off an extension of the crankshaft at the fore end, and one compressor can, if need arise, supply a sufficient volume of injection air for both engines. A large surplus therefore exists normally for charging the starting-air reservoirs. There are eight injection-air bottles, each with a capacity of 28.2 cub. ft. at 1,000-lb. per sq. in. Both engines have an overhung crank at the forward end driving the cross-head lubricating-oil pump with a delivery pressure of 300-lb. per sq. in., a lubricating-oil pump discharging to the gravity tank, and a bilge pump. The consumption of each engine is guaranteed not to exceed 0.418-lb. of oil per b.h.p. hour.

The two turbo blowers for the supply of scavenging air are at the top of the engine-room. They are arranged one on each side, with the blower in an enclosed compartment drawing air direct from the deck and the electric motor external to this chamber. Both are of the Brown Boveri type, with a maximum capacity of 19,100 cub. ft. per min., at about 2,750 r.p.m., and they are direct-coupled to 220-volt d.c. motors of 240 b.h.p. One will supply more than sufficient air for both engines when operating at full speed.

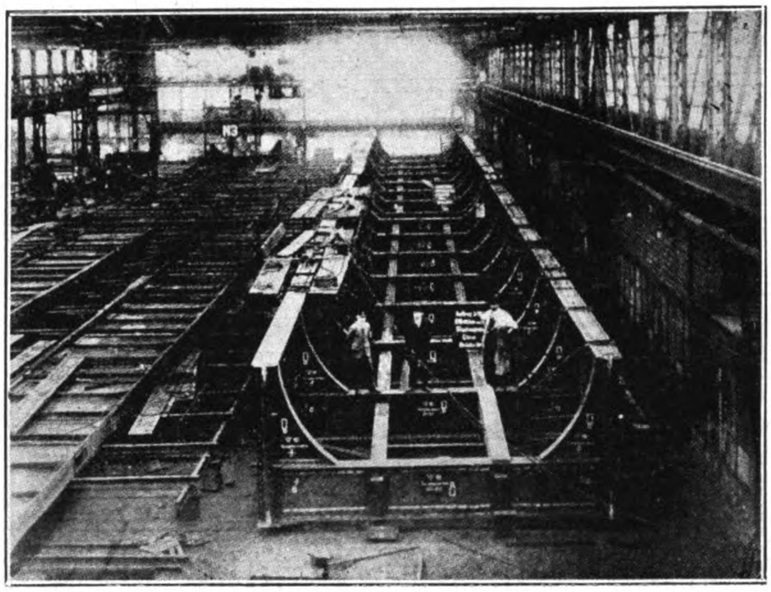
Airless Injection Auxiliary Diesel Engines

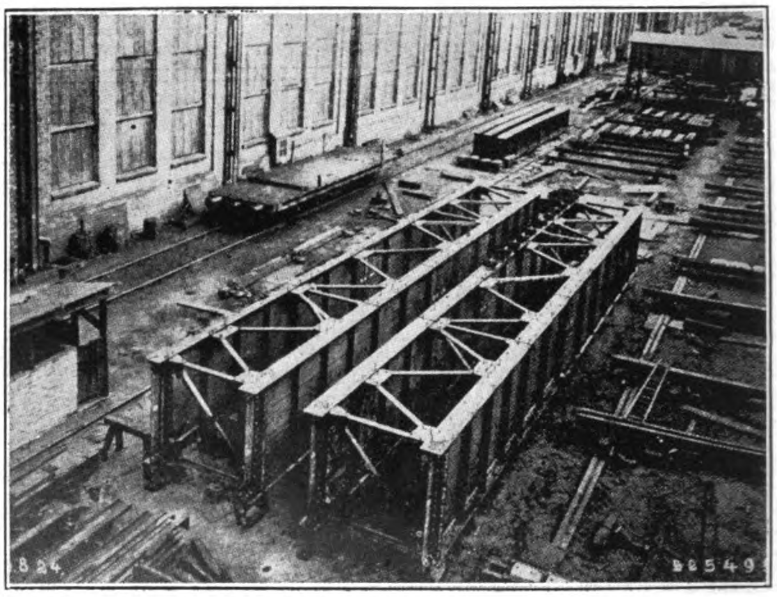
The auxiliary generating plant represents a departure from usual practice, as it is the largest installation of the new Sulzer airless injection Diesel engines we have yet seen. There are three sets, two of which will have to be continuously in operation on account of the requirements of the turbo blower. Each dynamo generates 135 k.w. at 300 r.p.m. and 220 volts and is driven by a four-cylinder

(Continued on page 231).



Engine Room Plans, etc.





The types of girders now being erected in the Kiao-Tsi Railway. The through girder and the deck girder. Pictures taken in Germany at the workship

Reconstruction of the Kiaochow-Tsinan Railway Bridges.

By F. K. Sah, Chief Engineer

THE existing bridges on the Kiaochow-Tsinan Railway, were put up by the German Engineers in 1901-1904. They are the type of bridges specially designed in Germany for colonial lines where the loading adopted is generally very light. But due to the rapid increase in the volume of traffic on this line, heavier locomotives had to be resorted to, consequently the factor of safety of these bridges decreased correspondingly.

Before the great war the German Engineers had worked out a plan for the strengthening of some of the important bridges on the line, but this plan had never been carried out. By adopting still heavier American locomotives of the Pacific and Consolidation Types (E-35 loading) during the Japanese Administration, 1914-1922, these bridges were further decreased in their factor of safety. Even if the German plan of strengthening had been carried out, the factor of safety would still be too small to carry these heavy American locomotives according to the American practice in bridge designs.

Since the taking back of the railway by China it was obvious that many necessary improvements of the Railway must be carried out and the bridge question being the most important was the first to be taken up. Upon the strength of the bridges depend the choice of the locomotives and rolling stocks which in turn effect the speed of the trains and the hauling capacity of the line.

At first the plan proposed for strengthening the bridges was to make use of the old structures by doubling up two trusses into one and encasing the small plate girders in concrete. But this plan was abandoned because it could only strengthen the bridges sufficiently to stand the present loading, making no provision for the increase in loading which is inevitable in the very near future. So finally it was decided to replace all the existing bridges by new bridges of Cooper E-50 which is the standard loading for new main lines of the Chinese Government Railway System.

Before this plan of changing all bridges to E-50 loading could be carried out, a temporary measure was planned and adopted to make the running of trains over existing bridges in the meantime as safe as it is within the power of the engineering department to make them. This temporary measure includes the changing of all loose rivets, repairing of cracks and bent members, constructing timber bents where possible to lessen the strain on the structural members, and strengthening of weak joint connections particularly the centre diagonals and stringer connections.

The bridge program, as finally adopted, involves the scrapping of approximately 847 spans of minor and 150 spans of major bridges aggregating a gross tonnage of approximately 8 500 tons and the replacing by approximately equal number of new bridges aggregating a gross tonnage of approximately 15,000 tons. The total cost of the entire program, including cost of handling, dismantling, erection and the remodelling of piers and abutments, etc. is estimated at M.$3,800,000. The work of reconstruction is to be started in March, 1925 and to be completed in three years.

The following types of bridges have been adopted :—

1 m. to 3 m. spans ;	Old rails, old channels, or I-beams imbedded in concrete.
4 m. to 10 m. spans ;	I-beams imbedded in concrete.
12 m. to 30 m. spans ;	Plate girders.
35 m. to 46 m. spans ;	Trussed bridges.

At the time of writing 33 plate girders of 15 m. to 30 m. spans aggregating 2,180 tons have already arrived at Tsingtao. Orders for these bridges were placed with G. Borkowetz representing Machinen-Fabrik Angsburg—Nuernberg, Germany, on May 24, 1924, at the unit cost of G.$82.80 per ton C.I.F. Tsingtao. The first shipment consisting of 17 spans arrived at Tsingtao on November 8 and the balance of the entire order arrived at Tsingtao on February 10, 1925.

The contract for the reconstruction of 26 spans had just been awarded to Yu Ching Construction Company of Shanghai at a total cost of $56,262. According to plan these 26 spans are to be erected by end of May, 1925.

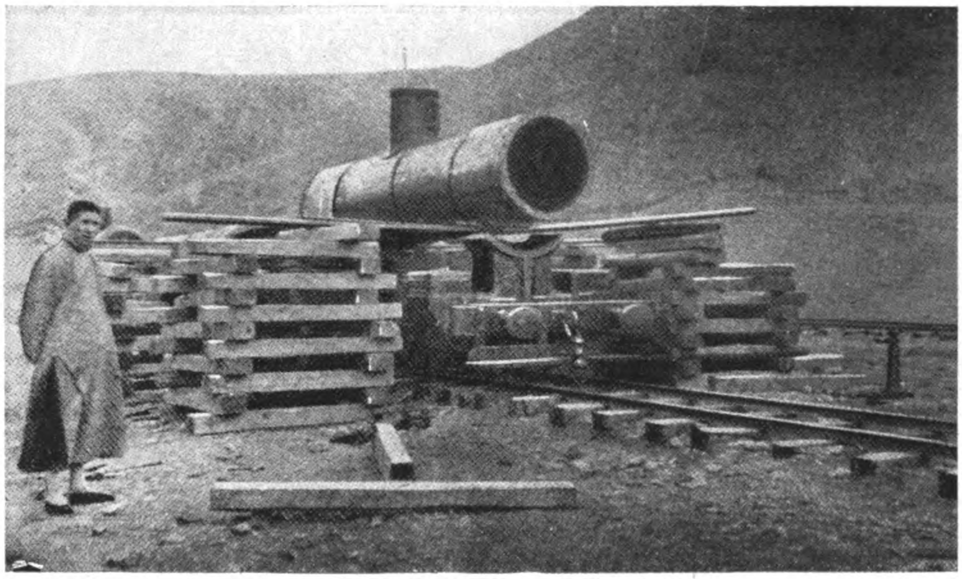
The Tientu Light Railway

By J. W. Kelker

THE project for the construction of a light railway in Kirin province, North Manchuria, has its inception in 1915. This railway was to start at the Chinese border on the Tumen River, twenty-five miles North of Kwainei at a small town known as Tumen River Siding, opposite Komosanbon, and extend to the Tienbaushan silver and copper mines, a distance of seventy-three miles. In addition, a branch line six and a half miles long was to be constructed, making a total of seventy-nine miles.

The Tienbaushan mines, which include a smelter and refinery, were built in 1915. Rapid progress was made in development work and operations continued until 1919 when they ceased on account of the low market of price of copper. These mines, however, have recently resumed operations.

As laid down in the project the work called for the construction of a light railway of 2-ft. and 6-in. gauge, with 25 lb. rail, to connect the Tienbaushan Mines, at Komosanbon, with the Tumen River Light Railway operating in Chosen along the border of China. At first the Chinese were opposed to the construction of this line, but in the latter part of 1922 a joint Chinese-Japanese stock company was organized with a capital of four million yen and stock equally divided, that is, 50 per cent. Chinese and 50 per cent. Japanese, and work on the new line, which was known as the Tientu Light Railway, was begun. The company was organized as follows: Chief Director, Chinese, Mr. Tao, Chinese Governor at Yenkiting; President, Japanese, Mr. Iida, of Tokyo; a dual management consisting of Mr. Ishibashi, Japanese General Manager, and Mr. Chia, Chinese General Manager; Chief Engineer, Japanese, Mr. Fukai, under whose jurisdiction came the superintendence of the surveys, track equipment, buildings, and the construction of the railway.


Ready to Lower Boiler, Running Gear in Place

Construction work on the first division, thirty-six miles long, to Lungchingtsun, proceeded rapidly through a hilly and even mountainous country which made it necessary to lay out a line with grades as high as 1.7 per cent. and with numerous curves of 264 ft. radius. This division was opened for traffic on October 10, 1923.

The second division, from Lungchingtsun to Laotaokou, a distance of twenty-seven miles with a six and a half miles branch line to Yenkiting, was graded in the fall of 1923 and the spring of 1924 and new rails and track laid in July, 1924. It is expected that this division will be complete and in operation early in 1925.

The third division, from Laotaokou to Tienbaushan, a distance of ten miles, will in all probability be graded early in 1925.

Since the construction of the railway many small villages have sprung up, and in the town of Lungchingtsun almost a thousand new houses have been constructed and many new streets laid out, graded and surfaced. Every town has a well-built station with waiting rooms for passengers and quarters for the station men. The main offices and shops of the railway are located at Lungchingtsun. The shops are built in connection with the round house and have equipment sufficient to handle running repairs. The machine shop is equipped with a wheel lathe, hydraulic press, three small lathes, a shaper and a milling machine. The power to operate the machinery is furnished by gasoline motor.

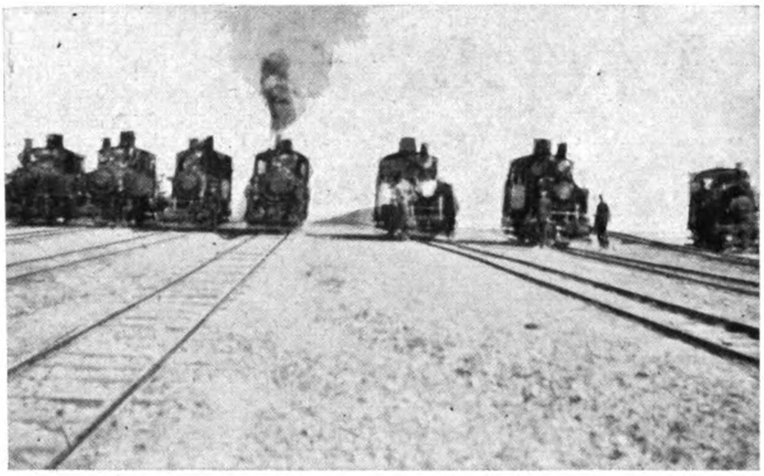
Water tanks along the right of way are built of wood. The water supply is derived from wells and the tanks are filled by a coolie, hand bucket system. During the severe winter weather considerable difficulty is experienced in preventing the water from freezing in the tanks.

The Tumen River Railway has constructed a temporary double track bridge of timber across the Tumen River between Komosanbon and Tumen River Siding on the Tientu Railway for the use of push cars in the transfer of cargo. The Chinese were much opposed to the building of this bridge and asked on several occasions for its removal, but an agreement has now been reached whereby a permanent structure will be built. This will insure through railway service from Tienbaushan and Lungchingtsun to Kwainei and will save a great deal of time and expense by avoiding the unloading and transferring of cargo at the bridge head. The Tumen River Railway stockholders are also interested in the Tientu Light Railway. These two lines are constructed to utilize the same type of cars and locomotives and built to the same gauge, therefore, their equipment is interchangeable and will facilitate the interchange of traffic.

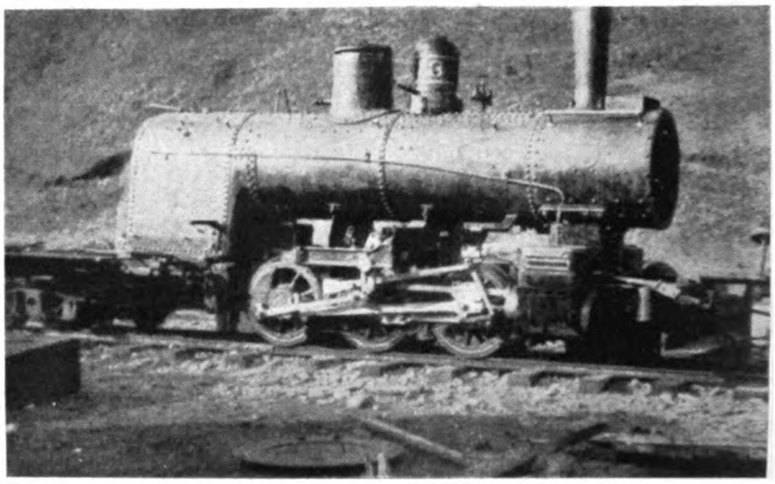
The section of country in which the Tientu Light Railway operates is practically under Japanese supervision and this includes the telegraph and telephone system, and prior to 1923 also included the post office. There are approximately 250,000 Koreans resident in this district. Lungchingtsan, the largest important town, has a population of 20,000 Koreans, 2,500 Chinese and 800 Japanese. It is the headquarters of the Japanese consular district as well as the Chinese customs. Lungchintsun is a progressive town with well laid out streets and good drainage facilities, and included among its buildings a Japanese hospital and many schools for Chinese, Japanese and Korean children. Among other important institutions the Bank of Chosen and the Canadian Presbyterian Mission are noteworthy. Agriculture is the sole industry, the principal exports at this time being soya beans, millet and wheat. The export of grain from this district in 1922 approximated 52,000 tons, transported by ox carts. In 1923 exportation had increased to 66,000 tons approximately, 33,000 tons handled by the new railway and the remainder by ox carts. The tonnage handled by rail represented its maximum capacity which was necessarily limited by the shortage in locomotives and cars.

A lignite coal mine, now in operation, is situated at Laotaokou. Upon completion of the railway to this town the coal supply will be utilized by the railway and by towns along the line. Coal will also be exported to Chosen inasmuch as the quality of coal in north Chosen is poor. At the present time the inhabitants of this district use twigs and dried weeds for fuel, as there is no available timber supply.

By reason of the extension of the main line and the anticipated increase in traffic, the Tientu Light Railway purchased from The Baldwin Locomotive Works, six 0-6-4 type, class 10-14 1/3D locomotives for passenger and freight service. These locomotives were designed with large fire-boxes to burn the grade of coal peculiar to the territory, and with hauling capacities sufficient to handle



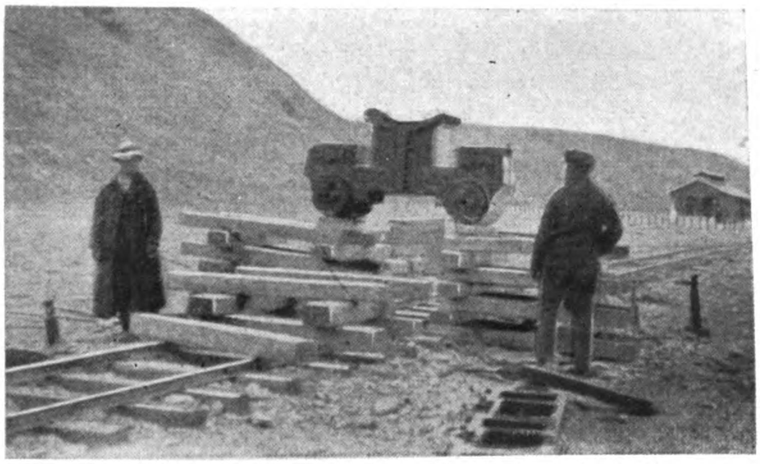
The Re-erected Baldwin Locomotives Under Steam



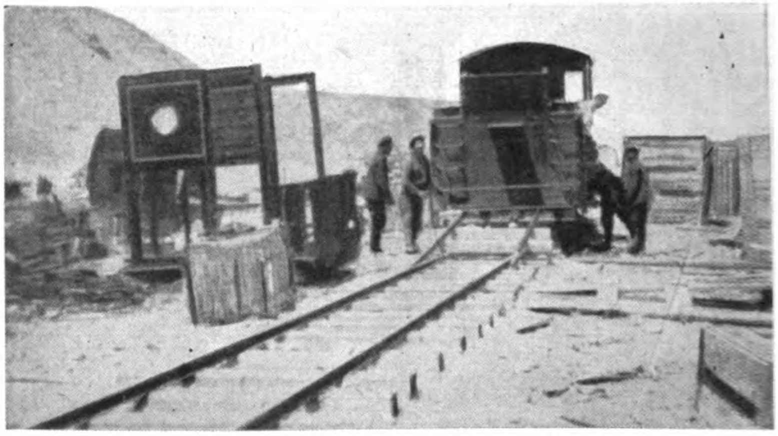
Bolier Bolted to Frames and Cylinders

trains of 90 tons over the heavy grades. The order was placed on September 22, 1923, completed at The Baldwin Locomotive Works November 29th, and delivered at Kobe on February 15, 1924. Unexpected delays at Kobe caused by the earthquake, prevented delivery to the railway at Tumen River Siding before April, 1924. The locomotives, however, were all re-erected by May 16th and were placed in service two weeks later. The Tientu Light Railway at the present time has eleven American-built locomotives, 1925 freight cars of five tons capacity, both box and gondola types, ten, four-axle flat cars, and approximately thirty passenger cars of the four-axle type.

It is planned to extend this railway to Kirin in the near future, but this is a political question for decision later. The prospects for extension are very encouraging and as the railway will collect a considerable amount of freight for transportation to the Chosen territory and the port of Seishin at the end of the South Manchurian Railway (Chosen lines), this line will eventually reduce the length of haul from North Manchuria to tidweater. At present the project calls for the opening of the country adjacent to the Chosen territory and the transportation of coal, ore and grain to the Japanese port of Seishin. It may therefore be expected that by the aid of modern transportation through a highly fertile country progress will be rapid, and the introduction of new capital into North Manchuria will necessitate the construction of the standard gauge line from Kirin to Kwainei, a step of extreme importance in the future development of China.



Cylinders Blocked Up to Facilitate Placing Wheels Under Frames



Sliding Water and Fuel Tanks Into Place

Indian Contracts

Of late a large number or more or less important contracts have been made for supplies for the Indian market, as well as many further tenders being called for. Vickers have supplied considerable quantities of pressed steel parts for rolling stock for several of the Indian Railways as well as many wheels and axles for the Great Indian Peninsula Railway; for the Bengal-Nagpur Railway a number of "all steel' wagons, and high sided and covered goods wagons for the Assam Railway. The South Indian Railway Company is calling tenders for 45 bogie steel covered wagons. The Bombay, Baroda and Central Railway Company is making enquiries for quantities of switchgear, rotary converter sets and transformers, and independence bonds for track circuiting. The South Indian Railway Company is calling tenders for steel covered goods wagons. Messrs. Beyer, Peacock & Co., of Manchester, are constructing two large "Garrett" locomotives for the Bengal-Nagpur Railway. These engines will be the most powerful locomotives operating in India. The Bedford Engineering Co., of Bedford, are making two large electric "Goliath" cranes, running on rails 60-ft. span for the Indian Stores Department. The British India Steam Navigation Company have placed another order for a 10,000-ton steamer with Hawthorn, Leslie & Co., of Wallsend-on-Tyne.

In India an expenditure of £2,000,000 has been ear-marked by the Madras and Southern Mahratta Railway for new locomotive and wagon building shops near Madras. The construction of the Raipur Partbartipur Chord Railway from the Central Province to a proposed new port near Vizagapatam is likely to make an early beginning, while a new line, 84 miles long, in the Barsi district, has been sanctioned by the Government, and the £500,000 capital required is about to be raised in London. The Nizam State Railways are to build huge railway works at Secunderabad to British designs. Electrical plant and equipment is to be purchased by a Burmese lighting company.

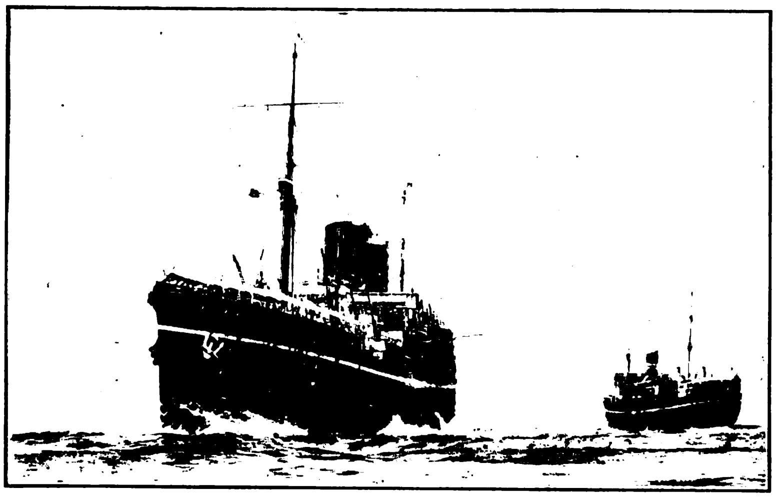
"Ranchi"—A New P. & O. Steamer

ON January 24, the *Ranchi* was launched by Lady Addis, wife of Sir Charles Stewart Addis, K.C.M.G., a director of the Peninsular and Oriental Steam Navigation Company.

The vessel has been built and engined by Messrs. R. and W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne. Her dimensions are :—Length overall 570 feet, beam 71 feet 3 inches, depth 47 feet, tonnage gross, about 16,000, speed 17 knots.

The *Ranchi* is a handsomely modelled passenger and mail steamer with two funnels, is the second of two sister ships that are being built at Hebburn shipyard for the Peninsular and Oriental Steam Navigation Co., and will shortly take her place in the company's oriental service. She has seven decks in all, and is designed on the most up-to-date lines, particular attention having been directed to the comfort of passengers travelling in tropical climates.

The first saloon is to be decorated in a French style. The lounge, music room and smoke room are designed with high ceilings, skylights and large bay windows. The lounge itself is decorated in a " Georgian " style while the music room is to be finished after an " Adams " period room. The furniture in the various rooms will be reproductions of that found in rooms of the respective periods, as will also be the case with the tapestry. The smoke room, an old English " Tudor " design, will be one of the main features of the ship, finished in a " grey colour " oak, with the characteristic small square panels broken here and there by vertical oak and plaster strapwork seen so often in so many of the " old world " towns in England. The smoke room will open out on to a verandah.



New P. & O. Steamers

The cabin accommodation is particularly spacious and well lighted, each cabin having a portlight through the ship's side, and special arrangements are being made whereby each passenger will have a constant supply of fresh air available. The old ventilation fan system is entirely superseded. Passengers in bunk or during the day simply press a button to obtain a supply of fresh air, which immediately supplies every part of the vessel. A passenger lift is to be fitted between all the passenger decks on the ship, thus facilitating access to all the public rooms and passenger accommodation. A number of special cabins are situated on " B " deck, each having a separate bath room. Large promenade decks are arranged where passengers can sit in the shade, and special places are allocated for deck games. The ship is provided with two hospitals, dispensing rooms, and surgery.

The second saloon accommodation is designed on similar lines to the first saloon, with dining room, lounge and smoke room. These rooms are all tastefully panelled out, and the latter are fitted with large bay windows. The galleys and pantries, together with the bakeries, butcher's shop and sculleries, are situated between the first and second saloons, occupying a considerable space amidships and are fitted with every cooking appliance for the company's " a la carte " service.

The *Ranchi* has seven cargo holds, which are divided up into mail rooms, bullion rooms, insulated spaces and bulk cargo holds, and they are served by a most efficient installation of hydraulic cranes for the rapid handling of all cargoes. Two cranes are fitted to each hatch.

The propelling machinery, constructed at the St. Peter's works of the shipbuilders, is the most up-to-date type of reciprocating machinery, and comprises two sets of four-cylinder quadruple expansion engines, balanced on the Yarrow-Schlick and Tweedy system, having cylinders 32½, 46, 67 and 96 inches by stroke of 60 inches. The engines will develop about 15,000 i.h.p. and are fitted with Brown Bros., direct-acting hydraulic reversing engine, and turning engines of the two-cylinder two-crank type are fitted for each main engine. The main condensers of the " Unifex " type are fixed to the back columns of the engines. Auxiliary machinery of the latest up-to-date practice is fitted to ensure the best possible economy, efficiency, and reliability on the exacting service in which the vessel will be employed. Thrust blocks of the patent " Mitchell " type are fitted to the main shafting. The propellers are fitted with adjustable manganese bronze blades. The boilers are of the multitubular type, six in number, double-ended, constructed for a working pressure of 215 lbs., and are arranged for burning oil fuel on the " Clyde " system in conjunction with Howden's forced draught. The oil fuel burning installation is in duplicate, each unit being of sufficient capacity for working the machinery at full power.

The " Atago Maru" and the " Asuka Maru "

(*Continued from page 227.*)

200 b.h.p. engine with cylinders 310 mm. diameter and 420 mm. stroke. It may be remembered that the two-stroke motors of this type which we have described have been referred to as crank chamber compression machines. In the engines on the *Atago Maru* a normal vertical scavenging pump has been adopted, driven off the crankshaft, which we think is an improvement for this class of work. The only valve in the cylinder cover is for fuel admission and this is automatic, the timing being effected on the fuel pumps, so that there is no question as to the simplicity of the design. The governor is on the end of the crankshaft and the speed is regulated within close limits by a large handwheel altering the tension of the governor springs.

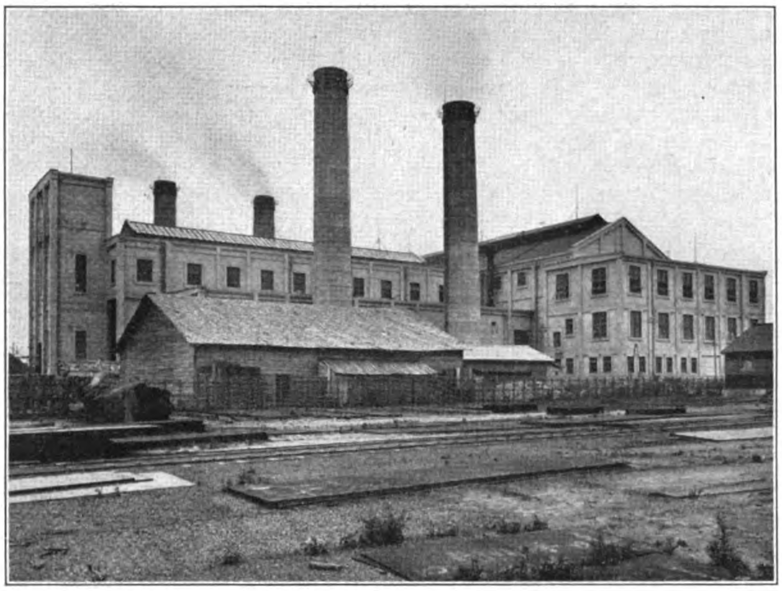
Two of these generating plants are on the port side of the engineroom and one to starboard, the two Sulzer air compressors being also on the port side. These work up to the maximum pressure of 1,000-lb. per sq. in. (in contrast with 360-lb. per sq. in. on the sister ship), but are relatively small, with an output of 105 cub. ft. per minute and driven by an electric motor of 50 b.h.p. A small steam-driven emergency air compressor is provided for use in the case of complete loss of air.

Sea-water is used for cooling the pistons as well as the cylinders of the main engines, but the pumps for the two services are separate. For the former are two rotary pumps of 30 tons hourly capacity working at 60-lb. per sq. in., driven by 8-9 b.h.p. motors, whilst for cylinder cooling (for auxiliary as well as main engines) there are two 100-ton low-pressure centrifugal pumps coupled to 22 b.h.p. motors. In each case one pump is a standby.

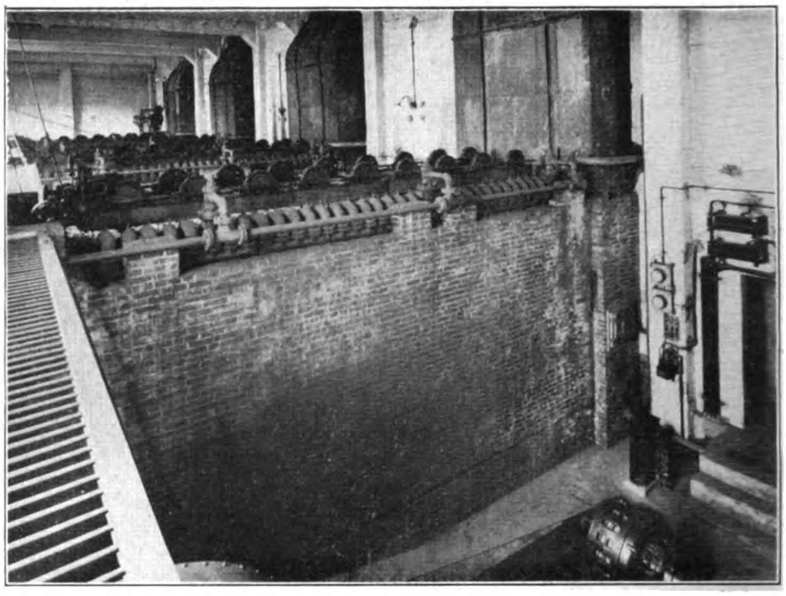
A 200-ton Drysdale Centrex ballast pump is provided, and a similar pump for cargo oil, whilst the motor is of 30 b.h.p. A 30-ton Drysdale upright type fire pump is fitted, also a Vickcen centrifugal separator and a fuel oil transfer pump. There are no independent lubricating oil pumps, apart from one compressed-air driven installation, which may be looked upon as an emergency set. A small steam-driven compressor, with a capacity of 15 cub. ft. of free air per minute, for use in case of complete loss of air, a Cochran donkey boiler, a 30 h.p. Sulzer airless injection engine coupled to a dynamo and a 50-ton upright Drysdale sanitary pump complete the engine-room auxiliary equipment.

The two fuel oil settling tanks are of about the same capacity as those in the *Asuka Maru*, being some 8-ft. in diameter and 10-ft. in height. The thrust blocks, which are incorporated in an extension of the bed plates, are of Sulzer's single-collar type designed for a pressure of 85-lb. per sq. in. In the *Asuka Maru* thrusts of the Michell type are used.

It will be gathered from this description that the two ships are in every respect vessels of the most modern type, and if the owners are willing to furnish some details of the comparative results obtained after being in service for a year or two, the figures would be of the greatest interest and value. In any case, the enterprise they have shown in investigating the relative advantages of two and four-stroke machinery is worthy of all commendation.



General View of Power House



Fuel Economizers

The Ujigawa Electric Power Company

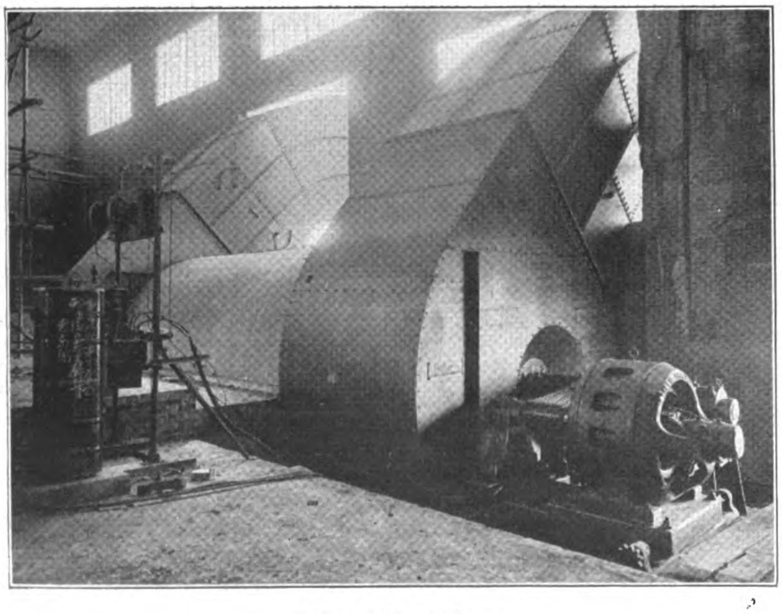
ONE of the great Japanese corporations which recently successfully negotiated a loan in the United States is the Ujigawa Electric Power Company, one of the largest hydro-electric Companies in Japan.

The Ujigawa Denki K.K. of Osaka was incorporated October 25, 1906 (the 39th year of Moji) with a capital of Y. 12,500,000 and represented the amalgamation of four other Companies.

Under the very able management of the President and Directors, the Company has expanded and increased to take care of their consumers of electric light and power until at present the capital stands at a grand total of Y. 85,000,000.

Mr. Yasushige Hayshi, the President, Mr. Sensaburo Kageyama, Managing Director and Messrs. Matazo Asami, Son, Noguchi, Juntaro Yamaoka, Zenpei Mayekawa, Senzo Nagai, Tetsu Kobayashi and Senji Sakamoto constitute the Board of Directors.

The ownership of stock is very widely spread and represents the ideal of successful public utility ownership as can be judged from the fact that 7,150 shareholders were represented at the last general corporation meeting.



Induced Draft Fans

The territory served by the Ujigawa Electric Power Company, Limited, directly or through municipal or other distributors, is in central Japan, has 188 cities, towns and villages, and includes three of Japan's largest and most important cities: Osaka, the largest manufacturing city in Japan, with a population of over 1,425,000, and with Tokyo, the capital, one of the two largest cities in Japan; Kobe, the largest port city, with a population of 724,000; and Kyoto, the former capital, with a population of 680,000. It includes the chief industrial district in Japan, manufacturing textiles, iron and steel products, chemicals, copper and copper wire products, machinery, electrical equipment, fertilizers, lumber, rubber, paper and a variety of other products. Total population of the territory served is over 7,000,000.

The Ujigawa Denki K.K. owns hydro-electric plant capacity of 72,367 k.w., steam plant capacity of 40,000 k.w. and in addition, purchases power up to a capacity of 55,400 k.w.

Their principal power and light market is in and around the fast developing city of Osaka and to the near by city of Kobe.

Osaka is supplied with an average of 8,000 k.w. per hour in daytime and 24,000 k.w. per hour during the evening lighting period. A constant load of 5,000 k.w. per hour is supplied to the Kyoto Dento K., of 4,000 k.w. per hour to Kobe and a scattered load of an additional 4,000 k.w. per hour about the city of Kobe.

In the Osaka district, the Company has 33 miles of underground wire and 2,343 miles of pole line wire, including the district between Osaka and Kobe.

The following figures illustrate the universal use of electricity in the district, even to the humblest dwelling, and the use of power among the small industries in Japan.

In the Omi Branch of the Company, there are 181,833 connected lights among 92,491 consumers and 5,504 horse-power among 1,219 consumers. This district has 3,679 miles of wire.

At the Yamato Branch, there are 82,615 connected lights among 32,623 consumers and 10,202 horse-power among 391 consumers. In this branch there are 3,133 miles of wire.

Kumano Branch has 42,084 connected lights with 19,548 consumers, 1 466 horse-power among 121 consumers and 694 miles of wire.

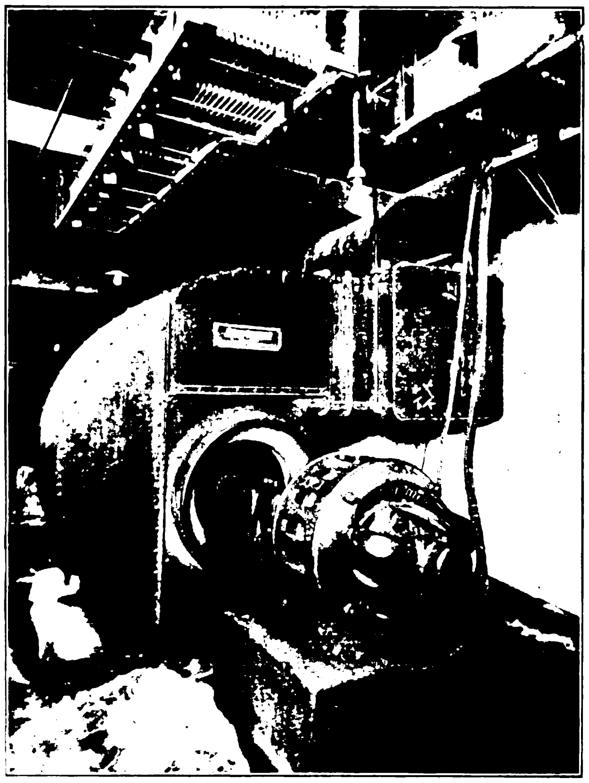
The very modern Fukusaki steam power-house of the Company is located at Fukusaki, Nichi-ku, a suburb of Osaka. The first installation of apparatus at this station was made in 1920 (the 9th year of Taisho) with a total generating capacity of 30,000 k.w.

The design and construction of the station was carried out by Wadachi Kobayashi, Chief Engineer, Tomoo Yabe, Engineer in Charge, with Kozo Sengoku, the Engineer of the Operating Staff.

The Plant is located on the river for condensing and boiler feed water and for bringing in coal and supplies.

All buildings are of re-enforced concrete laid out in unit system and so designed that future extensions are esaily made. In fact, a fourth steam unit with steam generating equipment was installed in May, 1923 (the 12th year of Taisho) bringing the present capacity up to 40,000 k.w.

The operation of the Plant has been most successful. Coal is burned on rilly underfeed stokers and as the forced draft and furnaces were all properly designed for the work, a very high rate of combustion and overall efficiency is maintained.



"Turbovane" Stoker Forced Draft Fans

The stoker forced draft consists of B.F. Sturtevant Company turbovane fans direct connected to 1,750 r.p.m. wound rotor induction motors. The induced draft fans are sturtevant multivane type of heavy construction and wheel overhung on shaft supported by two ring oiled water cooled bearings. The induced draft fans are silent chain driven by wound rotor induction motors.

There are installed ten Erie City Iron Works Vertical Type No. 7-S water tube boilers, each having a nominal rating of 711 horse-power. The boilers are equipped with superheaters and each boiler has an individual economizer. The economizers were built by B. F. Sturtevant Company and consist of 36 vertical sections, eleven pipes wide with 9-in. pipes.

The 10,000 k.w. turbo Alternator Units were built by Westinghouse Electric & Manufacturing Co., and the Turbines are their well-known single flow, reactive type. The same Company built the Leblanc type condensers.

The steam generating equipment, stokers and draft was supplied by the American Trading Company, Inc., and the main electrical generating equipment by Takata & Company.

Gross earnings of the Company, including other income, and net earnings after depreciation, applicable to interest, and sales in kilowatt hours, for the five years ended September 30, 1924, were:

Years Ending Sept. 30		Gross Earnings	Net Earnings Applicable to Interest	Times Interest on Present Mortgage Debt	Sales in kilowatt hours
1920	..	$4,418,969	$1,463,575	1.5	295,000,000
1921	..	5,045,386	1,898,309	1.9	337,000,000
1922	..	5,884,253	2,497,103	2.5	430,000,000
1923	..	6,766,364	3,079,143	3.1	457,000,000
1924	..	7,673,607	3,176,581	3.2	543,000,000

Average net earnings applicable to interest, for the five years ended September 30, 1924, were $2,422,942, or more than 2.4 times the $980,000 interest requirement on these Bonds, which constitute the Company's only present mortgage debt, and in each of the last two years net earnings were more than three times this requirement. Net earnings of $3,176,581 for the year ended September 30, 1924 were more than 3.2 times the interest requirement on these Bonds and more than twice interest on total present funded debt, including the debentures. Other income, included in gross earnings, amounted to less than 4.7% of total gross earnings for the year ended Setpember 30, 1924.

In addition to its properties and plants, the Ujigawa Electric Power Company, Limited, has substantial holdings in stocks of controlled and affiliated companies, including the Osaka Electric Machinery Works, Ltd., and Osaka Porcelain Company, manufacturing electrical machinery and insulating articles; the Nippon Electric Heating Apparatus Manufacturing Company; the Kawasaki Electric Lamp Works; the Osaka Electric Railway Company; (owing and operating interurban electric railway between Osaka and Nara); and the following affiliated electric power companies: Imazu Generating Company, 26,600 h.p. total generating capacity; Ibigawa Electric Compony, 23,000 h.p. total generating capacity; and Nippon Electric Power Company, 84,500 h.p. total generating capacity.

Machinery Market in China

THE rather unsatisfactory decrease which took place in the imports of machinery into Shanghai during last year, especially as this branch of the import trade was regarded as being the most likely to expand, calls for some explanation, and in the recently published annual trade returns for the port the position is dealt with in detail. It appears that during the year business has mainly consisted in the settling up of old contracts—*i.e.*, completing deliveries, and in trying to obtain overdue payments for large orders placed in previous years. While there has been a regular business in supplies of various kinds, there have been comparatively few large contracts for new enterprises, most of the machinery sold being required for extensions to existing plants and factories. The railway business in 1923 was very small. Owing to financial difficulties most of the railway companies have found it impossible to agree to the very stringent terms of payment insisted upon by merchants, and have had, therefore, to restrict their purchases to a minimum. No contracts of any importance were made in Shanghai during the year for locomotives or other rolling-stock, and whatever small orders were placed appear to have gone to Continental manufacturers, whose quotations have been as much as 40 per cent. under American and 20 per cent. under British prices. It would appear, however, that, on the whole, railways have allowed their stocks to run down very low, and that it will be necessary within the next few years for most of them to replenish not only their general supplies, but also their rolling-stock. Next to the railways the textile industries have, in late years, absorbed a great deal of the machinery imported into Shanghai, foremost among them cotton mills, a large number of which have either been installed or enlarged in recent times. But during last year the cotton mill industry suffered serious reverses, and by the end of December it was reported to be in a worse position than at any other time in the last ten years. It was, therefore, not surprising that the business in new textile machinery should have been practically nil. What little business there was went largely to American manufacturers, who have been willing to meet British competition—in some cases 30 to 40 per cent. lower than American domestic prices—in order to keep their hold on the market. As for other industrial machinery, there have been contracts for cement works, match-making plants, can-making plants, and especially flour mills, an industry which is showing unmistakable signs of expansion. A very big business has been reported in electric-light machinery, and there has been considerable development in the heating and plumbing business, which, with the continuous building of small but up-to-date residences, shows every sign of further development. The radiator business alone is reported to have increased from 34,000-ft. of radiation sold in 1921 to 90,000-ft. in 1922 and 137,000-ft. in 1923, with considerable orders for the present year. One of the most noticeable features of the machinery business during the year was the disappearance from the trade of a large number of foreign firms which, during the boom period, had added machinery departments to their business. These firms have found that to sell machinery on the same basis as they were selling other goods is not feasible in a country where, owing to lack of knowledge on the part of buyers, engineering firms have to employ a very large technical staff, not only to advise the buyer as to what kind of machinery is needed, but also to supervise its installation and, to a certain extent, its satisfactory operation.

Worthington Locomotive Feed Water Heater Awarded Medal

ANNOUNCEMENT has been made that the Franklin Institute of Philadelphia, U. S. A. has awarded a special medal to Mr. Thos. C. McBride a prominent member of the Worthington engineering staff, in recognition of his inventions connected with the famous Worthington feed water heater and feed pump for use on locomotive.

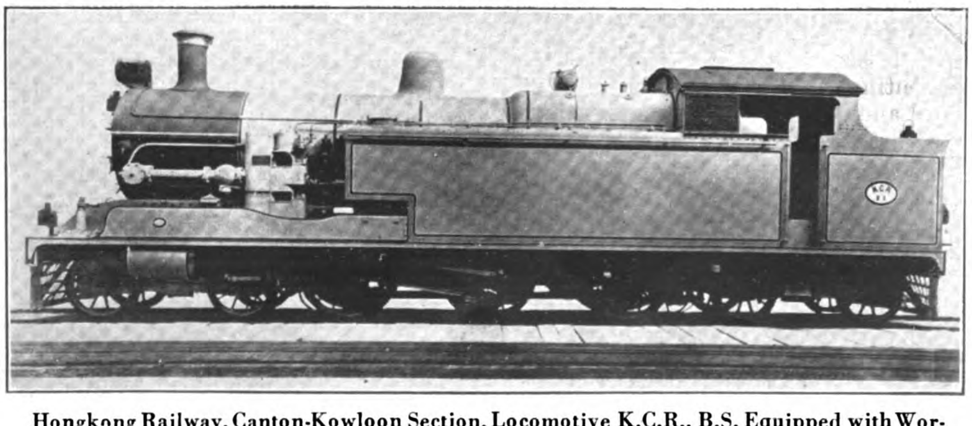
Mr. McBride has been one of the Worthington organization for nearly thirty years and is Manager of the Department in charge of this particular apparatus. He is a native of Philadelphia and a graduate of the University of Pennsylvania, with the degree of M. E. He is a past president of the Engineers Club of Philadelphia and is also a member of the American Society of Mechanical Engineers of New York, the Manufacturers Club and the Franklin Institute of Philadelphia.

Thomas C. McBride, the Worthington Inventor

The medal of the Franklin Institute is one that is very highly prized among American Engineers and is awarded only for inventions of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

The basic principles of the Worthington locomotive feed water heater were evolved by Mr. McBride in 1915, and the manufacture of this apparatus had its beginnings in 1917. Its de velopment into the present design has been a steady progression since then. So remarkable have been the results obtained in the use of saem that in this short time its reputation has taken on an international scope.

In making the above reference to the evolution of this heater under the sponsorship of Mr. McBride, with the great savings in fuel and water made possible thereby, it might be of interest to mention another outstanding benefit that locomotive owners have derived from its use. One of the most expensive and annoying troubles encountered in the operation of locomotives is pitting and corrosion of the boiler tubes. A major cause of this that has prevailed generally everywhere, has been found to be the production of electric currents between adjacent points on tube surfaces that are in contact with water. These currents are present even where there exists only a slight difference in the composition of the metal at those points. The flow of these currents releases what are known as "hydrogen ions," which carry off into solution with the water tiny particles of iron. A peculiarity of this action is that the water can absorb only an infinitesimally small quantity of these ionized particles, so that the solution quickly reaches a saturated condition, the electric currents become neutralized and further action ceases. By allowing air to enter with fresh feed water, the oxygen contained in the air immediately attacks and oxidizes the iron in solution, and this starts the cycles of activity all over again. It has been conclusively proven that these continue so long as air is admitted into the water space of the boiler.



Hongkong Railway, Canton-Kowloon Section, Locomotive K.C.R., B.S. Equipped with Worthington No. 2B Locomotive Boiler Feed Pump and Feed Water Heater (Heater Blake Built)

In designing the Worthington Heater this important matter was given careful consideration, and means were provided whereby more than 85 per cent. of the air that is normally in solution with all raw water is entirely separated and does not enter the boiler. As all of the exhaust steam used to heat the water in the Worthington open heater goes directly into the water fed to the boiler, the percentage of air present is thus further reduced to probably not more than 10 per cent. of that present in the feed water delivered by any other type of heater or injector.

In discussing this subject an experienced American engineer who for several years has made a close study of these conditions, states as follows :—

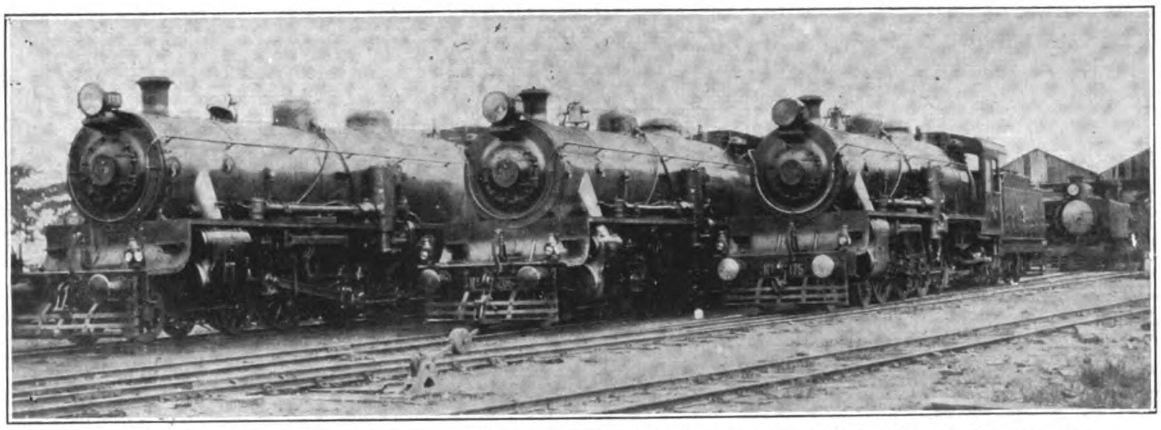
"The proof is complete when we find that the presence of an open feed water heater which nearly eliminates oxygen is sufficient to practically stop pitting in stationary boilers. Feed water heaters for locomotives are new in the world, but they are in successful use, and some of them are of the open type, so that the oxygen can escape while the water is being heated."

A number of mechanical and electrical devices and methods of water treatment have been tried out in an effort to counter-act this oxidation by the air taken in with the feed water, but all these have proven bothersome and expensive to install and to maintain. It has been found that the most practical method is to prevent the air from entering the boiler with the feed water in the first place. This the Worthington open locomotive feed water heater does automatically with no cost or bother either for extra equipment or for maintenance.

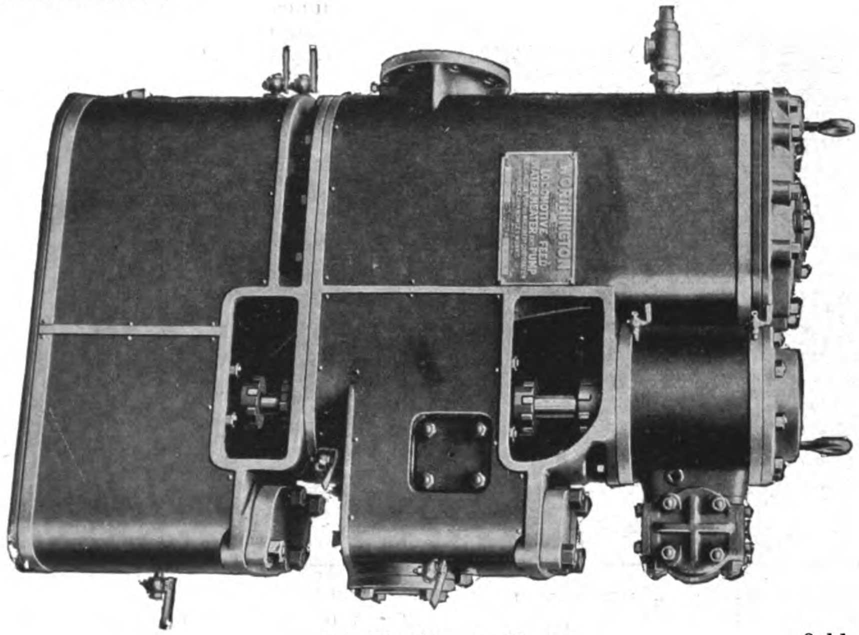
For many years Worthington had been manufacturers of closed feed water heaters for stationary service. In power plants where the heating of feed water was practiced the closed heater was in universal use. To-day but few of these can be found in use anywhere and concerns who made them have either gone out of business or have ceased their manufacture. Worthington was among the first to bring out a stationary heater of the open type.

It was the consideration of the above circumstances, among others, that induced Worthington engineers when designing the Worthington locomotive feed water heater, to discard the closed

type and to adopt the open type of construction exclusively. The immediate recognition by railway engineers of the possibilities possessed by the open type of heater for locomotive work has been fully justified by the wonderful results that have been realized wherever these Worthington heaters have been installed.



Manila Railways Company Locomotives Nos. 173, 206 and 175 Equipped with Worthington Locomotive Feed Water Heater and Pump of 32,500 lbs. per Hour (65 gals. per min.) Capacity Photo Taken at Manila, P. I.



The Worthington Heater

The rapidity with which the use of the Worthington open Heater has spread all over the world, and the fact that already thousands have been adopted by the most important railway system in all the principal countries of Europe, Asia, South America and South Africa, as well as on practically all the larger railways in the United States, Canada and Mexico, as standard and indispensable units of locomotive equipment, are marked tributes not only to the genius of the inventor who is the subject of this article, but they are also conclusive proof of the many exceptional merits of excellence that are inherent in this apparatus.

Bristol Ports Abolish Far East Freight Surcharge

The abolition of surcharge from Newport and Swansea to Far Eastern Ports has been officially notified by the Secretary of the South Wales and Monmouthshire Iron and Steel Manufacturers Association as from February 1, as a result of negotiations conducted by a committee representing the employers' associations of the South Wales iron and steel and tinplates trades and Chambers of Commerce, in association with the Great Western Railway.

It is considered that as nearly one-half of the total iron and steel exports from Great Britain to the Far East are dealt with at Bristol Channel ports, the concession will be one of prime importance to South Wales manufacturers in one of their foremost markets. The South Wales manufacturers have hitherto had to pay a surcharge of 5s. ($1.25 U.S.) on traffic loaded at the ports named or incur the expense of heavy railway carriage to the River Mersey. Freights from Newport and Swansea to the principal markets are now on the same basis as London, Liverpool, Glasgow, and Middlesbrough.

Largest Turbines for Export Ordered by Japan

Two 43,750 kv-a., 50,000 shaft horse-power, steam turbine generators, the largest complete units ever built for export, have been ordered by the Hayakawa Electric Power Co., of Japan from the International General Electric Company, U.S.A. The installation, to be made at a cost of approximately two million dollars, will be used in parallel with the hydro-electric developments of the company in the hamamatsu district for furnishing power to Tokyo. The average consumption of electricity in Japan for the lighting of homes is about 35 watts; these huge generators are capable, therefore, of lighting about two million homes. It is in the rapidly developing industrial field, however, that the major part of the power will be used.

The size of the turbines can be appreciated from the fact that the rotors weigh 60 tons each, and are 30-ft. long and four feet in diameter. Each turbine has a net weight of 785,000 pounds. Except for the rotors, the apparatus will be shipped disassembled, making the journey from Schenectady *via* the Panama Canal. Shipment of the first unit will be made this summer. The second unit will be shipped early in 1926.

The turbines will produce energy at a 11,000 volts and 50 cycles. The order also includes two 1,000 kw., 3,300 volt, 50 cycle house turbines. The equipment is to be installed in a new power station the Hayakawa Co. is building at Kawasaki, to the south of Tokyo.

The order for the equipment was received by the Tokyo office of the International General Electric Company through Mitsui and Company. The Hayakawa Electric Power Company is a subsidiary of the Toho Electric Power Company, which in turn has a controlling interest in the Daido Electric Power Company, one of the most important power amalgamations in Japan.

A year ago, the Toho company ordered from the International General Electric Company a similar turbine, but rated at 60 cycles rather than 50, for installation in Nagoya, in the south of Japan. That order established the record for export turbines, but has been surpassed in physical dimensions by the new order.

Another order received recently from Japan by the International General Electric Company from Mitsui & Company is for three vertical water-wheel driven generators, the order having been placed for the Gifu Electric Company. The generators are rated at 10,125 kv-a., 6,600 volts, and will have direct connected exciters. The order also includes a two unit, three bearing, motor generator set, seven 5,000 kv-a., 60 cycle, water-cooled transformers, and a 17-pannel switchboard.

The Soya Bean in Manchuria

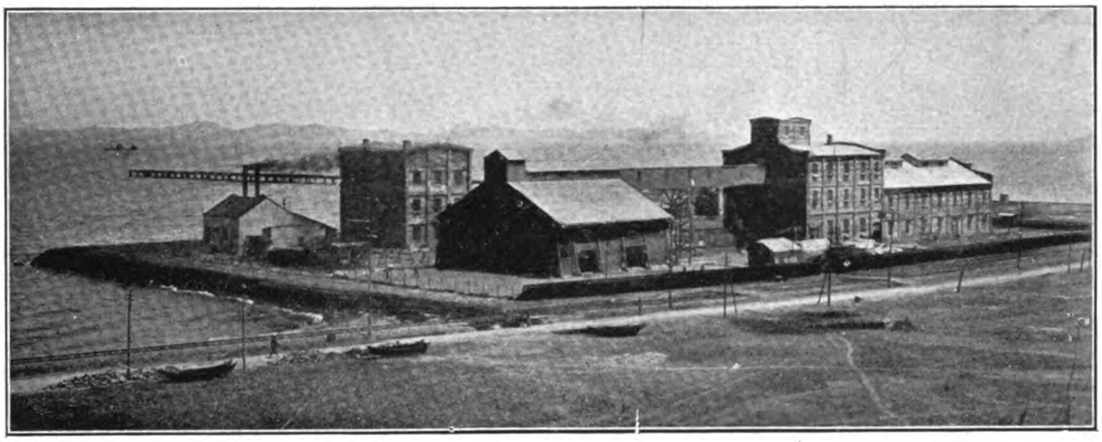
By Taro Ito of the Manchuria Railways Co.

A Paper Read at the Pan-Pacific Food Conservation Conference

AS all of you know, the soya bean has constituted an important foodstuff in China for the past 5,000 years. China boasts of the foremost position of the present-day world in the production of soya beans. Eighty per cent. of the world production is cropped in China at the present time and 70 per cent. of China's yield is produced in Manchuria.

Manchuria, therefore, ranks first in so far as soya bean production is concerned. Her annual yield is estimated at approximately 3,500,000 kilolitres.

These large figures are results brought about by the rapid development of recent years and this development is in turn due to the effort on the part of the Manchurian farmers as well as activities on the part of railroad authorities. Although the soya bean of Manchuria has now risen to the place of a world commodity, yet it was not until 1908 that Manchuria soya beans were introduced to the world market. In that year the first shipment was made to England; and ever since that time their utility has come to be recognized by European and American people, and they are annually exported either in the shape of oil and cakes or in the shape of beans. The soya bean has attained the position of being the most important agricultural product in Manchuria to-day, and it is by no means exaggeration to say that business circles depend to the greatest extent upon the market situation of this commodity.



South Manchuria Railway's Experimented Bean Mill

However, the Manchurian beans are not so important as such, as they are as the raw material for oil and bean-cake. The greater proportion of the soya-bean crop is consumed in oil factories for the manufacturing of oil and cake, while a lesser proportion is exported to China proper, Japan and other foreign countries, such as England, Germany, Holland and Egypt on the one hand, and America on the other.

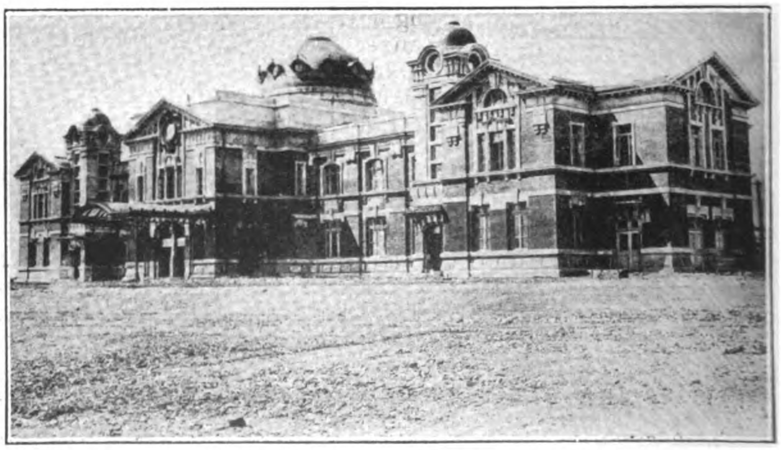
The quantities of soya beans carried by the South Manchuria Railway alone amounted to 2,000,000 metric tons for the year 1923. Of this tonnage 400,000 tons were exported to Japan, 150,000 tons to China proper, 80,000 tons to the South Sea Islands and Australia and 1,000 tons to America, chiefly to the port of Seattle, in the Pacific area, and 120,000 tons to Europe and Africa. The aggregate of exports amounts to 750,000 metric tons for the last year. That is, something like 37 per cent. of the beans which entered into the railroad traffic were shipped by steamers from Dairen, the southern terminal of the railorad.

Then, what became of the remaining 63 per cent.—or 1,250,000 tons? They were consumed in oil factories called by the Manchurians "Yu-Fang"; factories which flourish in Dairen and Yingkou, for the manufacture of oil and cakes. The export of oil reached 140,000 metric tons for the year 1923 and that of bean-cake 1,300,000 tons, the oil being exported mainly to Europe and America and the cake to Japan for fertilizer.

As well be gathered from the foregoing sketch, the transportation of soya beans occupies a significant position in the railroad traffic in Manchurian regions.

As peculiar to the method of transporting soya beans now in force on the South Manchuria railway (also on the Chinese Eastern railway, in so far as through traffic to the South Manchuria railway is concerned) attention must be called to the "mixed storage system" which is combined with the carriage. Not only has improvement in handling soya beans been effected but improvement of quality has also, through this system, been encouraged and at the same time merchandising has been facilitated. This system is not at all compulsory and those who do not desire to avail themselves of it can make shipments on the ordinary basis of transportation. But, in reality, the soya bean business derives many advantages and much benefit from the system, especially at a time of congestion of

The Business Street in Mukden



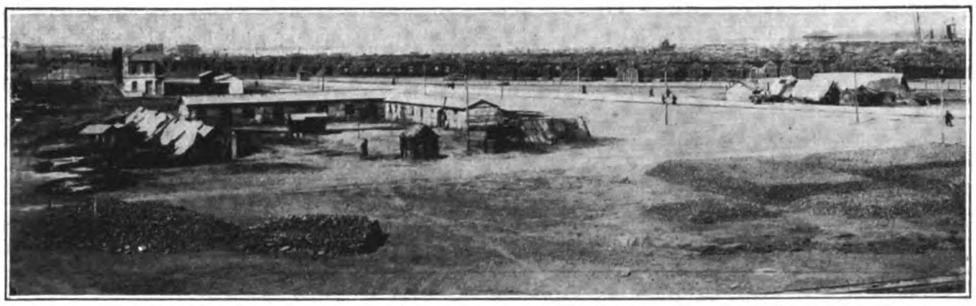
Mukden Railway Station

traffic. Ninety per cent. of the carload shipments utilize the system.

What is, then, the character of this mixed storage system and what functions does it play in the sphere of railroad transportation?

Mixed Storage System Now in Operation on Railroads

Merchants who are desirous of shipping their beans by rail from one place to another, some for the purpose of discharging their contracts, others for the purpose of supplying their mills with beans purchased for their plants at distant markets, can bring them in bags to specific depots designated as points of acceptance for carriage on the mixed storage basis and there offer them as mixed storage railroad freight. The quantity of one consignment is fixed at carload shipment—that is, about 30 tons, otherwise they cannot be accepted.


Acres of Bean Cake stored in the Open on Dairen Wharves

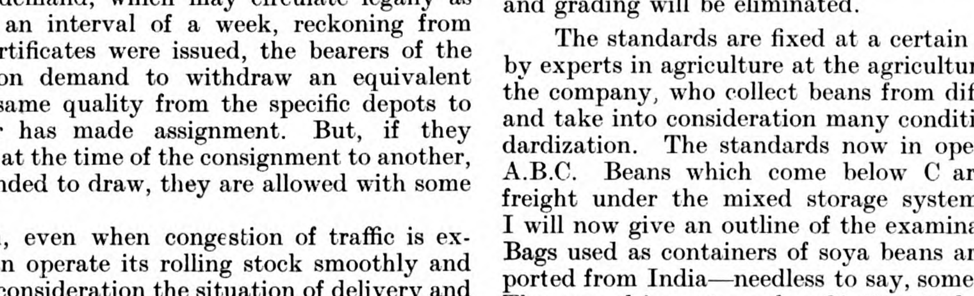
Previous to the acceptance the beans thus delivered are examined and graded by railroad agents appointed specially for this purpose, according to standards selected for the year. In addition to the examination and grading of contents, the containers (all of them are gunny-bags) are similarly examined and graded in accordance with the standards fixed for the year. In case the beans offered in this manner come up to the standard and the bags pass examination, they are accepted for storage with transportation. Depositors, who, in a sense, may be called consignors, are entitled to certificates issued on demand, which may circulate legally as negotiable paper. After an interval of a week, reckoning from the day on which the certificates were issued, the bearers of the certificates are entitled on demand to withdraw an equivalent amount of beans of the same quality from the specific depots to which the first depositor has made assignment. But, if they desire to change the depot at the time of the consignment to another, from which they had intended to draw, they are allowed with some restrictions to do so.

Through this system, even when congestion of traffic is experienced, the railroad can operate its rolling stock smoothly and efficiently, by taking into consideration the situation of delivery and withdrawals of beans over all its lines and appropriately adjusting their transportation to meet requirements of any of the depots, irrespective of the specific destinations designated in the consignment papers. This benefits not only the railroad but also consignors and consignees, because carriage will not be refused on the plea that traffic is too congested.

Through this system, improvement in quality of beans is believed to have been achieved. Examiners are vested with the right to determine whether the quality of beans is equal to the standards or not, and the beans which do not come up to the mark do not enjoy the benefit of the system, with the result that merchants do not care to purchase such inferior beans and accordingly farmers pay keen attention to producing beans of superior quality.

Besides these merits the mixed storage system is said to have another beneficial point. Regardless of the real carriage of any particular beans which are entrusted to the railroads, the bearers of certificates are given the right to make withdrawals after the lapse of a certain period of time. For this reason they are able easily to negotiate the papers with banks.

The "mixed storage system," as the railroad authorities call it, was adopted in 1919, by the South Manchuria Railway. Later, in 1922, an agreement was made relating to the through traffic in soya beans accepted on the mixed storage basis between the South Manchuria Railway and the Chinese Eastern Railway.


Small Part of Dairen Wharves showing Warehouses and Open Storage

In view of the economic situation of Manchuria, the South Manchuria Railway donates a bounty of 15 yen per consignment, that is, per carload, and by this means and others is endeavoring to improve the bean trade in its territory.

Examiners. Contrary to that of other countries, the system adopted by the South Manchurian Railway is peculiar in respect to the examiners. Thus in Canada and the United States the examination and grading of grain are usually undertaken by officially organized boards or committees. However, the examination and grading is done on the South Manchurian Railway by examiners appointed by the company. Their qualifications are in like manner determined by the company, which undertakes not merely the responsibility of carrying but also of examining and grading.

Examination and Grading of Soya Beans and Bags. The examination of beans is ordinarily carried on in the railroad yards by drawing a certain number of samples from one consignment which comprises 350 bags, each bag weighing not less than about 85.2 klgs. (142 kins). The method now in use is practical, based upon the appearance of the beans to the naked eye and their moisture content as estimated by chewing between the teeth. The authorities have under consideration the introduction of a more scientific method by which all the complaints arising from the examination and grading will be eliminated.

The standards are fixed at a certain time of the year annually by experts in agriculture at the agricultural experimental station of the company, who collect beans from different parts of Manchuria and take into consideration many conditions necessary to the standardization. The standards now in operation have three grades, A.B.C. Beans which come below C are not to be accepted as freight under the mixed storage system. So far for the beans. I will now give an outline of the examination and grading of bags. Bags used as containers of soya beans are gunny-bags, mostly imported from India—needless to say, some are imported from Japan. The annual import reaches 20,000,000 bags on the average, comprising, of course, old ones as well as new.

The bags in which beans are packed are examined and graded together with the beans. The standards thereof are also three. A new one is designated as A and old one used only once is designated as B, while an old one used twice is designated as C.

The railroad can make delivery of different grades of bags so long as it delivers beans of the same quality as it had accepted. The difference between the prices of superior and inferior grades of bags is paid or received by the company as the case may be.

Method of Packing Soya Beans and the Projected Elevator System. Soya beans are at present carried in Manchuria in gunny-bags and, as the weather in Manchuria in winter when the beans appear on the markets is dry, any precipitation falling as snow, open stacking is permissible without the slightest damage to the goods. But in view of the saving of time in handling the goods, as well as of economising the expenditure on bags the South Manchuria Railway is now considering the construction of grain elevators in the interior as well as terminals, as, for instance, in Dairen and Changchun.

This plan will be realized next year and building will be started.

New Dry Dock of Kiangnan Dockyard

THE large new dry dock of the Kiangnan Dock and Engineering Works, which had been under construction for sixteen months, was officially opened for service last month.

The new dock has been placed parallel to the old dock, leaving a space of about 150-ft. dividing the two docks, on which the pump houses for both docks are situated, also power house and other buildings for the use of the vessels using the docks.

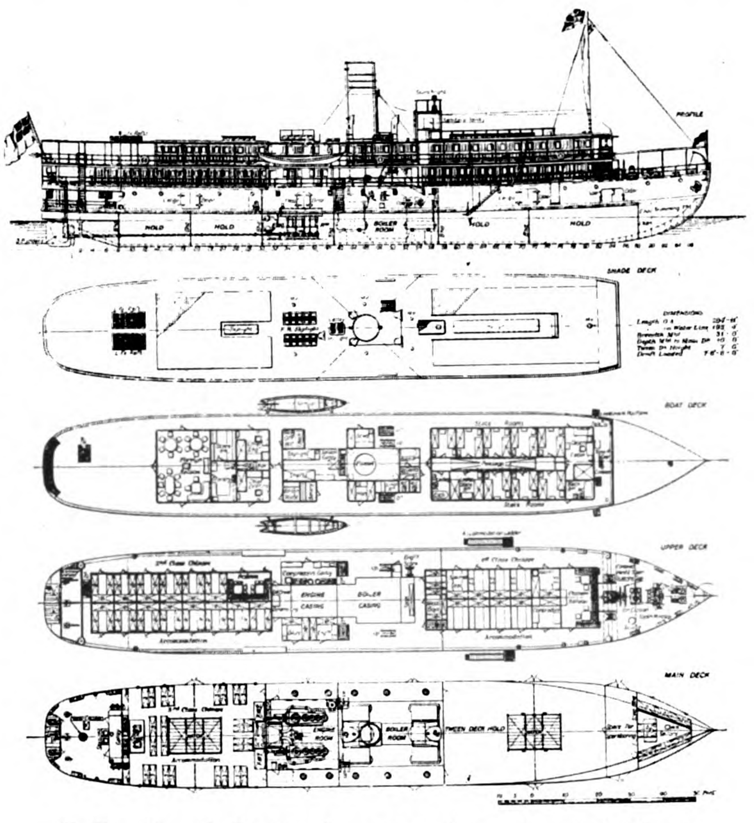
The first vessel to enter the new dock was the "Liberator," 11,713 tons displacement, 428-ft. long and 56-ft. beam. The operation of placing this large vessel in the dock was accomplished in a very short space of time, as two electrically driven capstans placed on each side of the dock, quickly warped the vessel into a central position.

The steel caisson closing the entrance to the dock was floated into position and in a few minutes after being placed was rapidly sunk into the recess for its reception and the order was given to start the dock pumps.

It was soon evident that the pumping plant was of large capacity as the water in the dock was falling at a very rapid rate, and within a few minutes the "Liberator" was resting on the blocks and about sixteen wood shores were wedged up to keep the vessel upright as the water receded and left the vessel dry.

The dimensions of the new dock are 502-ft. long, 60-ft. wide and 26-ft. 6-in. deep. The pumping plant consists of one 30-in., one 20-in. and one 10-in. electrically driven centrifugal pumps. All running together, the dock can be pumped dry without any vessel in the dock in about two hours.

In the docking of the 11,700-ton "Liberator," the 30-in. pump was not required, the two smaller pumps being sufficiently powerful to deal with the water to be discharged.



Shallow-Draught Steamer *Loongmow*, for service on the Upper Yangtze River, China, Built and engined by the Kiangnan Dock & Engineering Works, Shanghai

The general construction of the dock is of timber, imported from Canada and the Philippine Islands. The only concrete work visible is at the bottom of the pier heads behind the large steel caisson, which most effectively shuts out the river, with practically no leakage.

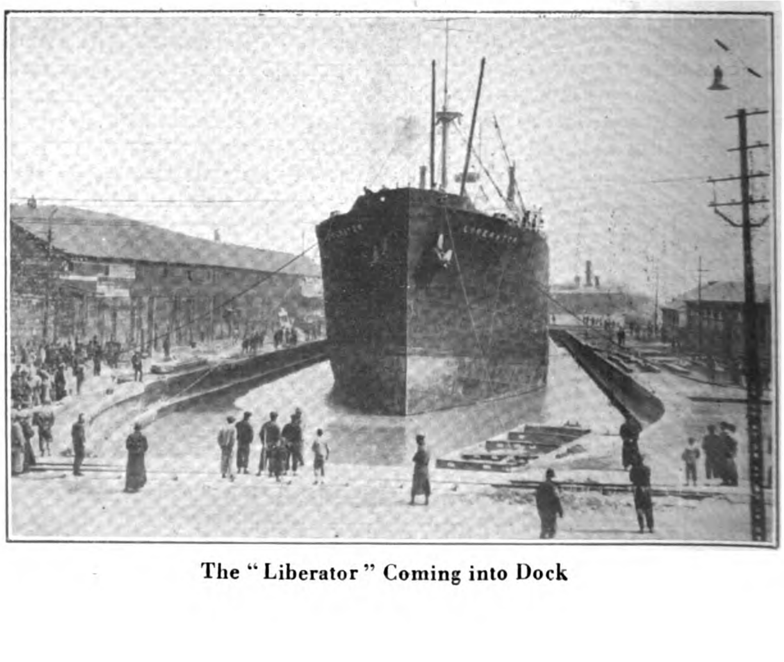
The whole structure of the dock is heavy and substantial looking and gives the impression at once as being imposing and a great engineering achievement, reflecting the very highest credit on the designer, Mr. R. B. Mauchan, the general manager of the Kiangnan Works.

The Kiangnan Works is now in a most enviable position, having two dry docks, and probably the best equipped plant in this part of the world, at the disposal of their many clients.

The dimensions of the docks are: Old dock, 545-ft. on blocks, 60-ft. wide, 20-ft. draft; new dock, 502-ft. on blocks, 60-ft. wide, 23-ft. draft.

The dockyards came into existence about seventeen years ago. There was a so-called dry-dock which was little more than a mud-hole, no machine shops and no building slips. The yard was supposed to be able to deal with the vessels of the Chinese Navy, but all repairs to Chinese warships had to be carried out in the British yards at Shanghai or Hongkong. In 1905, the Admiral in command of the Chinese Navy came to the conclusion that it was the height of absurdity that a country which had a Navy should not have a dockyard in which to repair its own ships. This was Admiral Yeh, who had been educated and trained in the British Navy, and he set to work to organize the Kiangnan Dockyard. It was a formidable task, but Admiral Yeh was a man of great courage, and regarded his country's interests as his own. He also had the great gift of being able to choose his men, and, having chosen them, he allowed them a free hand,

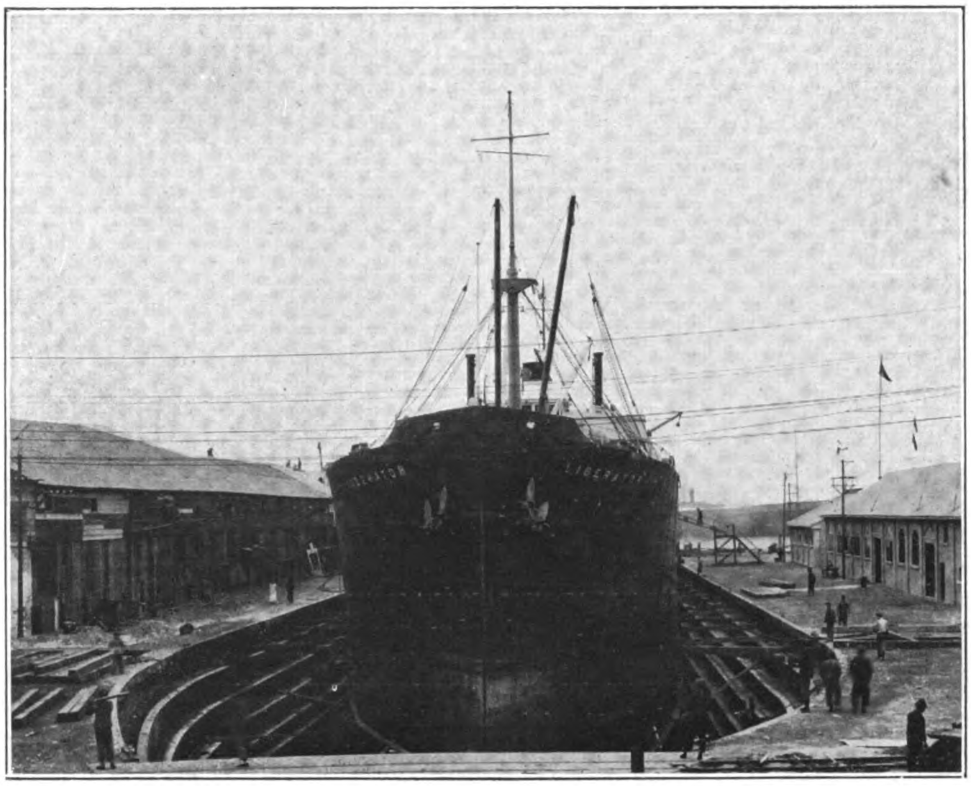
"Caisson" being Put into Position



The "Liberator" Coming into Dock

so long as they carried out the work which was allotted to them. As a director of the yard the Admiral appointed Captain Woo, who had also had considerable Western experience, and Mr. R. B. Mauchan was appointed superintendent.

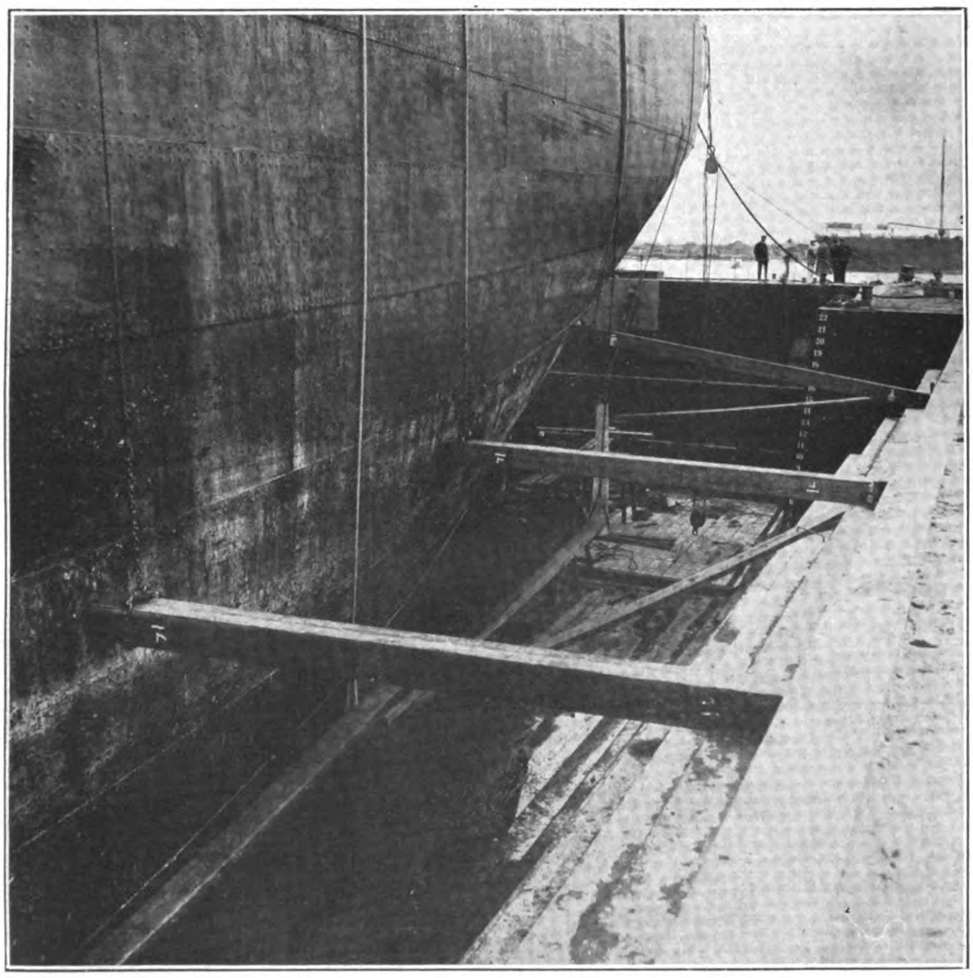
Mr. Mauchan had received his training in the yard of Denny and Co. on the Clyde, and had had several years' experience in the management of Chinese workers. Admiral Yeh, the original directors, and their successors, have consistently supported the efforts of Mr. Mauchan in his endeavours to make the Kiangnan Dockyard what it is to-day—the premier shipyard in China. It is this co-operation between the East and the West which has proved so successful. Without the whole-hearted support of the directors and government officials in Peking, the European staff, from the superintendent downwards, could have done very little, and, in their turn the directors have been able to rely upon the loyalty of the European staff. In this there is a lesson to be learned by all foreigners who come to China to develop her natural and industrial resources. It is not only necessary that the foreign staff should be technicians of the highest attainments, but they must have the courage to stand by their opinions, and be able to prove by the quality of their work that they are worthy of the positions they hold. It is this frank recognition by each of the qualities and attainments of the other that has proved so satisfactory in the case of the Kiangnan Dockyard.



The "Liberator" in Dry Dock

From the beginning the dockyard has been run on strictly commercial lines. It has enjoyed no privileges from the government that are not available to any of the foreign yards operating in China. The whole of the material imported for the yard has to pay the usual Customs duty. This is another factor that has tended to put the Kiangnan Dockyard at the head of the industry in China. It has had to justify its existence by financial results. It has the competitive incentive to lead the way in designing and workmanship, and has to its credit some special types of vessels that have not been attempted by other shipyards in China.

The yard covers an area of 66 acres, rather more than half of which is occupied by shops, dry dock, etc., and the new extensions will take up a considerable portion of the existing vacant space. As opportunity offers, changes are made with a view to arranging the shops so that the work will always move in the one direction, thus saving time and labor. Starting a tour of the yard we come to the following shops:—



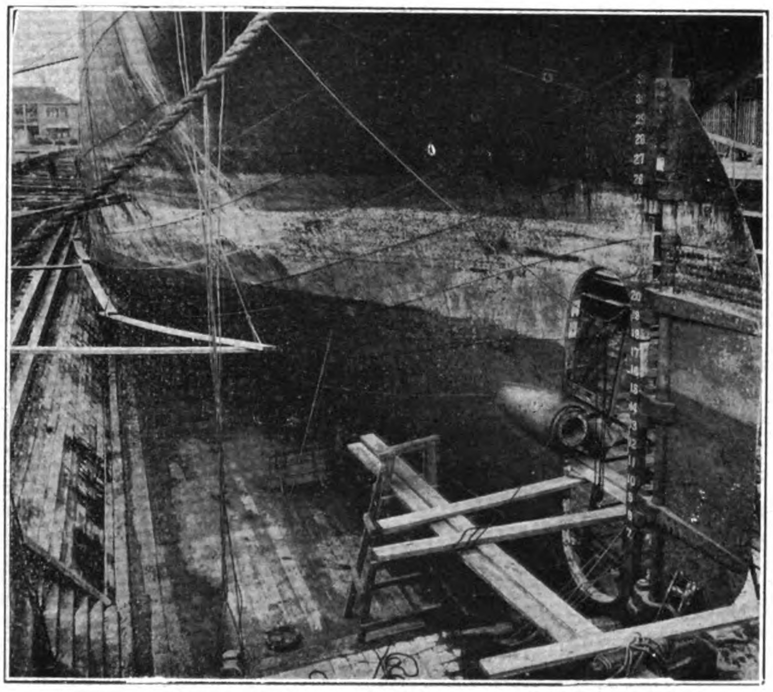
The "Liberator" in Dock, Looking to Caisson

The Pattern Shop is a well-equipped unit of the establishment, adjoining the foundry. It is fitted out with the latest wood-working machinery, and is a well-lighted and spacious shop.

Foundry.—This has been entirely remodelled and re-equipped within the past twelve months, and is now capable of dealing with castings up to twenty-five tons in weight. In view of the nature of the soil, special care has had to be taken to guard against subsidence in dealing with the heavier castings. The casting pits are built of reinforced concrete floated on the mud, thus guarding against movement. The cupolas are so arranged that they are capable of serving pits on either side. Visitors who have had foundry experience in Europe or America have always expressed surprise at the quality of the castings turned out here. An electric steel furnace is being installed and this will be the first of its kind in China.

Machine Shop.—This building is 440-ft. long, 65-ft. wide, and 24-ft. high, and is served by two 20 and one 10-ton overhead cranes. The machine tools are the largest to be seen in China, and comprise some of the latest British types. This shop is capable of dealing with the largest forging or casting likely to be required by the yard.

Erecting Shop.—This leads out of the machine shop. The frame work is steel throughout, with glass sides. It is 180-ft. long, 143-ft. wide, and is 36-ft. high, clear of the cranes. It is served by one 40-ton and two 20-ton



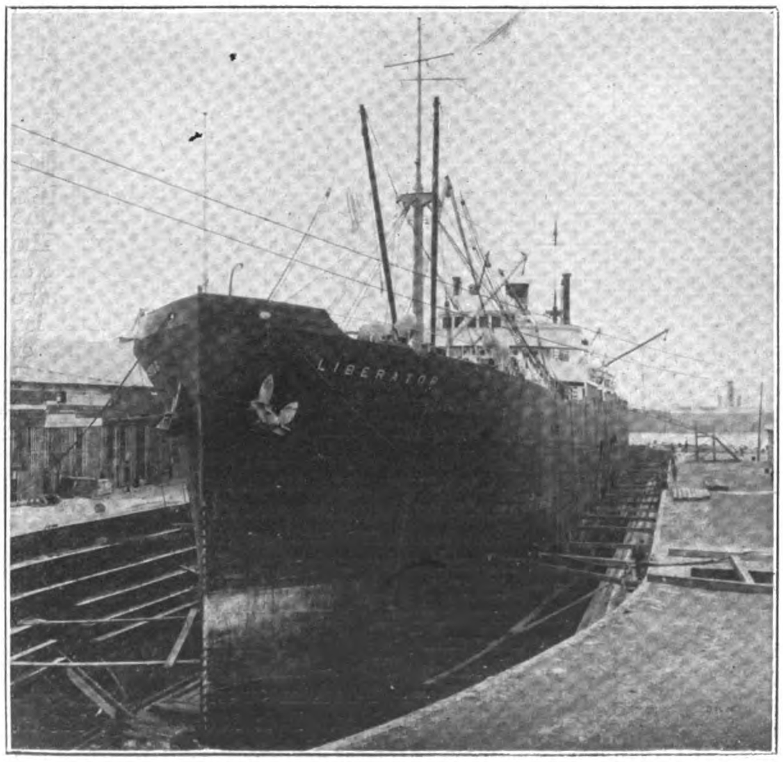
"Liberator" in Dock, Taken from Caisson

overhead cranes. Two of the largest drilling machines, by British makers, have recently been installed in this shop to be driven by electricity.

The Fitting Out Berth is at the head of the erecting shop, and is equipped with sheer-legs capable of lifting 75 tons. These sheer legs formerly stood at the other extremity of the dockyard, and were then only capable of lifting 40 tons. They were taken down, lengthened and re-erected on their present sites.

Dry Dock.—This marks the successive stages of the growth of the yard. It has been lengthened and widened from time to time to meet the growing demands, and is now 545-ft. long, and can dock vessels up to 60-ft. beam, and drawing 20-ft. of water. A new pumping plant has recently been ordered from Gwynne & Co., to deal with the increased size of the dock. A new dry dock is to be built, and work on this is to be commenced this month.

Boiler Shop.—This is the last item in the establishment to be reorganized. An entirely new shop is to be built, and the steel work for it has been ordered from Great Britain.



"Liberator' Dry in Dock on Blocks

Adjoining the building berths are extensive shops for handling the plates and sections used in the yard. These are equipped with the latest types of plate and angle-bending rolls, punching and shearing machines, etc., all driven by electrical machinery.

Slipways.—There are nine large slipways and several smaller ones for dealing with small harbor and other craft. Three slips are available for ships 600-ft. long; three for ships of 500-ft., and three for ships of 350-ft.

It will be seen from the above that, even judged by home standards, the Kiangnan Dockyard is an establishment of which China may be proud. If China can provide such a yard with locally-produced supplies of iron and steel there is no reason why this yard should not be capable of dealing with vessels of the best class. The Kiangnan Dockyard has built some very fine vessels for the Upper Yangtze services, and, in turning out the ships for the United States Shipping Board she at once takes her place in the forefront of Far Eastern shipyards. Those British manufacturers interested in iron, steel, and shipbuilding, who are looking to China as a field for their enterprise, might do worse than consider a scheme of co-operation with the Kiangnan Dockyard. It would bring together the best in the industrial elements of the two countries, and help considerably in that development of China to which all far-sighted Britons in that country look for the expansion of the trade of the two countries. In any such scheme, providing it safeguards the interests of both parties, British manufacturers may be assured that they will receive the cordial assistance of the present directors, Admiral Wong and Admiral Kwong, and of the general superintendent, Mr. Mauchan. These gentlemen have only one object in their minds in regard to the dockyard—the advancement of the interests of China in the industrial field with the help and good will of Great Britain, to the mutual advantage of both countries.

A New Holt Liner

The twin-screw steamer *Antenor* built at the Jarrow ship yard of Palmers' Shipbuilding and Iron Co., Ltd., to the order of Messrs. Alfred Holt & Co., was taken to sea on Thursday, January 15, for her trial trip. The *Antenor* is a large passenger and cargo liner and has been built to Messrs. Holt's special class and construction, and is fitted with two sets of Parsons steam turbines, built by the Palmer Company. The trial was in every way highly satisfactory, the turbines and gearing running smoothly, and there was complete absence of vibration. On the conclusion of the trial the vessel was handed over to her owners, and sailed thereafter for Glasgow from which port she will make her maiden voyage to the Orient.

New British India Steamer

The steamer *Queda*, built by Messrs. William Gray & Co., Ltd., of West Hartlepool, to the order of the British India Steam Navigation Co., Ltd., of London, successfully ran her trials on January 5 and 6. The vess elisof the following dimensions:—Length overall, 502-ft.; bre adth60-ft. 9 inches; depth moulded 32-ft. 8 inches. She has ample accommodation for a fewp assengers and for officers and crew, is fitted with wireless telegraphy, and has an electric light installation throughout. The outfit includes an ice house for provisions, fresh water distiller, steam windlass, and steering gear aft, with telemotor control in bridge, cellular double bottom, deep ballast tank and fore and aft peak tanks, 19 derricks, fitted on masts and derrick uprights, and one 25-ton derrick, 19 steam winches exhausting into winch condenser.

The propelling machinery supplied by the Central Marine Engine Works of the Builders consists of balanced quadruple engines, having four cylinders, 28½, 41, 58½, and 85 inches diameter by 54-inch stroke. The vessel is fitted with five large multitubular boilers working at 225 lbs., pressure, and working in conjunction with Howden's system of forced draught.

A number of "CMEW" steamship auxiliaries of the well-known type, also made by the Central Marine Engine Works, are fitted, including centrifugal pump, pair of main feed pumps, general service pump, fresh water pump, harbor feed pump, ash ejector pump, auxiliary condenser circulating pump, direct contact feed heater, evaporator and combined auxiliary condenser, and auxiliary surface feed water heater.

Agricultural Experiment Station in Java

By Dr. P. J. S. Cramer, Director, Experiment Station, Department of Agriculture, Buitenzorg

Before the Pan-Pacific Food Conservation Conference

IN describing the agricultural extension work in Java it must be kept in mind that our stations serve two different kinds of agriculturists. We have one system of production on a large plantation scale, each unit comprising several thousand acres. The native laborer on these plantations is more or less in the same position as the industrial laborer in the United States. He is simply the hand laborer, and the policies of the plantation are determined by Europeans or foreigners. The plantations aim to produce for the world market and the local consumption is quite secondary. Taking our largest plantation crop, sugar, we export 1,600,000 tons, while we use in Java something like 150 thousand tons a year. The export trade is the principal purpose of the industry. We have no manufacturing industry, as in the United States, raw material being sold to the world's markets.

Then on the other hand we have the native agriculture which is done on small farms, largely devoted to the growing of foodstuffs and the necessities of daily life. It is the agriculture which a century ago was able to provide nearly all the wants of the natives. However, in late years the contact of the native with the commerce of the outside world, the building of railroads, etc., has caused a tendency among the natives to also produce articles for the world's markets and we see in the year 1922 that while our large plantation exports were valued at something over $200,000, the value of the exports of the natives from their small farm units was $65,000,000, which is about the value of the sugar crop in Hawaii. It shows the tendency to develop the commercial side of agriculture, which seems to be the more profitable.

I shall explain also our situation with regard to research and extension work. With these two different kinds of production systems, it is clear that each needs its own type of research institution and its own way of running them. Our large plantations have organized their own experiment stations. Our sugar people have one of the largest and oldest experiment stations in the world, more than double the size of the sugar experiment station in Hawaii, and they have done some very excellent work. It is much on the same basis as the sugar experiment station in Hawaii. It is entirely kept up by the money of the companies who have invested capital in the sugar industry there. It is not directed by the planters themselves but rather by the banks which own the sugar plantations. In the rubber industry we have the same situation, and for the other industries much the same. We have a sugar experiment station in east Java and two rubber experiment stations in west Java we have one for coffee and one for tobacco, as well as one for tea. So we also find in Sumatra one for tobacco, and, independent of this, one for rubber and oil palms and for the other crops being developed there which seem promising for Sumatra. While these are absolutely independent and have nothing to do with each other so far as their finances are concerned, there is a mutual understanding between the staffs of all these stations ; they meet once a year and talk over their respective interests and exchange ideas for the mutual benefit of each other.

Apart from this whole organization of private stations, we have an Agricultural Department very much like your Federal Department. It tries to fill the gap between the local experiment stations. There are five main divisions : (1) abstract or pure science ; (2) general applied science ; (3) special applied science ; (4) extension work ; (5) the farmer and his welfare. In our experiment stations are special men who are located in the centre of the various sugar districts and report on the work done.

In our work for the natives the greatest difficulty is the extension work. It is much more difficult to advise the native than the European planter. The latter receives everything with open hands from the experiment station and hastens to follow the advice. The difficulty is to get the native farmer to practice better methods of production. I could cite examples to show you how superstitious the native farmer is. It requires a good deal of study to understand their mentality. They would rather do less work than improve their crops and get a larger production if it gives more trouble. It makes it extremely difficult for us, therefore, to get the farmers to use better farming methods. We have in every province of Java one trained agriculturist, generally trained in our agricultural high school in Holland. He has to pass an examination in the native languages and have a knowledge of native institutions. These men have done a great deal of work even though it is only the beginning of what we hope eventually to do for the natives.

Steel Works for Shansi

A program for starting two machine shops in Shansi province outlined by the Shansi officials was passed at the industrial conference held in Taiyuan in February. The object is to manufacture different kinds of light machinery for such native industries as paper and oil manufacturing, liquor brewing, etc. and also to turn out improved agricultural implements for the farmers. The program covers two periods. In the first period, the Yu Tsai or Training Machine Shop is to be established at an estimated cost of $194,800. This institution, though working on a limited scale, is to lay the foundation for a larger establishment. It is to study the various kinds of simple machinery which suit the needs of present industrial conditions in Shansi and also to train skilled mechanics for the Ching Tsi or Economic Machine Shop to be organized in the second period. The Ching Tsi Machine shop is to be on a considerably larger scale, its initial cost being estimated at $1,080,000. It is to turn out machinery in adequate amount to supply local needs. The object is not to make profits but to increase the productive power of the people, and the plan is to sell the output at less than the market price so as to bring labor-saving devices within the reach of the inhabitants of even the most economically backward districts. The Ching Tsi Machine Shop, when working to capacity, will turn out ten sets of hand-working machinery a day. According to this ambitious schedule of the authorities, it will take 30 years for the plant to turn out enough machines to meet the bare needs of the whole province, allowing ten sets for each village. (There are over 10,000 villages in the province). The Yu Tsai Machine Shop which is being organized, will be an experimental undertaking, and the authorities will carry out the latter part of their program if the results of the Yu Tsai Machine Shop warrant it.

In this connection Shansi authorities have also planned to establish two steel refining plants, one to be known as the Yu Tsai or Training Steel Plant and the other, Ching Tsi or Economic Steel Plant. The nature of these establishments is similar to that of the machine shops referred to above. This program also covers two periods. In the first period only experimental work will be attempted, estimated to cost $236,000 for the Yu Tsai Steel Plant and about $1,175,000 for the other. According to the estimate of the Shansi officials, a ton of steel turned out locally will cost about $40 as compared with $100 which now has to be paid for the same quantity of imported steel. The abundance of coal and iron mines in the province will greatly cheapen the cost of locally produced steel.

History of Mining in the Philippine Islands

(*Continued from page 206.*)

that the reason for this Filipino attitude is, principally, his lack of knowledge concerning mining. The same condition exists in the United States, where people who are engaged in agriculture or other industries show very little or no interest in mining. It takes a man who either has been engaged in mining work most of his life, or has lived in the neighborhood of an active mining district, to appreciate and enjoy the miner's or prospector's work and to entertain constant hopes for some success. This is illustrated in the Philippines in all the districts where some kind of mining has been done. However, most of the people benefited are illiterate, and are obliged to do what they have seen done, modified only perhaps by their personal experiences, because they are not able to acquire the knowledge requisite for advancement. The many failures of the pioneer Spanish and American activities are perhaps responsible for giving the Filipinos a somewhat distorted idea and distrust of the mining industry.

The Oriental Development Company in Korea

(*Continued from page 210*)

Fiscal year	Time redemption Accounts		Annual redemption Accounts		Total Accounts	
1909 ..	17	Y. 221,900.00	—	—	17	221,900.00
1910 ..	126	429,730.00	6	157,800.00	132	587,530.00
1911 ..	210	514,369.76	57	623,100.00	267	1,137,469.76
1912 ..	314	925,147.43	132	1,476,678.82	446	2,401,826.25
1913 ..	791	1,245,668.35	272	2,457,022.07	1,063	3,909,690.42
1914 ..	1,032	1,667,962.36	603	3,604,707.94	1,635	5,272.670.30
1915 ..	1,005	1,441,597.99	977	4,156,878.74	1.982	5,600,476.73
1916 ..	826	1,287,631.56	1,066	4,320,967.02	1,897	5,608,598.58
1917 ..	600	1,621,274.74	1,462	6,646,287.19	2,062	8,267,561.93
1918 ..	745	3,486,638.98	2,668	13,981,238.51	3,413	17,467,877.49
1919 ..	1,302	6,754,593.44	5,126	24,660,574.81	6,408	31,415,168.25
1920 ..	1,443	7,953,291.83	5,754	28,558,903.54	7,197	36,512,195.37
1921 ..	1,507	14,344,674.30	5,798	28,992,373.73	7,305	44,337,048.02
1922 ..	1,551	14,485,327.05	5,389	28,968,166.36	6,940	43,453,493.41
1923 ..	1,564	15,009,236.35	5,225	29,705,932.01	6,789	44,715,168.36

The Table showing the Items of Industries for which Loans have been accommodated : September 30, 1923.

Description	Time Number of account	Yen	Annual Number of account	Yen	Total Number of account	Yen
Land improvement and reclamation ..	866	4,141,359.130	3,254	12,874,165.87	4,120	17,015,525.00
Town planning ..	206	1,659,148.590	335	1,977,670.57	541	3,636,819.16
Irrigation enterprise	33	1,160,801.30	116	5,500,043.76	149	6,660,845.06
Agricultural management	211	689,128.18	999	3,582,163.74	1,210	4,271,291.92
Forestry	29	78,271.90	104	541,508.99	133	592,780.89
Ginseng-planting ..	8	106,430.00	23	202,851.54	31	309,281.54
Cotton-planting ..	1	5,000.00	3	11,838.19	4	16,838.19
Tobacco-manuf'ng ..	1	900.00	—	—	1	900.00
Fruit growing ..	24	65,604.60	69	157,392.22	93	222,996.82
Silk-raising	22	110,592.04	114	145,288.05	146	255,880.09
Live-stock breeding..	25	1,159,723.57	8	118,359.56	33	1,278,083.13
Aquatic products industry	7	40,050.00	17	49,176.11	24	89,226.11
Mining	3	954,100.00	44	2,704,339.10	47	3,658,439.10
Paper-milling ..	2	10,600.00	5	17,171.25	7	27,771.25
Flour-milling ..	1	8,000.00	2	4,653.89	3	12,653.89
Rice-milling ..	15	86,980.00	19	173,644.92	34	224,624.92
Ceramic	—	—	6	50,832.93	6	50,832.93
Brewery	5	26,603.66	8	21,578.83	13	48,182.49
Electric and Gas supply	6	4,502,000.00	—	—	6	4,502,000.00
Transportation ..	1	23,000.00	7	129,865.78	8	152,865.78
Various manuf'ng industries	2	15,000.00	4	16,011.83	6	31,011.83
Health	--	—	6	435,147.61	6	435,147.61
Educational ..	2	8,240.00	19	330,411.47	21	338,651.47
Miscellaneous ..	84	157,703.38	63	724,815.80	147	882,519.18
Total .. Yen	1,564	15,009,236.35	5,225	29,705,932.01	6,789	44,715,168.36

Japanese Railway Contracts in England

Several orders were completed last year and a number more are still in progress for multiple unit equipment for various railways in Japan, including the Keihan Railway, Keisei Railway, Nagoya Railway, the Shin Keihan Railway, the Kagamigahara Railway and the Toyokawa Railway.

Steel Railway Bridges for Siam

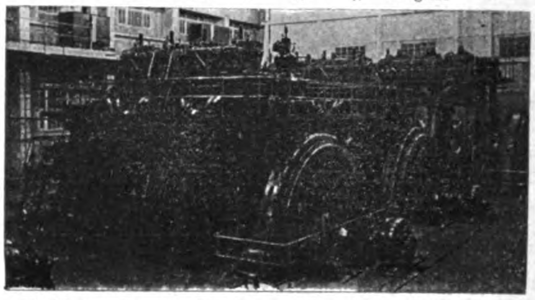
Tenders are now being called for a number of steel railway bridges for the Siam State Railways, which are returnable by May 15.

Tenders are also being invited for large quantities of steel rails and permanent way accessories for the Siam State Railway.

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE
No. 4 AVENUE EDWARD VII
Power Station, French Concession, Shanghai
2 by 1,500 bhp. 2-cycle Sulzer Diesel Engines
1 by 3,600 bhp. ,, ,, ,, Engine

蘇爾壽工程事務所
上海愛多亞路四號



本公司常備目錄供給各界 垂詢工程事務亦曷誠酬答

Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, STATIONARY AND MARINE DIESEL ENGINES, Airless Injection Diesel Engines, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

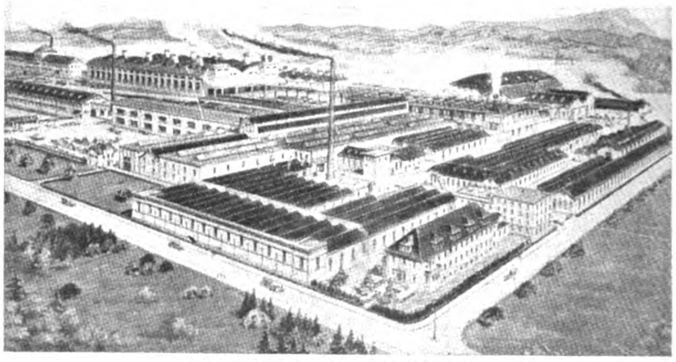
WINTERTHUR. SWITZERLAND.

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 Employees abt. 2,000



Our Works at Uzwil, Switzerland

SPECIALITIES:

Portland Cement Works
Brick and Tile Making Plants
Chocolate and Cocoa-Factories
Breweries and Malteries
Powder and Celluloid-Presses
Crushing and Breaking Machinery
Silico-Calcareous Brick Works
Paste-Goods Factories
Briquetting Plants
Rice-Mills
Roller Mills for Soap and Paint Manufacture
"Duplex" Newspaper Printing Presses
Conveying Plants of every kind

For particulars apply to the

Far Eastern Office: BUHLER BROTHERS

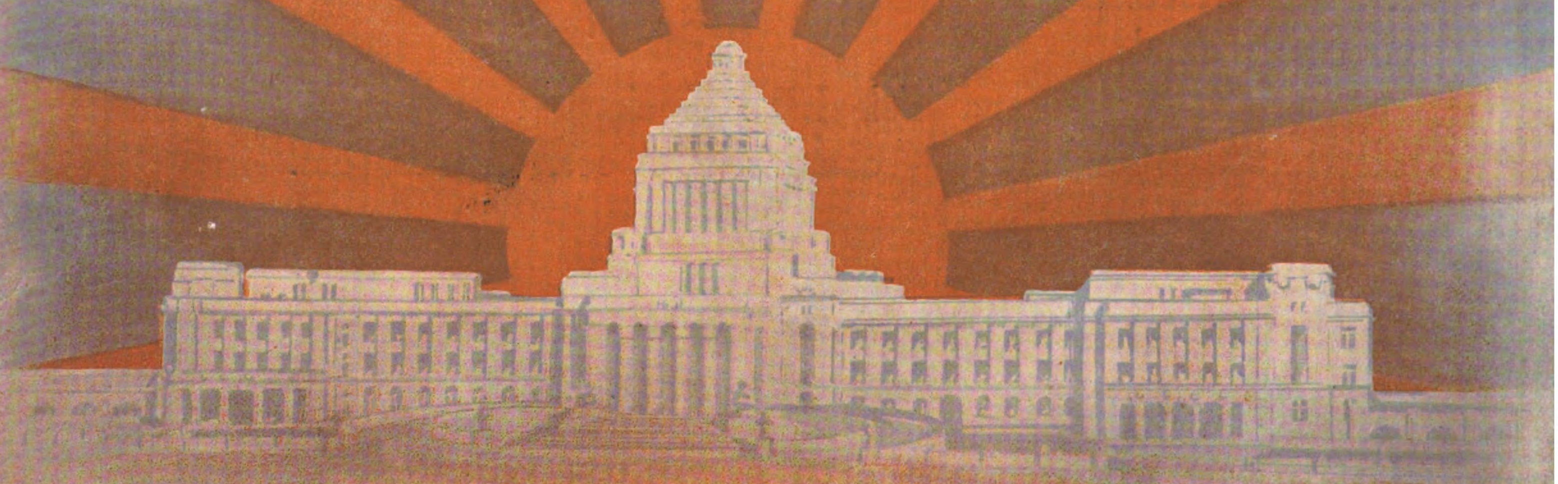
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

SEP 29 1925
PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

The Far Eastern Review

Reconstruction Number

June-July, 1925



A Monument To The Japanese Engineer

The Reconstruction of

Tokio

and

Yokohama

M.S.

L. J. HEALING & CO., LTD.

EIRAKU BUILDING, MARUNOUCHI

TOKYO—JAPAN

Established 36 Years

ENGINEERS—CONTRACTORS—MERCHANTS

IMPORTERS OF ALL CLASSES OF:

Machinery
Metals
Telegraph and Telephone Equipment
Electrical and Mechanical Devices, Cranes, etc.
Tools
Scientific Apparatus
Motor Cars and Motor Cycles and Accessories
Constructional Steelwork, etc., etc.

COMPLETE EQUIPMENT AND SUPPLIES FOR:

Power Houses	Arsenals
Railways	Public Works
Dockyards	Gas Works
Mines	Mills and Factories, etc., etc.

CONTRACTORS TO ALL JAPANESE GOVERNMENT DEPARTMENTS

LONDON—NEW YORK—OSAKA—DAIREN

See pages 16, 17, 18, 19 for Special Advertisements

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum

VOL. XXI JUNE-JULY, 1925 NO. 6-7

CONTENTS:

	PAGE
A Monument to the Japanese Engineer	*243
In Memoriam	*245
The Shanghai Strike	246
The Reconstruction Budget	*247
Memorandum Relative to the Reconstruction of Tokyo	*252
Replotting a Great City	*257
Street Scheme for the New Metropolis	*263
The Tokyo Municipal Water Works	*274
Tokyo's Modern Sewerage and Drainage System	*282
Gas Supply of Tokyo	*293
Vast Field for American Capital	*295
Modernizing Tokyo's Antiquated Fire-Fighting Methods	*296
Schools for the People	*301
The Municipal Central Market	*304
The Sumida River Bridges	*307
The Bridges of Tokyo	*313
The Arakawa Flood Prevention Works	*319
Tokyo's Tramway System	*323
Breaking Ground for Tokyo's New Subway	*331
Tokyo's Municipal Subway Project	*337
Restoration of Communications System	*343
The Key to Tokyo's Future Prosperity	*355
Tsurumi	*361
Tokyo—A Million Kilowatt City	*366
A 500,000 Kilowatt Development	*386
An Engineering Triumph	*395
Japan's Railway Electrification Program	*405
Electrification of the Tokaido Main Line	*420
Yokohama Rising from Its Ashes	*426
Yokohama's Brilliant "Come-Back"	*433
In Memory of a Beloved Ruler	*445
The Palatial Executive Office of the Yokohama Specie Bank at Tokyo	*448
The Mitsubishi Bank	*453
Foreign Borrowings of Japan	457
The Industrial Bank of Japan	*458
Building Construction for the New Tokyo	*460
Helping the Small Property Owners to Rebuild	*465
Restoration of a Factory Plant in Japan	*467
Architecture and the Buildings of New Tokyo	*468
Large Frequency Changer for Japan	*495
The Brains Behind the "Daido"	*496
Mitsui—Where Business is Humanity	*497
"Shibaura"	*506
Electrical Manufacturing in Japan	*514
Radio Development in Japan	*524
The Tokyo-Yokohama (Keihin) Electric Railway	*530
Operator Pushes Buttons; Elevator Does the Rest	*532

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The .. 90
Allan, Whyte & Co., Ltd. .. 67
Allen & Co., Ltd., Edgar .. 59
American Blower Co. .. 48
American La France Fire Engine Co., Inc. .. 95
American Locomotive Sales Corporation .. 113
American Tool Works Co. .. 48
American Trading Co., Inc. .. 25
Armstrong, Whitworth & Co., Ltd., Sir W. G. .. 50, 51
Asano Portland Cement Co., Ltd. .. 42
Associated British Locomotive Manufacturers for China .. 81
Attwater & Sons .. 80
Avery, Ltd. W. & T. .. 59

Babcock & Wilcox, Ltd. .. 11
Baldwin Locomotive Works .. 107
Bank of Chosen .. 98
Banque de l'Indo-Chine .. 100
Bank of Taiwan, Ltd. .. 105
Barnes Drill Co. .. 48
Bensinger Code Co., Inc. E. F. .. 83
Berger Manufacturing Co. .. 76
Bethlehem Steel Export Corp. .. 1
Bliss Co., E. W. .. 115
Brill Co., J. G. .. 58
British-American Tobacco Company (China), Ltd. .. 79
Brown & Sons, Ltd. David .. 119
Browning Co., The .. 65
Brunner Mond & Co. (Japan), Ltd. 38
Bucyrus Company .. 83
Buhler Brothers .. 534
Butterfield & Swire .. 84

Canada Carbide Co., Ltd. .. 120
Chambers Scott & Co., Ltd. .. 68
Chartered Bank of India, Australia & China .. 80
Columbia Ribbon & Carbon Mfg. Co. 119
Columeta .. 37
Crucible Steel Co. of America .. 42

Daido Electric Power Co., Ltd. .. 40
Dai-Ichi Ginko .. 106
Dai Nippon Brewery Co. .. 56
Diamond State Fibre Co. .. 49
Dixon Crucible Co., Joseph .. 114
Dodge Brothers .. 73
Drewry Car Co., Ltd. .. 61

Electricity Department, S. M. C. .. 82
English Electric Co., Ltd. .. 6, 7
Etchells Congdon & Muir, Ltd. .. 69
Escher Wyss & Cie .. 20
Evans & Sons (Wolverhampton) Ltd., Joseph .. 76
Exchange Bank of China .. 105

Fairbanks Co. .. 95
Fairbanks Morse & Co. .. 49
Ferguson Co., H. K. .. 14, 15
Foundation Co. .. 41
Fuji Gassed Spinning Co. .. 66

Gadelius & Co., Ltd. .. 27
Gaspary & Co., Dr. .. 68
Gleniffer Motors, Ltd. .. 61
Goodell Pratt Co. .. 115
Goodman Mfg. Co. .. 19
Goulds Manufacturing Co. .. 68
Graham Brothers .. 72
Green Island Cement Co., Ltd., The 96
Greenfield Tap & Die Corp. .. 94

Harley Davidson Motorcycle Sales Co. of Japan .. 71
Hasler Telegraph Works .. 118
Healing & Co., Ltd., L. J. .. Cover
Hennef Engineering Works .. 119
Hitachi Engineering Works, Ltd. 10
Hoar Shovel Co. .. 19
Hongkong Rope Manufacturing Co. 96
Hongkong & Shanghai Banking Corporation .. 103
Hongkong & Whampoa Dock Co., Ltd. 92
Horsfall & Bickham, Ltd. .. 61
Hotel Statler Co. .. 97

Iida & Co., Ltd. .. 43
Illies & Co., C. .. 28
Imperial Japanese Government Railways .. 108, 109
Industrial Bank of Japan, Ltd. .. 102
Ingersoll Rand Co. .. 21
International Banking Corporation 99
International General Electric Co., Inc. .. 4, 5

Japan Advertiser, The .. 45
Japan Sugar Co., Ltd. .. 82
Jardine Engineering Corp., Ltd., The 60
Jiji Shimpo .. 46
Jugo Ginko .. 100

Kanegafuchi Spinning Co., Ltd. .. 66
Kawasaki Dockyard Co., Ltd. .. 52
Keeler Company, E. Under Index
Kokusai Kisen Kaisha .. 88

Link-Belt Co. .. 65
London Directory Co., Ltd. .. 69
Louisiana Planter & Sugar Manufacturer, The .. 120

Manning Maxwell & Moore, Inc. .. 68
Marshall Sons & Co., Ltd. .. 17
Mather & Platt, Ltd. .. 91
Metropolitan Vickers Electrical Co., Ltd. .. 117
McConway & Torley Co. .. 94
Mitsubiki Trading Co., Ltd. .. 43
Mitsubishi Bank, Ltd. .. 101
Mitsubishi Iron & Steel Co., Ltd. .. 57
Mitsubishi Marine & Fire Ins. Co., Ltd. .. 57
Mitsubishi Shoji Kaisha .. 78
Mitsubishi Electrical Engineering Co., Ltd. .. 9
Mitsubishi Warehouse Co., Ltd. .. 57
Mitsubishi Zosen Kaisha, Ltd. .. 58
Mitsui Bank, Ltd. .. 101
Mitsui Mining Co. .. 78
Mitsui Bussan Kaisha .. 12, 13
Morris Ltd., Herbert .. 17
Mustard & Co. .. 94

Nippon Menkwa Kabushiki Kaisha 62
Nippon Yusen Kaisha .. 86, 87
Nipponophone Co., Ltd. .. 56
Nisshin Kisen Kaisha .. 44
Nobel Industries, Ltd. .. 64

Obayashigumi Co., Ltd. .. 35
Okura & Co. .. 47
One Hundredth Bank, Ltd., The .. 103
Osaka Shosen Kaisha .. 85
Oster Manufacturing Co. .. 41
Otis Elevator Co. .. 26

Petters, Ltd. .. 63
Pooley & Son, Ltd., Henry .. 116

Redpath Brown & Co., Ltd. .. 18
Reuther & Reisert, C. .. 119
Reyrolle & Co. Ltd., A. .. 69
Royal Bank of Canada .. 105
Ruston & Hornsby, Ltd. .. 16

Sale & Frazer, Ltd. .. 74
Samuel Samuel & Co., Ltd. .. 23
See Elevator Co., Inc., A. B. .. 22
Shanghai Dock & Engineering Co., Ltd. 93
Shanghai Municipal Council .. 82
Shibaura Engineering Works, Ltd. .. 8
Shimizu Gumi Co. .. 34
Siber Hegner & Co. .. 24
Siemens China Co. .. 70
Siemens-Schuckert Denki Kabushiki Kaisha .. 32
Simons & Co., Ltd., Wm. .. 63
Smidth & Co., F. L. .. 90
Smith Major & Stevens, Ltd. .. 70
South Manchuria Railway Co. .. 110, 111, 112
Sprout, Waldron & Co. .. 83
Standard Oil Co., of N. Y. .. 75
Standard Underground Cable Co. .. 68
Stewarts & Lloyds, Ltd. .. 116
Sturtevant Co., B. F. .. 65
Sulzer Bros. .. 534
Sumitomo Goshi-Kaisha .. 104
Sumitomo Bank, Ltd. .. 104
Superheater Co., The .. 67

Taiwan Seito Kabushiki Kaisha .. 44
Takenaka Komuten .. 36
Thornycroft & Co., Ltd., John I. 30, 31
Tokyo Gas Co., Ltd. .. 29
Toshin Soko .. 54
Toyo Kisen Kaisha .. 89
Trans-Pacific, The .. 45
Trimont Manufacturing Co. .. 39
Truscon Steel Co., of Japan, Ltd. .. 33

United States Steel Products Company .. 53, 77, Back Cover

Waggon-und Maschinenbau Aktiengesellschaft Gorlitz .. 118
Wallace & Tiernan Co., Inc. .. 67
Walworth International Co. .. 114
Westinghouse Electric International Co. 2, 3
Williams & Co., J. H. .. 91
Worthington Pump & Machinery Corporation .. 122
Wotan Werke, A.-G. .. 55

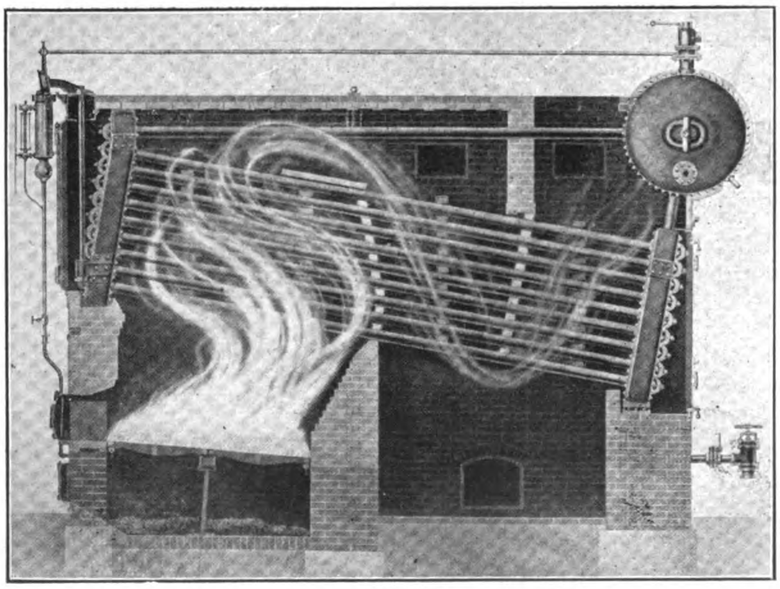
Yarrow & Co., Ltd. .. 49
Yasuda Bank, Ltd. .. 106
Yokohama Dock Co., Ltd. .. 56
Yokohama Specie Bank, Ltd. Cover

KEELER BOILERS

Standard in U.S.A. since 1864

Built to A.S.M.E. CODE.

For any Pressure.



POWER

DURABILITY

SAFETY

WATER TUBE—TUBULAR—CROSS DRUM

E. KEELER COMPANY,

Williamsport, Pa., U.S.A.

Far Eastern Branch—14 Canton Road, Shanghai

C. G. BROWN, Engineer

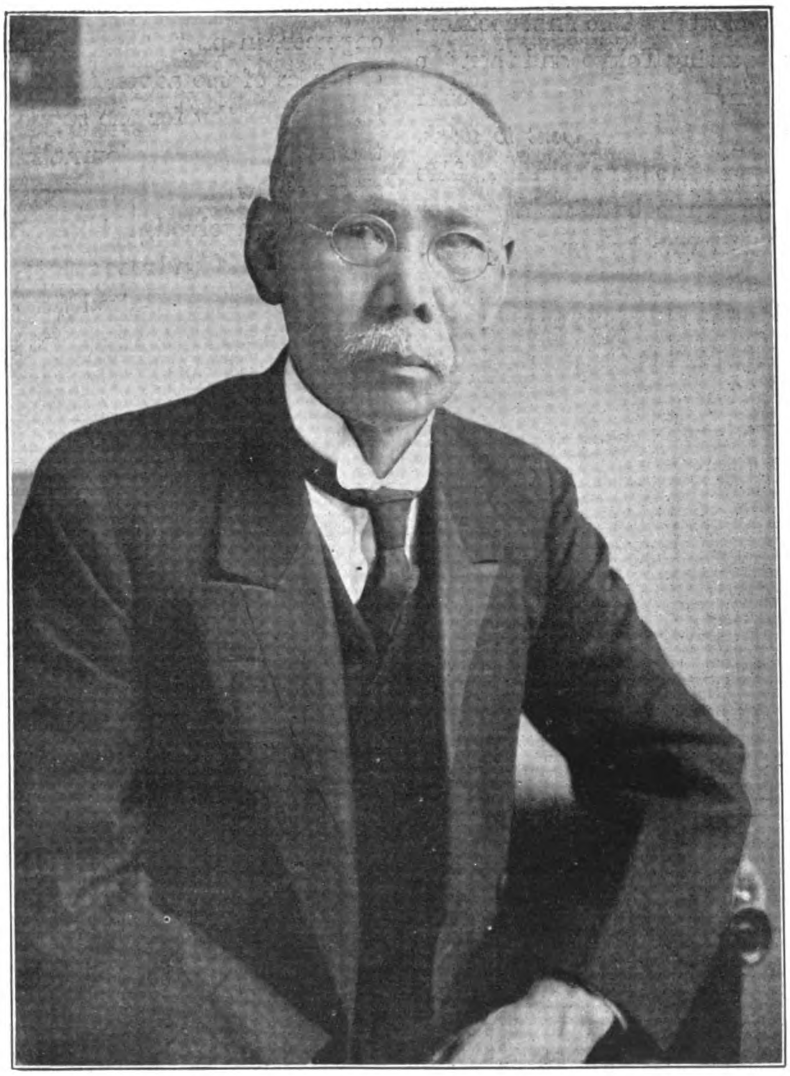
The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, JUNE-JULY, 1925 No. 6-7

A Monument to the Japanese Engineer

THE FAR EASTERN REVIEW dedicates this number to the Japanese Engineer, whose monument will ever be the re-creation of Tokyo and Yokohama after the terrible earthquake and fires had reduced these cities to veritable dust. The casual person little realizes what it means for a city to disappear and then again to arise out of its ashes. When news of the earthquake flashed across the cable wires to all countries universal sympathy for the Japanese people was engendered. Every nation tried to do its share in rushing assistance to the suffering. The United States was particularly generous in its exhibitions of friendship. Even China, which for years previously had only remembered the political differences between the two countries, was now impelled to show that in distress all peoples of the world are brothers.



The Reconstruction Mayor of Tokyo

MR. ZEKO NAKAMURA

One of Japan's Ablest Executives

From a minor post in the Formosan Government Service, Mr. Nakamura rose to the Presidency of the South Manchuria Railway Company, which post he held for five years during its formative period (1908-13); from there he was called to the vice-Presidency and then to the Presidency of the Imperial Japanese Railways. On the retirement of Mr. Nagata as Mayor of Tokyo, Mr. Nakamura was selected to fill this difficult position during the Reconstruction Period.

After the first flush of the shock of the disaster other peoples quite naturally settled down to their own affairs, and Japan was left with the problem of re-making her capital and her principal commercial port. It was to be a work from the foundations up. What the earthquake and subsequent fires actually did to Tokyo and Yokohama few who were not there at the time can imagine. An eye-witness's account,* written shortly after the event, describes graphically what happened :

> " On Monday we took a trip through the heart of Tokyo. Where shall one begin his description ? Shall it be the electric wires entangled overhead, torn loose, covering the streets ? Shall it be the overpowering odor of burning humanity ? Shall it be the buildings, now heaps of broken stone and wood, still smouldering, still smoking ? Shall it be the gaping crowds, or those picking in the *débris* for the bodies of lost ones ? Perhaps it is not possible to find words to describe these scenes. Perhaps we may pass over the havoc with just one sentence : the heart of Tokyo was gone, nothing was left but a few modern buildings. . . . ."

*" Diary of a Fortnight," by George E. Sokolsky in the *North-China Daily News.*

The Spirit Unbroken.

" The heart of Tokyo was gone." That phrase describes the physical condition of Tokyo, the capital of the country. But spiritually, neither the heart nor the indomitable spirit of the Japanese people was gone. Japan faced the earthquake and its aftermath, as Japan has faced her whole history, bravely, patiently, with strength and pride and an unerring certainty that there are qualities in the racial composition of the Japanese people which will preserve that nation from natural and human calamities. The Japanese people immediately settled down to work. Even while the earth was trembling the Japanese were thinking reconstruction and were beginning to clear away the destroyed old for the better new. There was for some time a doubt as to the wisdom of rebuilding these two cities. Some suggested that the capital might be moved. The final decision, however, was for rebuilding and preserving Tokyo, and then the whole nation went to work. Therein, perhaps, lies the secret of the tremendous success of Japan. *The nation went to work.* There was no letting up, no loss of spirit, no hopelessness. The nation went to work, and to-day Japan is building a greater Tokyo, a more beautiful Tokyo than was known before the earthquake. It will be a Tokyo of which Japan might well be proud and of which Europe and America will be proud. For it will symbolize the conquest of Asia by the engineer. It will symbólize the utilization of the most modern engineering and construction methods in the East under the direction of Japanese engineers.

In the following articles an opportunity is provided for the reader to familiarize himself with the work that has been done and is being done to reconstruct the devastated area. Particular attention, however, must be called to " The Reconstruction Budget," which tells the story of the heroic effort of a nation to save itself without imperilling its financial position, without losing its political independence of action. For devastations usually destroy the political safety of a nation, which, once forced to borrow for its reconstruction, finds often enough that it has pawned away its freedom of action. That has *not* happened to Japan. Japan emerged from the earthquake period politically as important as she was at Versailles. To maintain that position taxed every resource, every sinew of the Japanese people. In " The Reconstruction Budget " a detailed statement appears of the capacity of the Japanese people to meet such disasters, but, more important still, it indicates the fiscal strength of the nation, its willingness and ability to preserve the glory of Japan at any honorable cost.

In other articles particular attention is paid to the engineering features of reconstruction and the opportunity is utilized to show how the Japanese engineer is gradually advancing to a position where he can produce as high quality a machine as he formerly imported. At the same time, the work of the foreign engineers in Japan, who assisted, willingly and capably, in this work of reconstruction and who placed their services at the command of their Japanese colleagues, is recited.

The Japanese Engineer to the Fore.

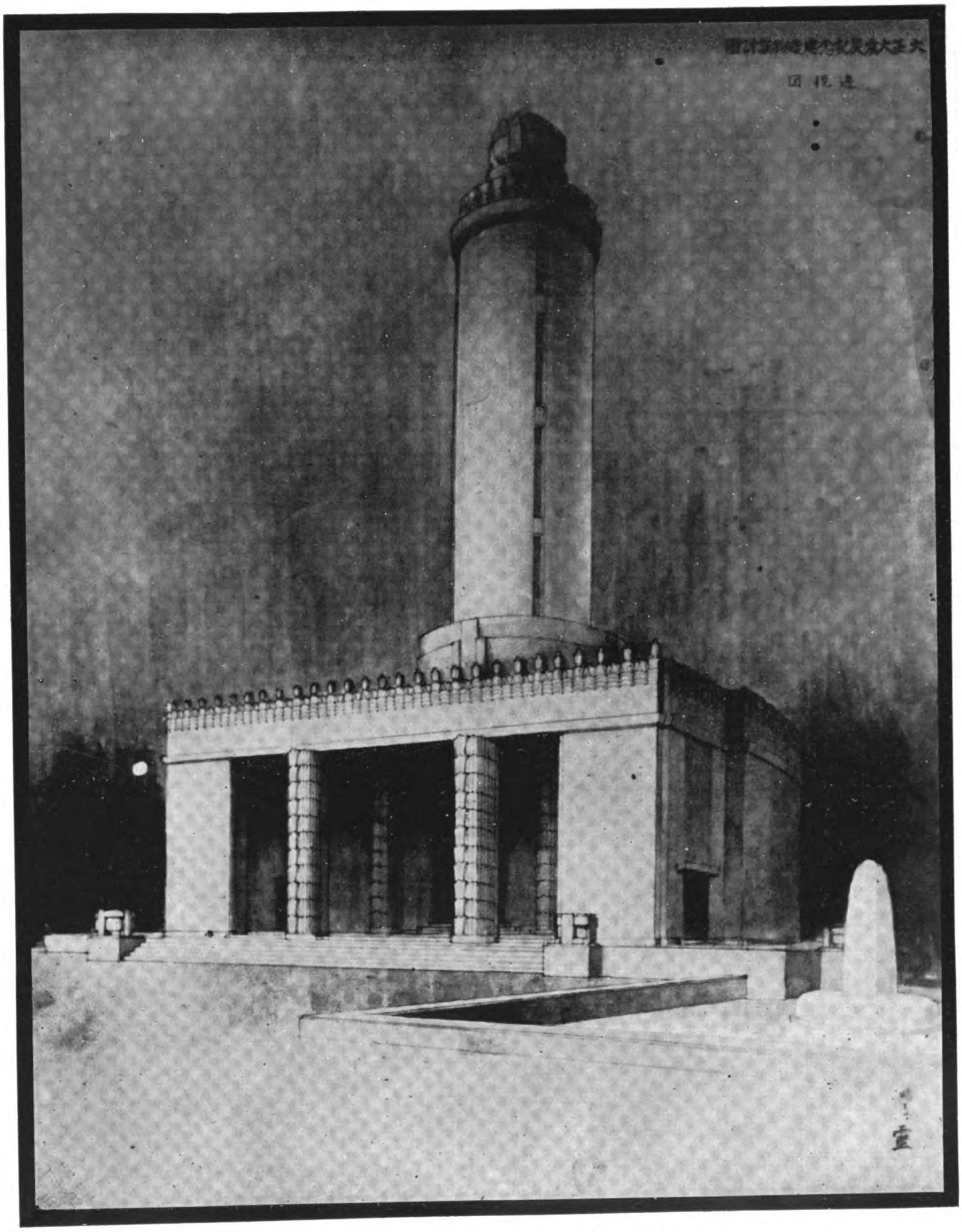
We live in the age of iron and steel, in an age of steam and electricity. It is the era of the engineer. The highest forms of industry are the products of the engineer, and it is perhaps not too bold a prophecy to suggest that when the art of this period is summarized, its finest products will appear in the bridges, the skyscrapers, the monuments of the engineer. To Japan the reconstruction of Tokyo and Yokohama will witness the full entrance of Japan in the fraternity of modern engineering. Japan takes her place among the great engineering nations of the world.

The pages of this number of THE FAR EASTERN REVIEW will describe the work of reconstruction and must present to the engineer, in particular, the hugeness of the task, the tremendousness of the adventure. Engineers deal in facts and have little sympathy for the suppositiousness of the politicians and the scare-mongering journalists, who without knowledge of the situation, without statistics, without a comprehension of the problems involved, hit upon a fact here and there, miss the broader issues, and reach the conclusion that Japan is preparing for a war. The United States suffers particularly from this sort of jingoism, the product of the professional anti-Japanese propagandist, a hater for the love of hating. This type of person, hiding his morbidity under the guise of patriotism, seeks to set two great nations at war for no other purpose than to satisfy the savage insincts of the less civilized elements in both nations, who seek a fight for the sake of the fight.

To the engineer such a war would be a tragedy, for it could only serve to destroy much of the engineering progress of eastern countries. But the engineer has an advantage over the politician and the Hearst journalist in that he is professionally competent to estimate facts and to judge their bearings. When the engineer studies the work of reconstruction now taking place in Japan he will immediately realize that surely the Japanese have no thought of an international war, emphatically not a war with the United States. For the engineer will realize how the full energy of the nation is being consumed in this task of reconstruction, how every possible resource is being tapped to provide the material for reconstruction. The engineer knows what are the works of peace and the works of war. The engineer at a glance realizes which are the nations which are laboring to produce the goods of the world and which are seeking the destruction of mankind. The engineer cannot be frightened by little minds, by meglomaniacs ; he deals in facts, and the facts as regards Japan are clear.

Japan wants no war. Japan seeks the friendship of the western nations, particularly the United States. Japan seeks the friendship of China in the hope of mutual economic benefits. Japan wants to have a breathing spell from the intricacies of old-fashioned international politics that she might work out her program of reconstruction. If the nations of the west

In Memoriam



TOKYO'S PLEDGE TO THE DEAD

The design for a Memorial Hall to be erected on the site of the former Military Clothing Depot in Honjo, where 38,000 persons perished in the Great Earthquake Fire. A standing pledge to the living and the dead that, as far as humanly possible, the New Tokyo will be Proof against Earthquake, Fire and Flood. The hall is to cost Yen 1,000,000, to be raised by popular subscription.

do not impose a war on Japan, there will be no war. But will Japan be given this breathing spell, this freedom to solve her internal problems ?

The Ugly Bear.

The answer to this question lies in Manchuria. On the borders of China and Korea, in close proximity to Japan's source of supply for food and for raw materials, lurks the huge and hungry Bear, the historical enemy of Asiatic nations, Russia. Changes may have taken place in Russia, the monarchy has been overthrown and a Soviet Republic instituted, but the international policy of Russia is the same to-day as it was when the Cossack freebooters of Siberia sought to conquer the whole of Manchuria. Russia to-day is seeking to take from China, Manchuria, Mongolia and Sinkiang. Mongolia has already declared its independence of China, but the independence is much like a Napoleonic Cisalpine Republic : Mongolia is free from China, but is attached by intrigue and corruption to Russia. In Manchuria, Russia has thus far been altogether unsuccessful, but the unfortunate weaknesses of the Chinese Government makes every possibility a probability. In West China the Russians are constantly intriguing with the Mohammedan populations against China. Within China itself the Russians reverse their policy, declare for ardent nationalism, subsidize anti-foreign agitations and endanger the position of foreign investments. Russia's policy is altogether without principle, except that there should be disturbances in China, that China should be weak, that China should become the buffer state between Russia and the remainder of the world, and that in the event of an international war China should take the shock of any attack on Russia.

This program is aimed at Japan and Great Britain. Japan, therefore, cannot view without apprehension this effort of Russia to disintegrate China, for Japan's interest in China is not only spiritual and sentimental, it is practical. China, particularly Manchuria, supplies Japan with her raw materials. The unfortunate policy of western nations, that Japanese, as Asiatics, should be excluded from their countries, leaves Japan only with the continent of Asia for emigration and for the production of necessities by her own surplus population. The Russian attitude towards China affects Japan directly. It becomes a life-and-death struggle. It becomes a matter of the rice bowl and the loaf of bread for the masses of the Japanese people. It is not a matter of high international intrigue : it is life itself. If, then, Japan is at any moment forced to forego her work of reconstruction and rehabilitation and to prepare for war, it will not be against the United States or any other Western Power. It will be a defensive war against Russia's aggressions on Asia.

Shall Japan Work or Fight?

But even such a war against the enemy of Asia Japan would avoid, if possible. For every dollar wasted in this war would have to be a dollar taken from reconstruction work ; every man thrown into the field would be a laborer taken off a reconstruction job. Japan has patiently noted Russia's antagonism and Russia's aggressions. In 1919 Japan might have stopped Russia's march into Asia from Siberia, but the Allies said " No ! " The Japanese expeditionary force was recalled. Japan abided by the decision of her western colleagues, and now may at any moment be called upon to pay the bill. Is it not only playing the game for the western nations to recognize what we have always learned to admire in individuals —grit, spirit, the sporting blood ? Is it not fair to expect that the western nations will make such a war an impossibility, will make such a war unnecessary? Soviet Russia, the enemy of Asia, is the foe of peace. Soviet Russia, involved in the chaos of her own economic instability, would drag the whole world behind her. Soviet Russia favors a policy of disturbances in Asia, relying on international jealousies to prevent the nations of the west from joining with Japan in defence of their common interests. Japan is the first objective, and Russia hopes to make China the tool.

The question of the hour in Asia, then, is : Shall Japan have the breathing spell to work out her program of reconstruction or shall Japan be involved in a destructive war on the continent of Asia in defending her vital interests against Soviet Russia ?

The answer lies, perhaps, with the western engineer.

The Shanghai Strike

THE Reconstruction Number of the THE FAR EASTERN REVIEW was to have appeared during June. On May 30, because of a riot which led to the shooting of Chinese by the Shanghai police, a strike took place in all industries involving foreigners, with the result that our printers were unable to print this journal. This strike is still effective in many industries as we go to press, but at the end of July the printers returned to work, and we hope that there will be no further interruption in our efforts to publish a monthly journal of engineering and political opinion on Far Eastern questions.

No reference, beyond requesting our readers and advertisers to pardon the delay in publication, can be made to this incident, and the series of political events growing out of it, in this number, which is limited to the reconstruction of Tokyo and Yokohama. The August number, which we hope may appear on time, will contain a complete analysis of the situation, with special emphasis on the unionization of labor and its effects upon industry.

We call our advertisers' attention to the fact that this number is issued as for June and July because of *force majeure* growing out of the strike.

The Reconstruction Budget

The Expression of a People's Determination to Survive and Their Willingness and Ability to Pay

"*Tokyo will remain the capital of the Empire. It will be rebuilt to entirely new plans that will make it in every sense a seat of government worthy of a great nation.*" This, in brief, was the import of an Imperial Decree issued on September 12, twelve days after the great disaster, the answer of the rulers of Japan to the agitation for the transfer of the Imperial palace and administrative center of government to Kyoto.

The old Tokyo, the city evolved from the mediæval stronghold of the shogunate, will disappear. On its ruins a new metropolis is being erected that will take its place amongst the other great capitals of the world along lines that will provide for the needs of a population that in the next two decades is expected to reach seven millions. It required courage to arrive at such a decision before the ashes of Tokyo had had time to cool and in the face of the possibility that another earthquake, more severe than the last, might destroy in a few minutes the labor of years. For a moment, and only for a moment, during the blackest moments of grief and depression following the catastrophe, did the Japanese consider the idea that it might be best to transfer the seat of government to the ancient capital at Kyoto, but the same indomitable will that urged them forward in their record-breaking march of progress for the past sixty years determined their decision to remain and erect a new city that would defy the fires, floods and earthquakes which in the past have exacted their periodical toll of lives and property.

Mr. R. Naoki, head of the Reconstruction Bureau which is responsible for the building of new streets, canals, parks and public markets in the destroyed district

The program for remaking the cities of Tokyo and Yokohama is one of the most heroic demonstrations of human imagination and will to survive that modern history can point to. To carry it through called for such huge expenditures that even a people more favorably endowed with natural resources than the Japanese might well have hesitated before embarking on such a task. In this brave struggle to turn the calamity into a blessing the most important obstacle was the budget, the key to success or failure. It took a long time to arrive at a sane and safe method of financing the great undertaking, and the estimate had to pass through many stages of change and alteration, cut down here and added to there, before the final draft was approved and passed by the Imperial Diet. As it now stands the Reconstruction Budget is not a mere hit and miss compilation of figures drawn up by politicians, but the concrete expression of the most expert minds of the empire, the concentrated wisdom of Government officials, leaders of finance, industry, engineering and sanitation.

The total national and local budget as finally passed calls for Y.741,570,909. There was no guess-work in arriving at this figure. It is the expression of the nation's willingness and ability to pay worked out by a pains-taking investigation of the national resources and the actual detailed costs attached to every branch of the reconstruction work. The budget, as it stands, is a tribute to Japan's soundness of comprehension, the vision and faith of a people in their ability to carry through and complete the task they have set themselves to do.

It would serve no good purpose to recount at this late date the inside history of the Reconstruction Budget. The machinery of government in Tokyo is antiquated, complex and involved, a hold-over from the feudal era, with the powers of state, prefecture and municipality hopelessly intertwined, overlapping and interfering with each other, and the whole overshadowed by the prerogatives of the Imperial Government and the Imperial Household, whose property holdings in the Capital are equal in value to one-third of the total devastated area. It was no easy matter to harmonize these conflicting interests and commit the national treasury to huge expenditures for reconstruction work in Tokyo and Yokohama, especially at a time when the Diet was dominated by a political party deriving its strength from the rural districts. As a consequence, the budget estimates had to pass through many hands before a compromise could be effected in order to insure its approval and enactment into law by the Diet.

On September 27, 1923, the first Reconstruction Board, composed of all the leading men of the nation, was organized, with Viscount Goto, then Minister for Home Affairs, as president. The plan proposed before the organization of this Board was a huge one, calling for an expenditure of Y.3,500,000,000, of which Y.2,000,000,000 were to be expended by the various Ministries for rehabilitation work under their respective departments, and the balance set aside for the reconstruction needs of Tokyo and Yokohama. These original estimates included the railways, canals, harbors, suburban districts and even the government buildings, swelling the total to an enormous figure and concentrating under one board practical supervision over all the other departments of the government. In order to keep the budget as small as possible and leave certain works to be carried out by the departments directly concerned, this tentative plan was therefore abandoned. An entirely new budget was prepared and approved by the committee of officials of the Board on October 23, 1923, in which it was decided to leave the major fundamental work to be executed by the departments concerned under their own budgets, but to include in the general reconstruction plan the Tokyo-Yokohama canal and the Tokyo harbor works. The revised estimates amounted to Y.1,300,000,000. This also had to pass through various meetings of the many interested boards and committees,

The budget, after being approved by the Reconstruction Committee totalled Y.751,000,000, itemized as follows:

1.	Streets and Roads	Y.430,000,000
2.	Canals	38,000,000
3.	Tokyo-Yokohama Canal	15,000,000
4.	Tokyo Harbor	35,000,000
5.	Waterworks and Sewer System	5,000,000
6.	Subsidy for Fire-proof Buildings	65,000,000
7.	Parks	30,000,000
8.	Land Readjustment	3,000,000
9.	Office Expenses	30,000,000
10.	Yokohama Reconstruction	100,000,000
	Total	Y.751,000,000

In all the discussions over the budget the question of replotting the city became the fundamental issue, as nearly everyone on the various boards were property owners to a greater or less extent. However, they finally accepted the plan permitting the Government to take over ten per cent. of the land necessary for improvements without compensation. With this and other economies the estimate of Y.751,000,000 was reduced to Y.574,816,049 and presented to the Diet in that form on December 11, 1923. Here the Seiyukai Party amended the figures on the ground that the city was laying too heavy a burden on the national treasury, their attitude being sustained by the House of Peers, and this figure became Y.468,438,849. The following table shows the original estimates as submitted to the Diet and the amendments:

	Original	Amended
1. Tokyo City Reconstruction	402,793,000	306,678,400
2. Yokohama Reconstruction	45,777,000	35,514,400
3. Loans to Local Governments	15,325,402	15,325,402
4. Subsidy to Local Governments	69,225,917	69,225,917
5. Interest to be paid by National Government on Local Government Debts	21,694,730	21,694,730
6. Subsidy for Fireproof Buildings	20,000,000	20,000,000
Total	574,816,049	468,438,849

This cut in the appropiations made the execution of the reconstruction plan very difficult, and it was a matter of considerable satisfaction to those interested in the rebuilding of the city to see the dissolution of the 48th Diet, followed by a new election which changed its political complexion. In the next session, which met on June 28, 1924, an additional sum of Y.105,000,000 was approved, which increased the budget to Y.573,438,849. Apart from this, there are Y.168,123,060, which is to be financed by the cities of Tokyo and Yokohama themselves for specific purposes. This brought the budget up to Y.741,570,909, where it stands to-day for carrying out the initial steps in the huge plan of reconstruction.

This figure does not include the expenses for rehabilitation work to be carried out by the various Ministries under their own annual appropriation and earnings. For example, the Government colleges and institutions of learning supported by the State are to be rebuilt by the Ministry of Education, quite apart from the large appropriations under the reconstruction program for primary and other schools supervised by the cities and prefectures. The Railway Department will carry out its own reconstruction and plans for extending its steam and electrified lines. The Department of Communications in the same manner will restore the telephone, telegraph, radio and other work coming under their jurisdiction. The Home and Finance Departments will also finance such works as come under their immediate jurisdiction.

In addition to this, the Hypothec Bank of Japan, a semi-official institution, was authorized by the Diet on July 22, 1924, to issue what is designated as Reconstruction Savings Bonds to the amount of Y.200,000,000, of which half is to be loaned by the bank for the rehabilitation of industries in the destroyed area and the other half loaned at low interest for reconstruction works. Furthermore, a Reconstruction Building Company is in process of organization for the purpose of facilitating the fire-proof construction necessary to carry out the plans of the reconstruction program, and this also is to be assisted by a loan of Y.60,000,000 advanced at the same rate of interest charged the city by the national treasury.

As a matter of fact, the reconstruction estimates are somewhat complicated. The total for reconstruction and rehabilitation of the entire devastated area, including Tokyo, Yokohama and the five prefectures, is approximately Y.1,700,000,000 (Y.1,695,898-067). Out of this, the expenses to be borne by the National Government is approximately Y.1,500,000,000 (Y.1,501,743,152). In this figure is included the cost of all reconstruction work which comes under the jurisdiction of the various departments of the Government, as well as the relief work expenses of Y.24,000,000 (Y.24,181,051).

For the reconstruction of Tokyo about Y.629,000,000 will be expended over a period of five years, all work to be completed by the end of the fiscal year 1928. Out of the billion and a half yen approved for the expenditures of the National Government, one billion yen is to be raised by internal and external loans. Out of the Y.629,000,000 set aside for the reconstruction of Tokyo about Y.180,000,000, about 29 per cent., is to be borne by the city, the rest almost exclusively by the National Government. Even here a large part of the city's share is to be obtained by a loan from the national treasury and the rest from municipal loans issued for public subscription.

Analysis of the total expenditures of Y.741,570,909 reveals that the National Government will pay out of the treasury the sum of Y.342,192,800, and Y.357,683,379 will be borne by the local governments. Then Y.20,000,000 are to be subsidised for fireproof constructions, and Y.21,694,730 are to be aided by the national treasury for the local governments for interest charges.

The amount to be spent by the various local governments in actual construction amounts to Y.357,683,379, of which total the National Government will contribute a direct subsidy to the extent of Y.128,080,917, and the balance (Y.229,602,426) will be borne by the local governments in the following proportions. The amount allocated for Tokyo Prefecture is Y.20,333,204. Of this, Y.7,583,506 (for exclusive road construction) is a direct contribution from the national treasury, and the balance of Y.12,749,698 will be advanced to the prefecture as a loan from the same source. In Kanagawa Prefecture a total of Y.3,318,075 will be expended, of which Y.742,-371 is a direct charge on the National Government and the balance, Y.2,575,704, is a loan from the same source.

The reconstruction expenses of Tokyo as provided for in the budget will total Y.277,443,100. The National Government will bear Y.103,216,707 as its share, and Y.41,743,000 is to be loaned to the city, and Y.132,483,393 is to be raised by municipal loans guaranteed by the National Government up to Y.100,000,000.

The appropriation for Yokohama is Y.56,589,000, of which Y.16,538,333 is a direct charge on the national treasury, Y.4,402,000 is to be loaned by the national treasury to the municipality of Yokohama, the balance (Y.35,684,667) to be raised by municipal loans. The external borrowing capacity of the city of Yokohama (with government aid) is restricted to Yen 40,000,000.

In order that the local governments can meet the interest charges on these various loans (aggregating Y.168,352,462), the National Government will guarantee the payment of interest over the five-year construction period up to Y.17,408,274 for Tokyo and Y.4,286,456 for Yokohama, a total of Y.21,694,730. In addition, the National Government also sets aside the sum of Y.20,000,000 to subsidize the erection of fireproof buildings.

The actual budget as passed by the Diet authorizes the expenditure of only Y.573,438,849. The loans to be issued by Tokyo and Yokohama, amounting to Y.106,882,060, and the advances to the revenue-producing public utilities of both cities, totalling Y.61,-250,000, were excluded. The sum total of these figures is the national and local Reconstruction Expenses and brings the total authorized appropriations up to Y.741,570,909.

A résumé of the reconstruction expenses therefore reveals the following:

National Government		Y.367,640,016
Reconstruction Work	Y.197,864,369	
Subsidies	128,080,917	
Interest on Loans	21,694,730	
Fireproof Building Subsidy	20,000,000	
Local Governments		Y.373,930,893
Tokyo Prefecture	12,749,698	
Kanagawa Prefecture	2,575,704	
Tokyo City	304,441,374	
Yokohama City	54,164,117	
Total		Y.741,570,909

On the loans authorized for the city of Tokyo (Y.132,483,393), up to Y.100,000,000 the National Government will guarantee and also pay the interest on Y.84,983,393 for five years, and of the loans authorized for the city of Yokohama (Y.35,648,667) the National

Government will guarantee up to Y.40,000,000 and also pay interest charges for loans up to Y.21,898,667 for five years. The total amount of interest thus guaranteed by the National Government is Y.21,694,730: Y.17,408,274 for Tokyo and Y.4,286,456 for Yokohama.

EXPENSES FOR RECONSTRUCTION OF TOKYO BORNE BY NATIONAL GOVERNMENT

Streets and Roads	
Compensation for Land Construction Expenses and Bridges	Y.241,047,524
Underground Works and Miscellaneous	16,410,876
Canals	
Compensation for Land and Construction	26,864,875
Miscellaneous	1,705,125
Parks	
Compensation for Land and Equipment	11,900,000
Land Adjustment	
Executive, Miscellaneous, Purchase and Indemnification	8,750,000
Total	Y.306,673,400

EXPENSES FOR RECONSTRUCTION OF YOKOHAMA BY NATIONAL GOVERNMENT

Streets and Roads	
Compensation for Land, Construction & Bridges	Y.24,487,400
Miscellaneous	895,000
Canals	
Compensation and Construction	5,520,000
Miscellaneous	92,000
Parks	
Compensation for Land and Equipment	1,959,000
Land Adjustment	
Executive, Miscellaneous, Purchase and Indemnification	2,561,000
Total	Y.35,514,400
Total for Tokyo and Yokohama	Y.342,192,800

This sum, spread over a period of five years, will be expended in the following annual proportions: 1923: Y.6,291,800; 1924: 87,607,000; 1925: 68,855,400; 1926: 58,690,800; 1927: 72,235,934; 1928: 48,511,866.

WORK UNDERTAKEN BY LOCAL GOVERNMENTS (TOKYO PREFECTURE)

National Roads and Bridges	9,583,204
Prefectural Roads	7,500,000
Schools	3,250,000
Total	Y.20,333,204

To be expended over a five-year period as follows: 1923: Y.2,308,006; 1924: 4,670,881; 1925: 4,466,802; 1926: 5,887,515; 1927: 1,500,000; 1928: 1,500,000.

WORK UNDERTAKEN BY LOCAL GOVERNMENTS (TOKYO CITY)

Streets and Bridges, Restoration Work	Y. 16,055,100
Streets and Extensions	60,852,000
Land Adjustment	33,951,000
Water Works	10,000,000
Sewer System	43,500,000
Small Parks	10,000,000
Dirt and Garbage Disposal	1,850,000
Central Market	15,000,000
Sanitation Equipment	3,100,000
Schools	38,610,000
Social Welfare Works	4,525,000
Electrical Works	40,000,000
Total	Y.277,443,100

The above expenditures are also spread over a period of five years in the following proportions:

1923	Y.14,189,000
1924	62,380,000
1925	65,779,000
1926	62,717,000
1927	40,947,000
1928	31,431,100
Total	Y.277,443,100

TOTAL EXPENDITURE BY KANAGAWA PREFECTURE (Y.3,318,075)

National Roads and Bridges	Y.1,318,075
Schools	2,000,000

This sum is also to be spread over a period of five years in the following proportions: 1923: Y.400,000; 1924: 1,418,075; 1925: 500,000; 1926: 1,500,000; 1927: 500,000

TOTAL EXPENDITURE BY THE CITY OF YOKOHAMA (Y.56,589,000)

Streets and Bridges, Restoration	Y. 7,442,000
Roads	6,018,000
Land Adjustment	4,179,000
Canals and Rivers	6,000,000
Water Works	3,000,000
Sewer Works	1,250,000
Schools	10,950,000
Social Welfare Works	750,000
Electrical Services	8,500,000
Gas Works	3,000,000
Central Market	4,000,000
Public Health Work	1,500,000

This will also be spread over a five-year period as follows: 1923: Y.1,781,000; 1924: 12,019,000; 1925: 13,393,000; 1926: 11,873,000; 1927: 9,789,000; 1928: 7,734,000; Total, Y.56,589,000.

Analysis of the above estimates shows that the total reconstruction burden on the national treasury is in the neighborhood of Y.1,500,000,000, approximately $700,000,000 gold. This, however, does not mean that all of that sum is to be paid by the National Government. As is clearly indicated, a portion of this represents the National Government's aid to cities, prefectures, towns and villages which were suddenly deprived of the major portion of their normal revenues for taxation. This aid is in the form of loans from the national treasury, the interest being paid out of the capital account for the first few years, or until these communities get back to a normal basis and can redeem or pay the amortization instalments out of their current revenues.

Such aid is purely temporary, and the above figures make no allowance for the costs that must eventually be shouldered by the local governments in carrying forward the necessary improvements and extensions to meet the requirements of a rapidly growing population. Neither do the figures embrace the costs of those important public utility extensions now controlled by private corporations, such as gas, electric light and power, and the lesser tramways and transportation companies who must find large sums in the open market to expand their facilities. Neither does it include that other vitally important undertaking, so essential to the future greatness of Tokyo—the harbor improvement. Nothing here will meet the growing needs of the metropolis but a comprehensive plan spread over a period of years, which will convert the entire foreshore into wharves and warehouses on reclaimed land extending south to where the improvements will dovetail into the work of the Tsurumi reclamation and the Yokohama harbor. The figures make no provision for the new subway construction or many other essential public improvements which cannot be much longer sidetracked if Tokyo is to retain her position as the first city of the empire.

Mere speculation as to the amount of money required during the next decade to carry forward these schemes leads nowhere, but the essential truth is clearly demonstrated that the totals will run into enormous figures. They cannot be set aside. Japan has entered upon a road from which there is no turning. Each year will call for further and heavier financial burdens if the metropolitan district is to develop along lines that will enable its population to exist in comfort and within reasonable living costs.

If Japan is to take her real place in Asia and play out the rôle her men of vision have assigned to her in the drama of history that is rapidly unfolding in the Pacific she must have a capital city commensurate with her greatness. If this capital city is to care for the comfort and health of the millions who will flock to it, it must be modernized from the substructure up in every sense of the word.

Can the city of Tokyo stand the strain? Will the funds be available? The city of Tokyo may have to go abroad for funds to carry out its full program for public improvements. Here it stands in a most favorable position. Nearly all of its small outstanding debt is for revenue-producing utilities, such as tram-lines and waterworks. The costs of carrying forward the new program come under the same general head of revenue-producing public utilities, which, when completed and in operation, will not only take care of their own financing but return a handsome surplus to the municipal

treasury. The new subways, waterworks extensions, the harbor improvements, the sewer system, electric light and power are all business propositions, and with the municipal guarantee there should be no difficulty in raising the funds for their construction. In addition to producing revenue, these improvements will automatically appreciate the land values throughout the city and provide its government with the means of increasing its revenues from taxation and its borrowing capacity.

In arriving at any conservative estimate of Tokyo's debt limit, we are met at the outset by conditions arising from the catastrophe which deprived the city of its normal revenues from taxation, resulting in a deficit of Y.11,070,000 in 1923, due to the remission of taxes for those whose properties were destroyed. The 1923-24 budget of Y.39,660,000 is Y.6,320,000 in excess of estimated revenue, traceable solely to the extraordinary reconstruction expenses, which for the next three decades will form the largest item in the municipal budget.

Notwithstanding this handicap, it is estimated that the increase in revenues due to the normal appreciation of property will change the deficit into a surplus by the end of the five-year reconstruction period in 1928-29. By practising strict economy and retrenchment all along the line the normal rate of increase of city administrative expenses will be pared down to five per cent., and by 1928 it is estimated that the revenues will exceed expenditures by Y.1,096,000. By that year the heavy reconstruction work will have been completed. Permanent building operations will be well under way, public utilities extended, and other improvements carried out that will greatly enhance property values and increase the taxing powers of the city.

In the meantime annual deficits will be met during these five years of rebuilding by subsidies from the national treasury and by the issue of debentures. The total deficit for this period will approximate Y.44,788,341, but once the corner is turned in 1928, the next five years are expected to roll up a surplus of Y.78,795,000.

Dr. Charles A. Beard, commenting on Tokyo's borrowing capacity, in his work on the " Administration and Politics of Tokyo," points out that the per capita debt of Tokyo is only Y.80.25 against Y.602 for New York, 111 for Chicago, 331 for Boston and 218 for Philadelphia, and then shows that only 30.2 per cent. of the bonded debt of all American cities of 30,000 inhabitants and over in 1919 had been issued for revenue-producing public utilities and 69.8 per cent. for unproductive undertakings. On the other hand, 85 per cent. of Tokyo's debt is for revenue-producing public utilities and fifteen per cent. for non-productive undertakings.

In determining the borrowing capacity of the city of Tokyo for non-productive revenue purposes Dr. Beard applies the New York rule of ten per cent. on the actual value of the taxable property, which fixes its debt-creating power at Y.337,245,426. Summing up his inquiry into the ability of Tokyo to pay, he places the debt limit of the city at somewhere between Y.100,000,000 and Y.200,000,000.

These conclusions, however, are not intended to be final, as the Tokyo municipal authorities have been guided by the principle that wise city plans increase the value of the land affected by them, and such value forms the basis of the security for the cost of executing such plans. Property values will steadily increase in Tokyo with the growth of the city even if no great improvements are undertaken. This normal increase is entirely apart from special increases due to specific improvements such as subways, sewers, new streets, etc. On the basis of this normal increase it is entirely proper to borrow more money than the present revenues and land values warrant in order to meet existing needs. It would be unwise, as Dr. Beard points out in his Memorandum on the Reconstruction of Tokyo, to limit the amount borrowed now to the small sum guaranteed by the present land values and revenues of the city. This, he contends, would be as shortsighted as a borrowing policy based on the assumption that there is no limit to the financial burden which the city can carry.

A study of the Reconstruction Budget of the City of Tokyo is illuminating when viewed in the light of the above principles accepted by American authorities as the basis of a community's debt-contracting power. We find that the city of Tokyo is authorized to issue loans to the extent of Y.132,483,393. Of this, the National Government will pay or guarantee interest on Y.84,983,393, leaving only Y.48,000,000 on which the city must meet the interest. Further reference to the table also reveals that the municipal borowings are for the purpose of creating the following revenue-producing public utilities, the profits from which will amply provide for their own interest charges, amortization and redemption :

Sewer System (Total cost Y.43,500,000, half paid by the National Government)	Y.21,750,000
Central Market	11,250,000
Water Works Extension	7,500,000
Electric Tramways	37,600,000
Electric Light Supply	2,400,000
Total	Y.80,500,000

So, out of a total of Y.132,983,393 in municipal loans for carrying out the reconstruction program, approximately 40 per cent. (Y.48,233,393) is for non-productive purposes and 60 per cent. for creating revenue-producing public utilities. The National Government also restricted the external borrowing capacity of the municipality of Tokyo for reconstruction at Y.100,000,000, but as yet this privilege has not been taken advantage of.

From this brief survey it is obvious that the city of Tokyo is still far within its borrowing powers, conserving its credit for some definite purpose. It may well be assumed that this will take the form of financing the subway system, and possibly the harbour works, two essential and highly remunerative public utilities. The cost of constructing the 41½ miles of projected subways is estimated at Y.187,000,000, the work to be spread over a period of ten or more years. The harbor program, when definitely decided upon in all its details, will call for further large sums, also spread over a period of years.

Tokyo's recuperative powers and ability to meet the interest on these series of loans out of her own resources without help from the national treasury is best expressed in the following estimates of ordinary revenues and expenditures prepared by the municipal treasurer :

Ordinary Revenue and Expenditures

Year	Revenues Total	Derived from Taxation	Expenditures Total	Deficit or Surplus	
	Y.	Y.	Y.	Y.	
1923 ...	36,314,831	6,368,402	36,314,831	18,953,509	Deficit
1924 ...	20,174,243	8,584,150	30,241,326	10,077,083	,,
1925 ...	23,652,910	10,799,858	30,383,993	6,731,083	,,
1926 ...	27,127,710	13,015,646	32,059,293	4,931,583	,,
1927 ...	30,609,863	15,231,394	32,698,946	2,089,083	,,
			Total	Y.42,782,341	,,
1928 ...	34,196,864	17,447,142	33,000,804	1,096,060	Surplus
1929 ...	46,683,162	28,368,467	35,569,494	11,113,668	,,
1930 ...	51,351,479	31,205,314	38,530,233	12,821,246	,,
1931 ...	56,486,628	34,325,864	41,825,556	14,661,072	,,
1932 ...	62,135,292	37,758,431	45,440,026	16,659,266	,,
1933 ...	68,348,823	41,534,274	45,905,038	22,443,785	,,
			Total	Y.78,795,097	,,

National Finances

When the Japanese Government issued a $150,000,000 loan in the United States the early part of last year, simultaneously with one for £25,000,000 in England, the general impression prevailed that the proceeds of these loans were to be employed for purely reconstruction purposes. This idea has become firmly fixed in the minds of many people in Japan, who, failing to participate in the distribution of profitable orders for such large quantities of materials as the loan total seemed to imply, are wondering what has become of the money. It is well to remember, however, that this so-called Reconstruction Loan was primarily a refunding operation by which the Japanese Government retired the outstanding balance of the 4½ per cent. sterling loan, first and second series, falling due February 15, 1925, and July 10, 1925, respectively. This loan, issued during the Russo-Japanese war in 1905, was for £60,000,000, and up to last year the Japanese Government had retired about £25,000,000, or 40 per cent., leaving outstanding bonds equivalent to $170,500,000 gold par value. The object of the new loan was to call in these outstanding bonds for redemption on October 1, 1924, and clear the way for the reconstruction program forced on the nation by the earthquake and fire of September 1, 1923.

It was estimated that the reconstruction program of the Japanese National Government would call for the expenditure of Y.1,500,000,000 ($700,000,000), of which about half ($350,000,000)

RECONSTRUCTION BUDGET FOR CITY OF TOKYO

Construction Items	Total Expenses	1923-24	Expenditures for Fiscal Year					Source of Funds					
			1924-25	1925-26	1926-27	1927-28	1928-29	Amount of National Subsidy	% of Total	Loans from Nat. Govt.	Municipal Loans		Railway Board
											Amount	Interest Paid by N. G.	
Roads and Bridges	16,055,100	600,000	3,500,000	3,000,000	3,000,000	3,000,000	2,955,100	6,689,625	5/12	—	9,365,475	9,365,475	—
Sewers	43,500,000	1,500,000	8,400,000	8,400,000	8,400,000	8,400,000	8,400,000	21,750,000	½	—	21,750,000	21,750,000	
Parks	10,000,000	950,000	1,900,000	1,900,000	1,900,000	1,900,000	1,450,000	3,333,332	⅓	—	6,666,668	6,666,668	—
Garbage Disposal	1,850,000	—	600,000	600,000	650,000	—	—	462,500	¼	—	1,387,500	1,387,500	—
Central Market	15,000,000	—	4,500,000	5,250,000	5,250,000	—	—	3,750,000	¼	—	11,250,000	11,250,000	—
Primary Schools	38,610,000	—	8,000,000	8,000,000	8,000,000	8,000,000	6,610,000	9,652,500	¼	—	28,957,500	28,957,500	—
Charity Hospitals	600,000	—	350,000	250,000	—	—	—	} 775,000	¼	—	2,325,000	2,325,000	—
Dispensaries	2,500,000	—	1,000,000	500,000	500,000	500,000	—						
Social Welfare	4,525,000	—	900,000	925,000	900,000	900,000	900,000	1,243,750	½* ¼*	—	3,281,250	3,281,250	—
Total	132,640,100	3,050,000	29,150,000	28,825,000	28,600,000	22,700,000	20,315,100	47,656,707		—	84,983,393	84,983,393	—
Streets and Roads...	67,531,824	1,290,000	11,237,965	15,737,965	18,609,965	11,403,965	9,251,964	30,426,000	½	30,426,000	—	—	6,679,824
Land Adjustment	33,951,000	849,000	8,328,000	12,252,000	8,343,000	4,179,000	—	22,634,000	⅓	11,317,000	—	—	—
Total	101,482,824	2,139,000	19,565,965	27,989,965	26,952,965	15,582,965	9,251,964	53,060,000		42,743,000	—	—	6,679,824
Water Mains Repairs	5,300,000	3,000,000	1,003,574	1,083,624	212,802	—	—	} 2,500,000	¼	—	7,500,000	—	—
Water Works Extension	4,700,000	—	1,996,426	1,916,376	787,198	—	—						
Total	10,000,000	3,000,000	3,000,000	3,000,000	1,000,000	—	—	2,500,000		—	7,500,000	—	—
Electric Tramways	37,980,000	—	19,580,000	13,000,000	5,400,000	—	—	—		—	37,980,000	—	—
Electric Supply	2,520,000	—	1,510,000	1,010,000	—	—	—	—		—	2,520,000	—	—
Grand Total	284,622,924	8,189,000	72,805,965	73,824,965	61,952,965	38,282,965	29,567,064	103,216,707		41,743,000	132,983,393	84,983,393	6,679,824

* ½ for Employment Agencies ; others ¼.

would be used for the purchase of materials and supplies, a large proportion of which would come from abroad. Now the Japanese Government and the Bank of Japan have bank deposits and short-term foreign Government securities in New York and London aggregating over $250,000,000, or more than sufficient for retiring the sterling bonds when they fell due, but this course obviously would have left only $80,000,000 on deposit abroad with which to finance the purchasing of reconstruction materials.

The two loans netted the Japanese Government approximately $230,000,000, enabling it to retire the $170,500,000 sterling obligations and leave a balance of some $59,500,000 to be added to its cash deposits in New York and London. The net result of the operation therefore increased these reserves to about $310,000,000, or the amount necessary to finance the large purchases of reconstruction materials. The external debt of Japan was not increased to the full amount of $270,000,000. It simply added another $100,000,000, or say Y.200,000,000, to the total outstanding external debt, which at the time of issuing the new loans stood at Y.1,320,624,818, thus raising this figure to about Y.1,520,000,000. In other words, the new loans did not materially increase Japan's financial burden. As a matter of fact, during the past ten years Japan has reduced its external debt by more than Y.325,000,000, and even after adding the new issues, the external debt of the nation is less than the amount that was outstanding on March 31, 1914. This, in itself, is a remarkable showing, due perhaps to the unprecedented prosperity as the result of the war. It indicates, nevertheless, that Japan's sound financial position is not materially impaired as a result of last year's operations. She is better equipped to face the heavy task that looms ahead in carrying out her program of reconstruction.

Over one quarter of the national debt of Japan is self-supporting, the profits from the State railways alone being more than ample to take care of the interest and redemption of her outstanding foreign indebtedness. The State railways, comprising over 7,000 miles, were valued at cost of construction or purchase, at the end of 1923 at over Y.2,100,000,000. The railway accounts are carried independently of the general budget and show for the past fifteen years a substantial profit after payment of all expenses and interest charges. This profit is invested in the improvement or extension of the State railway system. The net profits for the fiscal year ending March 31, 1924, were approximately Y.120,000,000.

The total outstanding domestic obligations of the Japanese Government on July 1, 1924, was Y.3,184,029,109, and of this some Y.540,000,000 represents railway obligations, which carry themselves. In contrast to this and the external debt, the Japanese Government owns State forests, harbor works, telegraph and telephone systems, public buildings, special funds and other investments, all aggregating in excess of Y.12,000,000,000 in estimated value at the present time. The total wealth of the Japanese people at the end of 1921, including public wealth, has been estimated by the Government at close to 100 billion yen, or over 21 times the total indebtedness of the Government. This is considerably more favorable than the relation between the national wealth of the United States and the total debt of its Government. Interest charges on the general debt of the Japanese Government as estimated in the current budget amount to less than 12 per cent. of the Government's ordinary revenues. During the past fifteen fiscal years the Government has retired an average of over Y.39,000,000 of its debt annually by means of a statutory amortization fund, the appropriation for this purpose in last year's budget being Y.42,000,000. According to statute, at least 1.16 per cent. of the Government's funded debt (and not less than Y.30,000,000 in any event, must be retired each year.

The revenues of the Government rest on a broad basis of taxation. In 1922-23 over 62 per cent. of the ordinary revenues of Y.1,428,206,000 were derived from taxes. An income tax of practically universal application, with rates ranging from ½ of 1 per cent. to 36 per cent., produced the largest single amount, Y.229,132,000. In the total ordinary revenues for 1924-25 the income from taxes, excises, etc., is placed at Y.711,937,000. The Government undertakings, such as postal, telephone and telegraphs, State forests and monopolies, bring in Y.333,786,000, while from other sources are derived the additional sums which bring the total ordinary revenue for the year up to Y.1,214,988,000, a shrinkage of a little over Y.200,000,000, due to the earthquake and fire.

(*Continued on page 281.*)

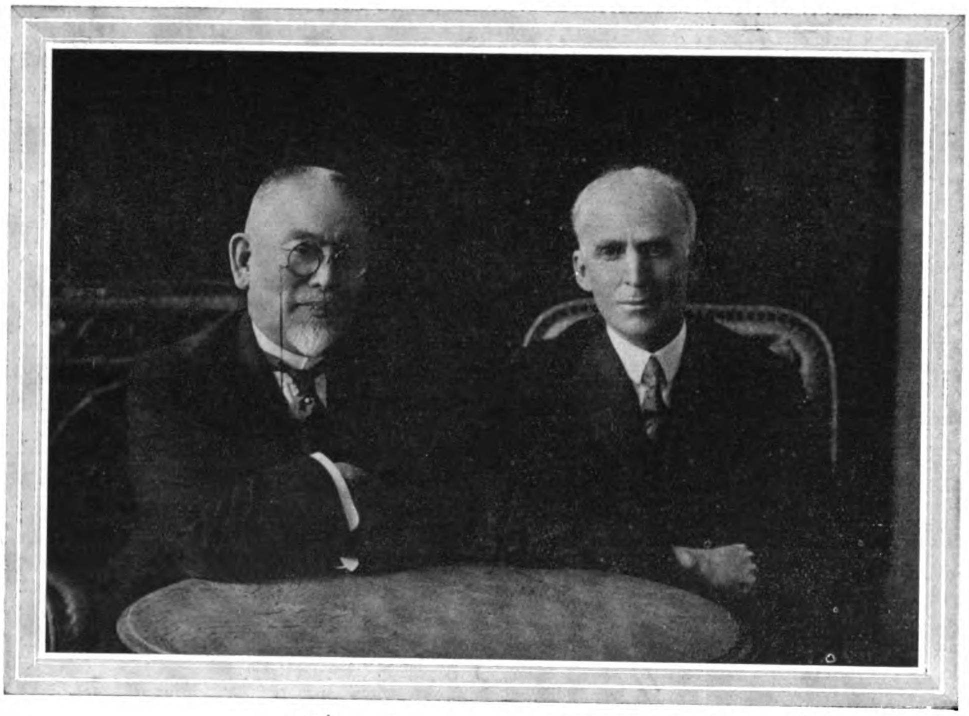
Memorandum Relative to the Reconstruction of Tokyo

Presented to Viscount S. Goto by Charles A. Beard

I. New Street Plans

THE subject of street planning in Tokyo had been carefully studied by the Home Office Bureau of City Planning, the Provincial Committee on City Planning (under the law of 1920), and the Research Section of the City Government. The character of the data to be used had been agreed upon and the general outline of comprehensive plans had been made by engineers and technicians. These plans have been reviewed since the disaster by engineers and technicians from the Reconstruction Board and the City Government. I have held many conferences on the economic aspects of the plans with the representatives of both agencies.

The principles controlling such plans are clear: (*a*) the requirements of the capital as a civic centre must be met; (*b*) street plans must be made with reference to the economical transportation of goods and passengers; (*c*) better fire protection must be afforded by wide streets and park spaces; (*d*) it is more important to provide numerous small parks and places of safety in residential districts than to make streets of extra width; (*e*) the narrow alleys in the old congested districts of the city must be abolished immediately by application of a general rule that no houses shall be built on streets of less than two ken or more in width; (*f*) in all streets in which the traffic will be heavy allowance shall be made for sidewalks for pedestrians; (*g*) street plans must be adjusted to the provisions made for railway terminals, markets, and other public services; (*h*) street plans must be related to subway development and street car line extensions; (*i*) street plans must be related to proposed zoning for industrial, commercial, and residential purposes; (*j*) street plans for the burnt area must be related to plans for the entire area of Greater Tokyo; and (*k*) street plans in connection with rapid transit must be arranged to facilitate the transfer of a large population from the former congested area to outlying regions.



Viscount Goto and Professor Beard

On the street lines it is necessary to realize these principles; both Imperial and Municipal engineers are in general agreement, because they employ the same statistical, engineering, and topographical data. The technical and engineering work of plotting these streets is entirely outside my competence. That calls for old and experienced Japanese engineers and architects familiar with the topography, industrial and business economy, social habits, and artistic taste of the capital. I am deeply impressed, however, by the immense amount of labor which has been spent by your technicians in the study of their peculiar problems.

II. The Land and Housing Problem

Every important aspect of this question has been the subject of earnest inquiry and discussion. The worst slum areas of old Tokyo are now laid waste, and this is the appointed time to prevent their restoration. The experience of the western world shows that the housing problem cannot be left to the tender mercies of landlords unrestrained by social requirements. If it is, slums, misery, disease, and degradation inevitably follows. The whole tendency of western thought and practice is against the unrestricted private ownership of land for housing purposes. With the numerous experiments in munipcial housing in England and Germany Japanese students are familiar. A number of workmen's dwellings had been completed in Tokyo before the earthquake. Osaka is now making interesting progress in this sphere. Thus Japan herself has precedents.

Some German cities own as much as eighty per cent. of the land within their boundaries. These cities keep down land values, rents, and the cost of living by careful administration of their land. This is the time for Tokyo to acquire large areas for industrial housing to be undertaken by public authorities or by private associations with or without Government aid. In addition there should be enacted a carefully drawn law controlling the use of land for housing in the interest of health and safety.

III. Legal Adjustment of Rights

With reference to this point I cannot do better than to refer to the notable example set by England after the great fire of 1666. Parliament passed one of the most remarkable laws in the history of legislation (18 and 19 Charles II., chap. 7). It stands out as a tribute to the genius of the English for arriving at practical methods for meeting difficulties as they arise.

This Act of Parliament created a court of fire judges whose duty it was to make adjustments in all cases of controversy arising out of the calamity which fell on London.

The elements of the Act are as follows:

1. The fire court was empowered (*a*) to sit without any of the formalities of the ordinary courts, (*b*) to examine witnesses, (*c*) to require the attendance of parties, (*d*) to issue orders, and (*c*) to render judgements.

2. The court had the power (*a*) to cancel existing agreements and contracts, (*b*) to substitute new agreements and contracts, (*c*) to order new leases put into effect, and (*d*) to extend the term of leases to not more than 40 years.

3. The principle upon which the court was to act was summed up in brief form in the preamble of the Act: "It is just that every-one concerned should bear a proportionable share of the loss according to their several interests."

The practical application of this general principle took the following forms:

1. If the tenant or leaseholder had been ruined in fortune by the fire and could not resume business, the court cancelled his lease, and in some cases required the landlord to pay him a small sum of money in return for cancelling his claims.
2. If a tenant was ruined in fortune or badly impoverished, the landlord was forbidden to compel the tenant to restore the burned or damaged building.
3. If a landlord suffered great damages in the fire and could not restore the building on the old terms, the court cancelled the old lease and required the tenant to assist the landlord by paying an increased rental.
4. If the landlord was without money to restore his building, the court gave the tenant the power to rebuild and compensated him by granting him an extension of his lease and a reduction in rent.
5. If neither landlord nor tenant was able to rebuild within a period of three years the city government was empowered on the nine months' notice to seize the land and sell the same, handing the proceeds to the parties entitled to such proceeds.

IV. The System of Transportation

I have not found anywhere among your technicians any dissent from the proposition that provision must now be made for the unification of railway terminals with subsidiary stations, and that a system of rapid transit must be provided. Western experience shows that the transportation problem should be treated as a unified problem, involving steam and electric railways, street car lines, busses, rapid transit lines, and traffic regulation. The electric bureau of the city of Tokyo is thoroughly alive to the significance of this fundamental fact.

There is general agreement also on the proposition that subways offer the best solution for the problem of rapid transit. On this point I have nothing to add to my first report, except that this is the time to act, because a large part of the subway can now be built in new streets by open cut, saving an enormous sum of money. If the Imperial Government or Municipal Government is prepared to finance the construction of subways, that is the quickest way of solving the problem. If neither Government is prepared to take the risk, then the next method offered is that of co-operation with private capitalists. The subway contracts in New York show how to effect that co-operation. Care must be taken, however, to avoid some of the mistakes of New York.

V. Priority in Work of Reconstruction

There is substantial agreement among us as to the order in which the work of reconstruction should be undertaken. The first consideration should be the restoration of the economic and home life of the devastated area. This means the complete establishment of street, park, and public building sites in detail at the earliest possible moment, in order that private builders may begin their work of permanent construction immediately. Revenue-producing utilities, such as water works, electric light and power equipment, street railways, etc., should be restored as rapidly as possible to full earning capacity. This should be done as a public service to the people and with a view to improving the financial condition of the city. Public assistance in housing construction already begun while you were Mayor of Tokyo should be renewed and extended at the earliest practicable moment. The reconstruction of school buildings, especially for the elementary and middle schools, should be put on the preferred list.

Permanent official buildings, monuments, the development of parks, the construction of permanent markets and works of an ornamental or aesthetic character should be put last in the program of rebuilding.

VI. Machinery for Action in Reconstruction

The controlling principle here is: "What agencies already existing for construction work have demonstrated a certain degree of ability in their respective fields?" The task of assembling skilled engineers and workmen and collecting materials for construction is a difficult one at best; hence it is not desirable to create any new agencies for operation except in fields not well occupied.

In view of the above principle, I suggest the following: (*a*) that all existing construction agencies of the Imperial and Municipal Governments be utilized to the full, and strengthened by special assistance; (*b*) that the Reconstruction Board confine itself largely to laying out streets, parks and building sites, the purchase of materials in large lots, and construction work in which Japanese engineers have had little or no experience. That special construction work includes subways, street paving, and modern steel and concrete buildings. Improvements and replacements of this character, I respectfully suggest, should be put in the hands of established and experienced contractors working under heavy bond according to approved specifications. In the case of pavements the contractors should be bound to maintain for a period of years on fixed terms.

VII. Open Bidding on Materials

Inasmuch as the purchase of supplies and the letting of contracts involve large amounts of money, it is necessary to surround these operations with the closest safeguards. Therefore I recommend the following:

1. The preparation of standard specifications for each group of supplies and for each important contract.
2. The wide advertising of each great purchase to be made and each contract to be let.
3. The reception of bids at a given time and place from all responsible parties, offering proper bond for the execution of tenders, if and when accepted.
4. The opening of bids in a public room in the presence of any and all bidders who care to send representatives.
5. The award of orders and contracts to responsible parties offering the most favorable terms.
6. The publication of specifications, offers, and awards.

In the way of assistance in perfecting the technique in this field, I have presented to you copies of the specifications, forms, and rules used by the government of the city of New York.

VIII. Building Construction and Design

This is a matter outside my province. However, at your request I have prepared a digest of American engineering opinions with respect to the effects of the San Francisco earthquake and fire on construction. Moreover, I have had occasion to consider the administration of the building code as a part of municipal administration in general. Inevitably also I have informally discussed the problem with Japanese and foreign engineers as well as with public officials.

There seems to be general agreement among them all that there are types of construction that will resist with a high degree of efficiency earthquake shocks such as occurred in Tokyo. They lay stress upon facts obvious even to laymen like myself: first, that steel-frames and re-inforced concrete stood the shock well on the whole, but that the walls of some steel buildings were badly shattered and that some re-inforced concrete buildings collapsed; secondly, that some brick and stone buildings near to badly damaged buildings of steel and concrete came through the shock with hardly a crack, while others quickly fell down—a heap of ruins. These experts also emphasize a fact noted by competent engineers in San Francisco, namely that the protection afforded to fire-proof buildings may be utterly defeated by permitting the erection of inflammable buildings nearby or in their midst.

In view of these circumstances there seems to be a general concensus of opinion among engineers that emphasis must be laid on (*a*) foundations of an approved character, (*b*) proper design adapted to uses and stresses, (*c*) modern fire-proofing, (*d*) segregation of fire-proof buildings, and (*e*) carefully supervised construction according to approved specifications. These I offer as the reflections of a layman derived from expert engineering opinions.

I also venture to offer two other suggestions in this connection. First, that the Reconstruction Board take advantage of the special studies already made by the Buildings Bureau in the Police Commissioner's office. The Buildings Bureau had already prepared a fire code, which was pronounced excellent by Mr. William A. Bassett, consulting engineer of the New York Bureau of Municipal Research, who has had wide experience in the field of administrative control over fire hazards. In the second place I suggest that before the new stipulations as to building zones and regulations are adopt-

ed, they should be published in draft and a public hearing held with a view to obtaining the widest possible concensus of opinion as to precautions against fire and earthquake hazards.

IX. Financial Problems

This subject may be treated under five heads :

1. Financial condition of Tokyo previous to the disaster.
2. Basis of future security for revenues and loans.
3. Basis of contributions from the Imperial treasury.
4. Methods of meeting cost of street improvements.
5. Character of the loans to be floated.

1. As to the first point, it is fortunate that Tokyo previous to the earthquake and fire was unlike all other great cities in the world in that it had a very small debt as compared with the values of real estate (land and buildings), namely, Y.174,307,132. Moreover, nearly all of that debt was for revenue-producing utilities, such as waterworks and street car lines. The total debt for non-revenue-producing purposes was only Y.26,281,772. The waterworks and street car lines are rapidly approaching a paying basis again, although large outlays are necessary for new equipment. Hence it follows that, relatively speaking, the city's financial condition is sound. Nevertheless, great burdens now fall upon it at the time when revenues from taxation are depleted. Hence the financing of improvements must proceed cautiously.

2. There are two outstanding facts with respect to the basis for future security for revenues and loans. The first is that wise city plans, made with reference to the economy, safety, and convenience of the city, increase the value of all lands coming within the range of such plans. The second is that plans for the future must be based on the justifiable assumption that there will be a great increase in land values as the city grows in industry and population.

Examples of the increase of land values due to public improvements are numerous, but one or two instances may be cited by way of illustration. During the period of sixteen years after the laying out of Central Park in New York City, the general increase in land values throughout the city was 100 per cent., while the increase in the value of the land in the wards immediately adjoining the park was 800 per cent. A more notable instance is that of the New York subways. The increase in land values along the subway in Upper Manhattan and the Bronx within seven years after the beginning of operation was more than six times the cost of building that part of the subway.

This great principle is therefore established on the basis of experience : *Wise city plans increase the value of the land affected by them, and such value forms the basis of the security for the cost of executing such plans.*

The second great principle is that land values will steadily increase in Tokyo with the growth of the city even if no great improvements are undertaken. This may be called the " normal increase " which is entirely apart from special increases due to specific improvements such as subways and sewers. *On the basis of this normal increase it is entirely proper to borrow more money now than the present revenues and land values warrant in order to meet existing needs.* In this case the amount set aside for amortization or redemption of loans should be small for the first five years and then gradually increase with the steady rehabilitation and growth of the city. According to this principle it would be unwise to limit the amount borrowed now to the small sum guaranteed by the present land values and revenues of the city. This would be as short-sighted as a borrowing policy based on the assumption that there is no limit to the financial burden which the city can carry.

3. Basis of subsidies from the Imperial treasury. Who should pay the bills of reconstruction ? That is a thorny question if looked at selfishly. Certain groups in Tokyo wish to throw the whole burden or the major portion of it on the National Treasury. Certain groups outside of Tokyo wish to place the burden on the city. Both are wrong. There are principles of justice and equity which can be applied here, principles which should command the assent of all thoughtful citizens.

In the first place it will surely be agreed that Imperial, Prefectural, and Municipal buildings should be restored by the Imperial, Prefectural, and Municipal Governments respectively.

In the second place, all new streets and avenues laid out mainly with a view to enhancing the beauty or serving the needs of the capital of the Empire should be paid for by the Empire.

In the third place improvements made with reference to the uses of Tokyo as a business, industrial, and residential city should be paid for in large part by special assessments on land benefitted and by the city treasury.

As to the apportionment of the burden of cost in cases in which both a city and a capital are served by the same improvements, certain principles have been worked out in Western theory and practice. This point is covered in my first report, but I summarize the principles here :

(*a*) The Imperial Government and the Imperial Household are large owners of land within the city. The total area of taxed land in the city is 11,547,019 *tsubo* ; the total area held by the Imperial Government and Imperial Household is 4,190,511 *tsubo*. The streets adjoining Imperial property must be built, repaired and lighted. Other improvements must be made for it just as for private property which is taxed. On the principles of justice, the citizens of Tokyo should not be compelled to pay taxes to maintain municipal improvements which mainly serve the Imperial Government and the Imperial Household. Moreover, there are thousands of Imperial officers in the city. They use the streets and improvements of the city for the transaction of Imperial business. On the basis of strict justice, therefore, the Imperial treasury should pay a large part of the current expenditures of the city and a large part of the cost of improvements. In the case of the American capital, Washington, the national treasury of the United States pays about one-half of the principal expenditures of the entire city.

(*b*) If special assessments are laid on private landowners to pay for specific street improvements, then special assessments should be laid on Imperial lands adjoining such improvements.

(*c*) Whenever a new street is cut or an old street is widened in order to make an approach to an Imperial building, then the Imperial Government should pay the entire cost.

(*d*) Imperial subsidies for social work, education, etc., should be apportioned among all cities, towns and villages on the same principles, that is, on the basis of population, or some other uniform rule.

Surely no one can question the justice of the above principles. If they are fairly applied in the present emergency, justice will be done to both parties, that is, Tokyo and the nation.

4. Methods of meeting the cost of street improvements. In view of the fundamental fact that wise plans increase land values, all modern city planners agree that a large part of the cost of executing such plans should fall upon the owners of the property benefitted. This is the only possible way in which money can be secured to reconstruct Tokyo and provide it with the conveniences and necessities of modern life.

Financing on the basis of increments in values may take one of several forms. The most popular system in the United States is that of " special assessments," or taxes laid upon the owners of land adjoining public improvements. Japanese law already makes provision for a limited application of this principle in the case of street improvements. Since a beginning has been made, it may be readily extended. This subject is discussed in my " Collected Addresses," and in a pamphlet issued by the National Municipal League, both of which have been translated into Japanese.

The second method is that known as " excess condemnation," which has been extensively used in France and England. In such a case, the Government condemns more land than is necessary for the particular improvement and then re-sells the remainder or leases it in such a manner as to make gains from the increments in values caused by the improvement.

A third method is Municipal ownership of land on a large scale. This practice is widely adopted by German cities, which derive large sums from ground rents and control the distribution of the population. Such financing calls for large initial outlays, but by careful management such undertakings produce revenues which meet both interest and amortization charges.

A fourth method is that employed in some German cities and recently adopted with modifications in the replanning of Salonica after the great fire. Under this plan the entire area to be reconstructed is condemned and taken by the Government. The owner of each lot is given a certificate equal in amount to the value of his land. The new streets, parks, and building sites are laid out. New lots of land are laid out. The new lots are then distributed among the former owners or sold at auction to the highest bidders, preference being given to the former landowners. This may be combined

with subventions from the Muncipal treasury to pay in part for the land taken for new streets, parks, and building sites.

It may be found desirable to apply two or more methods to financing the street plans of Tokyo. Therefore the following practical suggestions have been offered with a view to securing wide streets at a minimum cost to the Imperial and Municipal Governments :

Decree by law that in certain sections twenty per cent. of all lots of land above a certain size shall be taken for widening streets without any compensation to the owners, and that certificates of indebtedness bearing six per cent. interest shall be issued to the owners of lots too small for use after twenty per cent. has been taken for streets. Such certificates in each case shall be for the present market value of the lot, and they shall be paid in cash or permanent bonds at the expiration of five years.

This method is the best of all if it can be adopted, for it saves the great expense and difficulties involved in valuation, condemnation, and resale. It is the cheapest, for it calls for a very small outlay of money immediately. It is the most just, for it places the principal cost on the property benefitted.

If in some districts it is not possible to apply this principle, or if the law prevents, then the principle of special assessments can be applied without adding materially to the Imperial or Municipal debt. Apply this method in the following manner :

Lay out the new street. Create on both sides of it a special assessment district. Charge against this district a certain part of the cost of the new street. Issue special assessment bonds as mortgages or first liens on the land within the district. Provide that the interest and redemption of such bonds shall be met by annual taxes laid upon the owners of land within the district. In order not to burden these taxpayers until they have had an opportunity to re-establish their homes and business, it may be provided that the interest and redemption installments for the first five years shall be met by the Imperial treasury on the principles laid down above for the apportionment of costs between the Imperial and Municipal Governments and private landowners.

There is still another method by which smaller streets may be widened. That is direct law forbidding the erection of buildings on any street which is not two or more ken wide. At present the law provides, I am informed, that no new building shall be erected on a street which is less than one and a half ken wide (nine feet). This law could be easily changed to read two or more ken, but in such case a study should be made of its effect upon the owners of small lots. Compensation might be made in case the amount taken exceeds a certain fixed proportion of small lots.

Finally there is a last resort, in case all others fail. That is to decree that no lot owner shall build any structure within five or ten feet of the present street line. In this case the Government does not take any land from the owner. It simply forbids him to build on the front part of his lot. In this case, however, the Government is not permitted to build a street or sidewalk on any part of owner's land. It merely reserves a part of each lot to the public. When the finances of the Government are in a better condition it may then condemn the land reserved in the front part of the lots and use it for streets and sidewalks. At that future time it will not be compelled to pay for tearing down any buildings to make room for street widening. At most it will merely be compelled to pay for the land actually *taken*, and at that time it may recover all or part of the purchase-money by levying special assessments on the district benefitted.

This method is sometimes applied in the United States with excellent results. It is one way of securing quick action at a small financial outlay. It can be applied, however, only to the widening of existing streets. It is not applicable to the cutting of new streets or to cases in which a large portion of all the land on both sides of an existing street is taken.

5. As to the character of the loans to be floated, I offer the following suggestions. First, that no large general loans be floated either at home or abroad. Secondly, that the loans to be floated be divided into two classes : (*a*) loans for specific undertakings which will produce revenues, such as waterworks, street cars, etc., and (*b*) loans for public buildings and works necessary to the transaction of public business. Loans of the first class, guaranteed by the Imperial Government and supported by detailed specifications as to uses and earning capacity, would meet with a favorable reception abroad, especially if the proceeds are spent in purchase of materials for revenue-producing works. Loans of the second class should be floated in the domestic market if possible.

Perhaps a word may be said with respect to emergency loans. The devastated cities and villages have suddenly lost the major portion of their normal revenues from taxation. It will be necessary for the Imperial Government to aid these local governments. Direct gifts and subsidies will raise political controversies. Therefore loans will be better in such circumstances. In making these loans it could be stipulated that during the first two or three years the interest shall be paid out of the capital account, and that as soon as the restoration of normal life permits the redemption or amortization installments as well as interest shall be paid out of current revenues.

X. A Definite Financial Plan and Its Economic Basis

In order to give precision to the above principles I venture to suggest a somewhat concise scheme of financing the new street and park plan. In order to show that it rests upon sound principles, I preface it with a reference to the economic basis of such financing.

Can Tokyo afford to have the street and park plan necessary to assure safety to life and property in the future ? How can the cost of such a plan be met ?

Let us assume that the cost of the new street and park plan will be not less than Y.200,000,000. The value of the land to be taken for public purposes will be fixed by a commission of three men on the basis of values *after*, not *before* the fire.

Is there a sound economic basis in Tokyo for such a huge outlay ? How can it be met ?

1. The first fact to be noted is that the great fire destroyed at least Y.2,000,000,000 worth of property in Tokyo, to say nothing of lives. That is Y.20,000,000 a year for one hundred years. It is safe to assume from past experience that within another hundred years a disaster equally great or even greater will occur if proper precautions are not now taken against the danger. If Tokyo had had on September 1, 1923, a proper street and park plan it is conservative to say that at least Y.500,000,000 worth of property could have been saved, namely, an amount equal to twice the total cost of the proposed street plan.

2. The actual financial basis of the new street and park plan, however, is the *value of land in Tokyo*. As there was no scientific, full-value assessment we do not know the value of land in Tokyo before the earthquake and fire. However, a number of careful studies were made at the Institute for Municipal Research ; estimates of land values were prepared. These estimates ran from Y.1,300,000,000 to Y.1,880,000,000. Some students were inclined to place the value at Y.2,000,000,000.

As there has been no scientific assessment system in Tokyo, there is no way of knowing the amount of the *annual increase* of land values in Tokyo.

In New York city the value of the land in 1920 was $63,000,000 more than in 1919. In the city as a whole the value of the land doubles about every fifteen years. In other American cities of the first class land values double every twenty or twenty-five years.

In San Francisco the land values sank immediately after the earthquake and fire, but they were back at normal within ten years.

Tokyo is a great capital of a great nation. It is the center of commerce, industry, and finance. It is the home of more than 3,000,000 people, if we reckon the suburbs.

There is every reason to believe that the value of land in Tokyo will return within ten years to the figure at which it stood on September 1, 1923.

There is every reason to believe that within twenty years it will double. The rate of increase will itself increase. It is safe to estimate the value of land in Tokyo in 1950 at Y.5,000,000,000. *This does not include Greater Tokyo. If that is included, the amount will be enormously increased, as the area of Greater Tokyo is seven times that of the present city.*

The value of Tokyo land will increase more rapidly if provisions are made for safety to life and property. Otherwise industry and business will move elsewhere and land values may suffer.

Now the value of land is a measure of the economic power of the community, of its ability to pay for necessary public improvements.

It is safe to say, therefore, that within a period of 27 years the increase in the value of land in present Tokyo will be ten times the total cost of the street and park plan.

It is in insurance against disaster and in the increase of land values that we must find the economic basis for meeting the cost of the new street and park plan.

Definite Scheme for Financing Street Plan.

1. Purchase of land for streets and parks.

Y.200,000,000 to be paid for land taken.

Y.66,666,666 to be paid from Imperial Treasury on basis of principles set forth above.

Y.66,666,666 to be paid by the city of Tokyo as a whole.

Y.66,666,666 to be paid by the property owners benefitted.

The landowners are to be compensated by Imperial Government certificats bearing 6 per cent. interest for the whole amount of Y.200,000,000. The Imperial Government is thus to lend to the city of Tokyo and to the property owners benefitted enough money to meet their shares of the cost, including interest charges for five years. At the end of five years the city government and the property owners benefitted shall begin to pay the interest charges on their shares and small annual installments on the principal. These amortization installments shall increase slowly but steadily in such a way as to discharge the principal within a period of fifty years.

2. Compulsory widening of congested area streets without compensation to owners of lots.

Provide that no house shall be built on a street less than two ken wide, and that every house built on a street only two ken wide shall be set back from the street at least one half a ken. By this process streets will in fact be three ken wide.

To carry out this law, a commission of three men should be created to lay out the new streets and indicate where buildings can be erected. This court should consolidate remainders of land and lots too small for building purposes and sell the same at auction. The proceeds of such sales should be distributed among former owners on the basis of their old holdings.

This shall be done without any compensation to landlords in the name of public safety and public health.

Even in America, where private property is surrounded with close safeguards, the use of land for building purposes is strictly regulated in the interest of health and safety, and courts have declared such legislation is not confiscatory, but merely regulative.

By legislation of this character the old slums of Tokyo could be wiped out without spending one yen. This alone would be a revolution in the street plan of Tokyo.

3. Financing of public improvements other than streets.

Delay as long as possible all improvements which do not produce revenue.

Issue bonds for revenue-producing utilities. Make such bonds a first charge on the revenues of the utilities and back them by the guarantee of the Imperial Government. If necessary the Imperial Government should take over and manage the utilities until the bonds are paid off from earnings.

Make sewers revenue-producing by putting a charge on the people who use them. The cost of removing night soil is now great, and no doubt the sewers could be made to produce large revenues.

XI. Considerations of Prestige and Aesthetics

On this subject I have already submitted to you a memorandum, but I cannot conclude without referring to it once more. The drama of history is shifting from the Atlantic Ocean to the Pacific. Japan will play a great rôle in that drama, and Tokyo will be the seat of many impressive scenes. It is of the highest significance, therefore, that the capital of Japan should have distinction. A mean capital will lower the prestige and dignity of the nation in the councils of the Powers.

Now that distinction cannot be achieved by reproducing here the architecture of third-rate provincial American cities. Already there are too many Western monstrosities in Tokyo. The capital of Japan will have distinction only by expressing the artistic genius of the nation. Having seen with my own eyes the glories of the past, I shrink with dread from the thought that the spirit of the ancient beauty may be trampled to earth in the period of reconstruction. I know that the practical requirements of commercial and industrial architecture are incompatible with some aspects of the old architecture. I do not insist upon the impossible, but I do venture to make the following recommendations: (1) that if possible a touch of Japanese style be given to all public buildings; (2) that western monuments of stone and bronze in western style be ruthlessly discarded in favor of monuments in pure Japanese style; and (3) that all parks and public gardens be done in pure Japanese style.

Many leading American cities have established art commissions to pass upon the designs of all public monuments and buildings. These commissions have been highly successful in elevating public taste. They have made many mistakes, for their members are mortal, but they have awakened public interest in æthetics and they have prevented the erection of thousands of architectural monstrosities. I therefore renew my earlier recommendation that a permanent art commission be appointed for the capital. To allay the fears of hard-minded practical men, I may add that beauty and distinction in Tokyo will "pay," for they will draw thousands of tourists from all quarters of the world. No one will want to visit Tokyo if it is a mere reproduction of a modern American or European commercial town. When the Japanese spirit has fully recovered from the disaster the Japanese themselves will be ashamed if great efforts are not now made to provide for beauty and distinction in their national capital.

In conclusion I take pleasure in presenting to the Japanese Government through your good offices a collection of books, papers, maps, and documents placed in my hands for transmission by the Plan of New York and Its Environs, the National Institute for Public Administration (Bureau of Municipal Research), and the American Water Works Association.

Biggest Dam in Japan

PRELIMINARY work has been started on the Otaki Dam on the Kiso river, Japan, which will be the biggest dam in Japan and will be one of the highest dams in the world,. The dam being built for the Daido Electric Power Co., and will be two and one-half times the size of the Kiso No. 6 dam completed last December out of the proceeds of the $15,000,000 Daido bond issue which was offered in the United States by a banking syndicate early last summer, headed by Dillon, Read & Co.

The new Otaki dam, which will be at the headwaters of the Kiso river, will be 300 ft. in height, will contain 375,000 cubic yards of concrete and will have a storage capacity of 73,500 acre-feet. Location of this new gigantic dam at the head of the Kiso River, on which the Daido Co. already has 8 other hydro-electric developments now in operation with a total capacity of 154,800 k.w., will greatly increase the water supply available for all other plants on the river.

It is expected that the annual output of the entire group of Kiso river plants will thereby be increased by 30 per cent. Work has also begun on two other plants on the Kiso river. Thus, upon completion of these plants, the Daido Co. will have 11 hydro-electric developments on the Kiso river. This section of the Kiso is about equi-distant between Tokyo and Yokohama to the north, and Osaka to the south. Nagoya lies near the mouth of the Kiso.

The company now has contracts in hand for sale of power, which call for delivery of approximately the following kilowatt hours in the future:

Year ended November 30, 1925, 1,101,300,000 k.w.; 1926, 1,377,100,000 k.w.; 1927, 1,589,100,000 k.w.; 1928, 1,716,200,000 k.w.; 1929, 1,821,800,000 k.w.

To meet the demands of the Tokyo districts the Daido Co. has recently made new contracts with the Tokyo Electric Co. to increase its supply to that company to 50,000 k.w. by November 1926. Daido has also just received a franchise to build a 154,000 volt transmission line to sell industrial power to Tokyo and Yokohama.

Replotting a Great City

A Drastic and Sweeping Readjustment of Land Values, on which the Whole Reconstruction Scheme of Tokyo is Based

PROUD as its position was before the earthquake, Tokyo, the fourth city of the world, was little more than an over-grown village in which magnificent stone office and bank buildings stood side by side with insignificant wooden shops, fronting on smelly tidewater creeks or canals, or streets too narrow for two Fords to pass in. The wooden buildings of bamboo and mud walls were as highly inflammable as paper, and helped to destroy their modern neighbors in the fire, while the alleyways which served as roads in the most populous down-town districts helped to roll up the hideous toll of deaths of those who could not escape from obstructed streets to places of safety.

Time after time since the Tokugawa's made it their capital, Tokyo has burnt to the ground and built up again. In the twelve years before the great fire, two disastrous fires wiped out Kanda and Asakusa, both important business quarters. Yet with these examples of the dangers of allowing wooden buildings in business districts, and the inconveniences of narrow streets ever before them, the authorities were unable to reform the building laws, or to untangle the confusion of narrow roads in the down town districts. Superficially, Tokyo was rapidly being modernized during the past fifteen years, attested to by the many beautiful modern office buildings in all parts of the city, the tramways, automobiles and other improvements. The streets and canals, however, remained the same, except in some of the residential districts where street improvements were being carried out on an entirely inadequate Municipal appropriation. In 1922, certain important business centres, notably Marunouchi in Kojimachi Ward, and Kanda Ward, were selected as the nuclei of several fireproof districts, but before the earthquake only a few buildings had been erected under the regulations then issued.

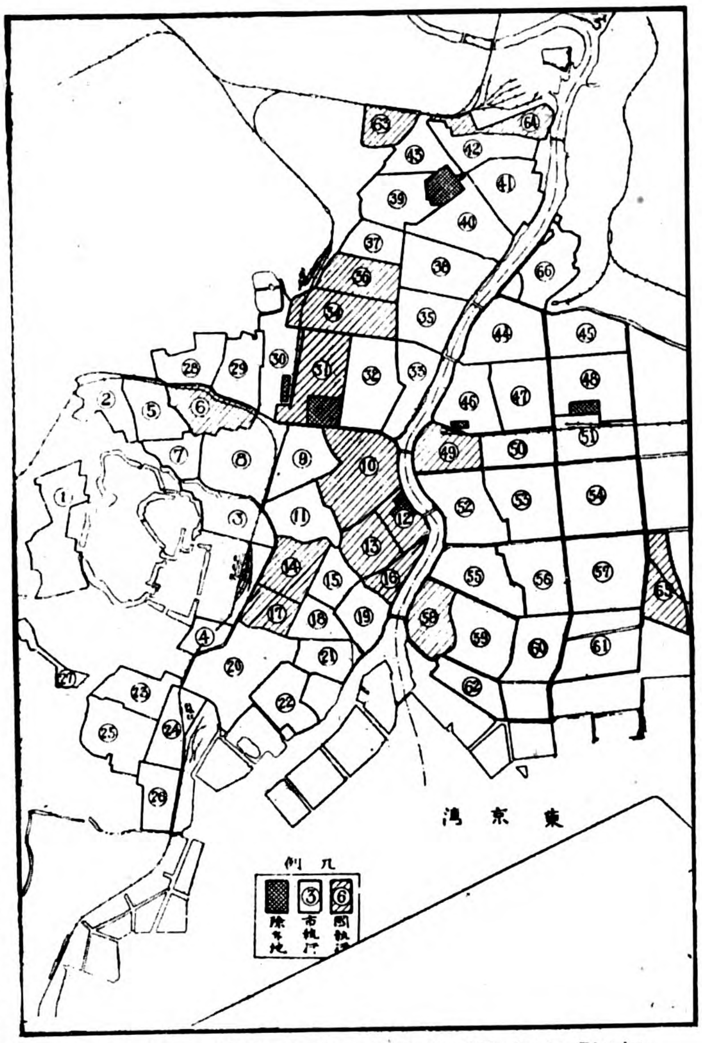
One thing was clear, the task of making Tokyo a modern city worthy of being the capital of the nation, was hopelessly beyond the existing powers of the municipal authorities. The assistance of the national government was essential to effect any reforms of administration and obtain the necessary loans to finance the improvements. This was difficult. Land in Nihonbashi and Kyobashi Wards was valued at the excessive price of 30 to 40 yen a square foot, far too expensive for the Municipality to contemplate any extensive road building program compatible with the needs of these important business districts. On the other hand, landowners were most reluctant to decrease the size of their properties, especially when buildings had to be altered to make room for roads.

The modernization of Tokyo before the earthquake had reached a stage where neither the municipality nor the citizens could move to alter the situation without the aid of the national government.

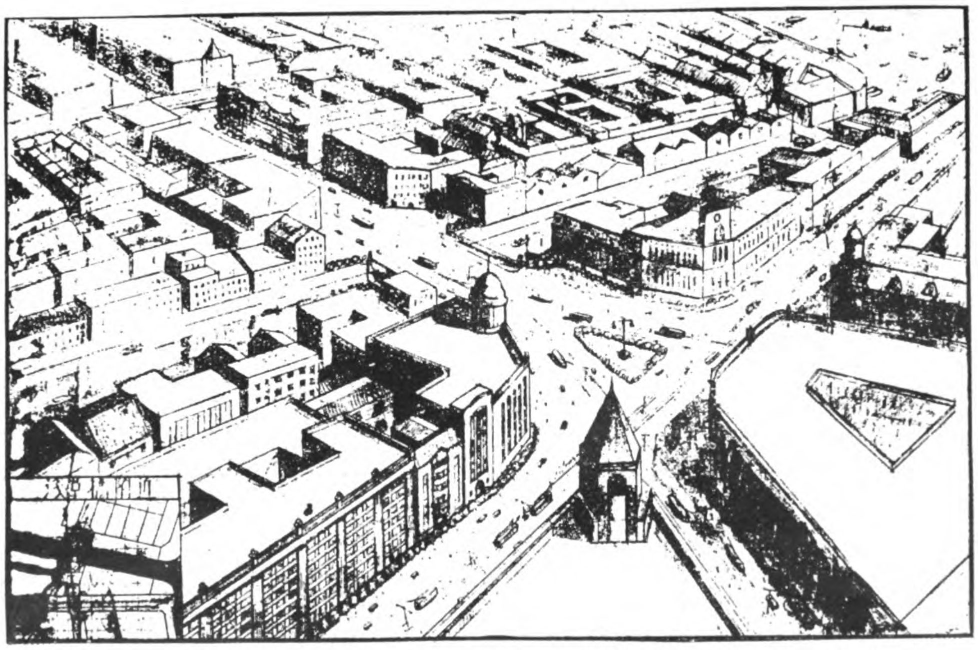
At the end of 1924, before any readjustment of land-plots had been carried out, there were about 570 miles of streets in Tokyo. Of this total, 45 miles were 72-ft. or more wide; 67.5 miles, 48 to 72-ft. wide; 57.5 miles, 36 to 48-ft. wide; 70 miles, 24 to 36-ft. wide; 110 miles, 18 to 24-ft. wide; 130 miles, 12 to 18-ft. wide, and 87 miles were less than 12-ft. wide. More than half the total, or 327 miles, were less than 18-ft. wide. Automobiles are not allowed to use streets less than 15-ft. wide. More than half the city was so badly laid out that any attempt to better conditions became a problem of the greatest magnitude.

Then the earthquake and fire destroyed half the city, and the opportunity for reform which decades of legislation could not have effected without prohibitive cost, was ready to be siezed by far-sighted, public-spirited officials and financiers.

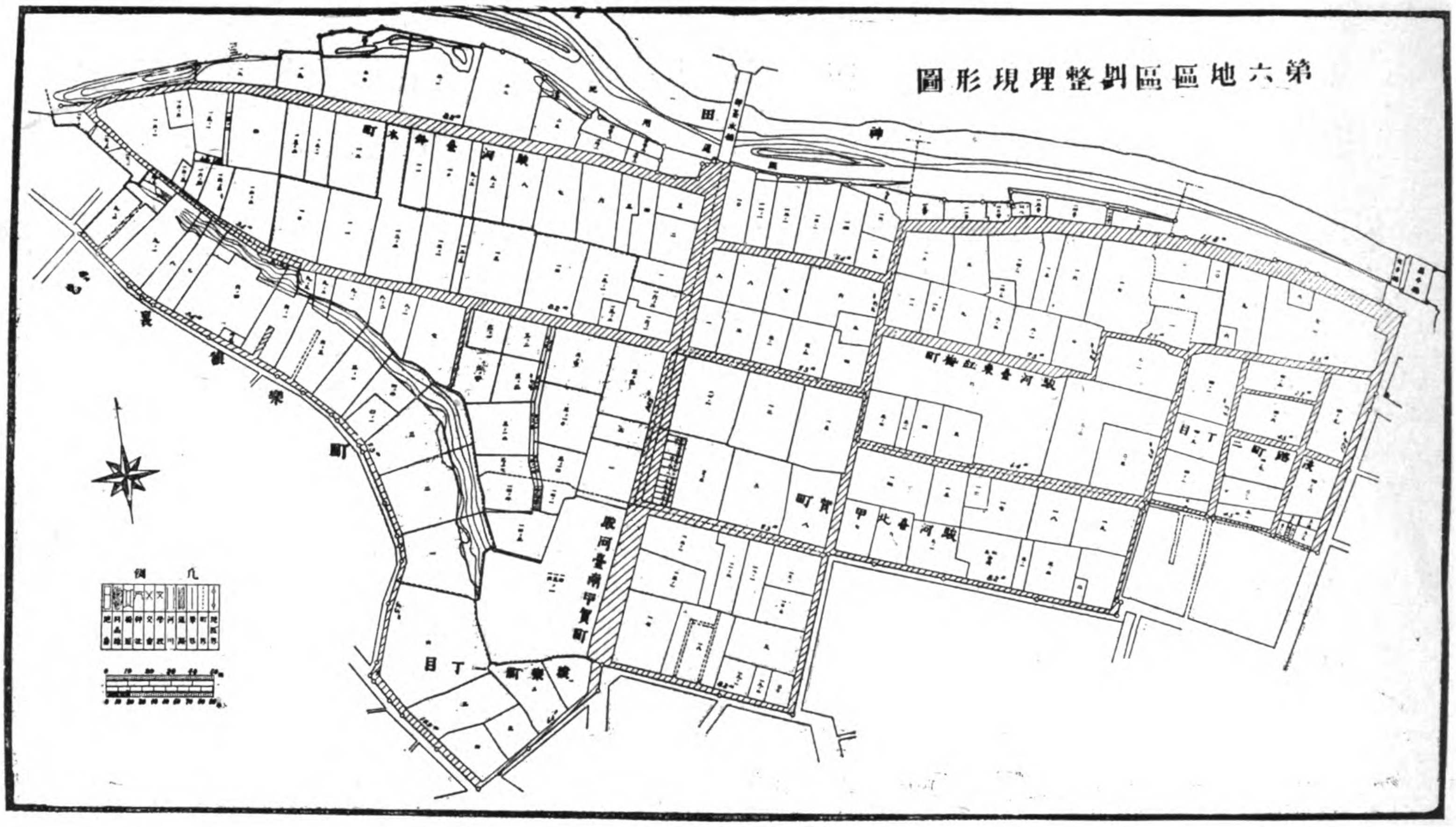
Reconstruction, not rebuilding, was the principle on which they based their plans for the new Tokyo that was to rise from the penitential ashes of the old. No longer was the capital to suffer from periodic conflagrations

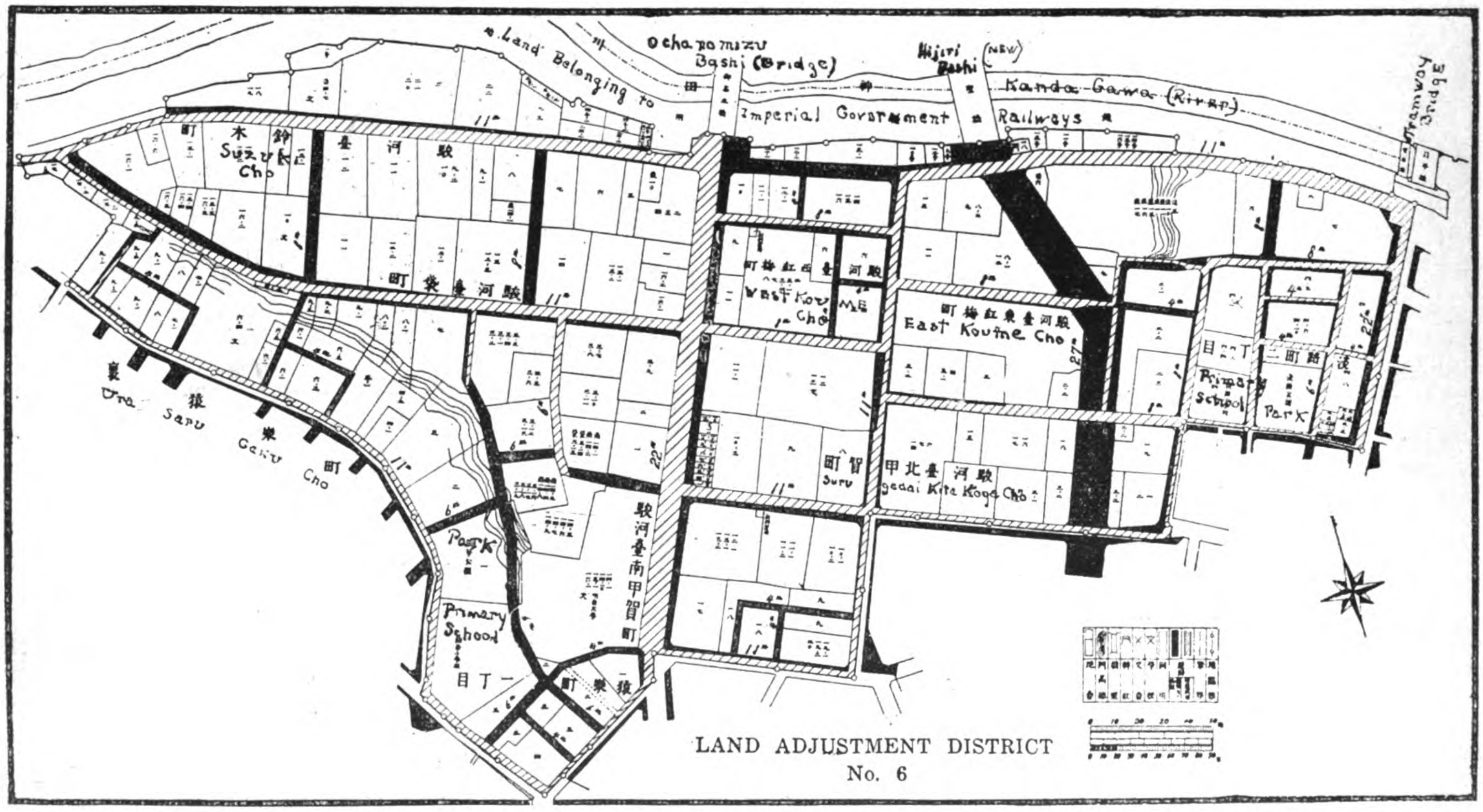


The burned area of Tokyo has been divided in 69 Replotting Districts as shown in the Map to make room for New Streets, Parks and Other Public Improvements. This Work must be finished before the new program can be carried out and permanent building construction Undertaken



A Suggestion as to the Future Appearance of one of Tokyo's Districts after the Streets are Widened and Permanent Buildings Erected.

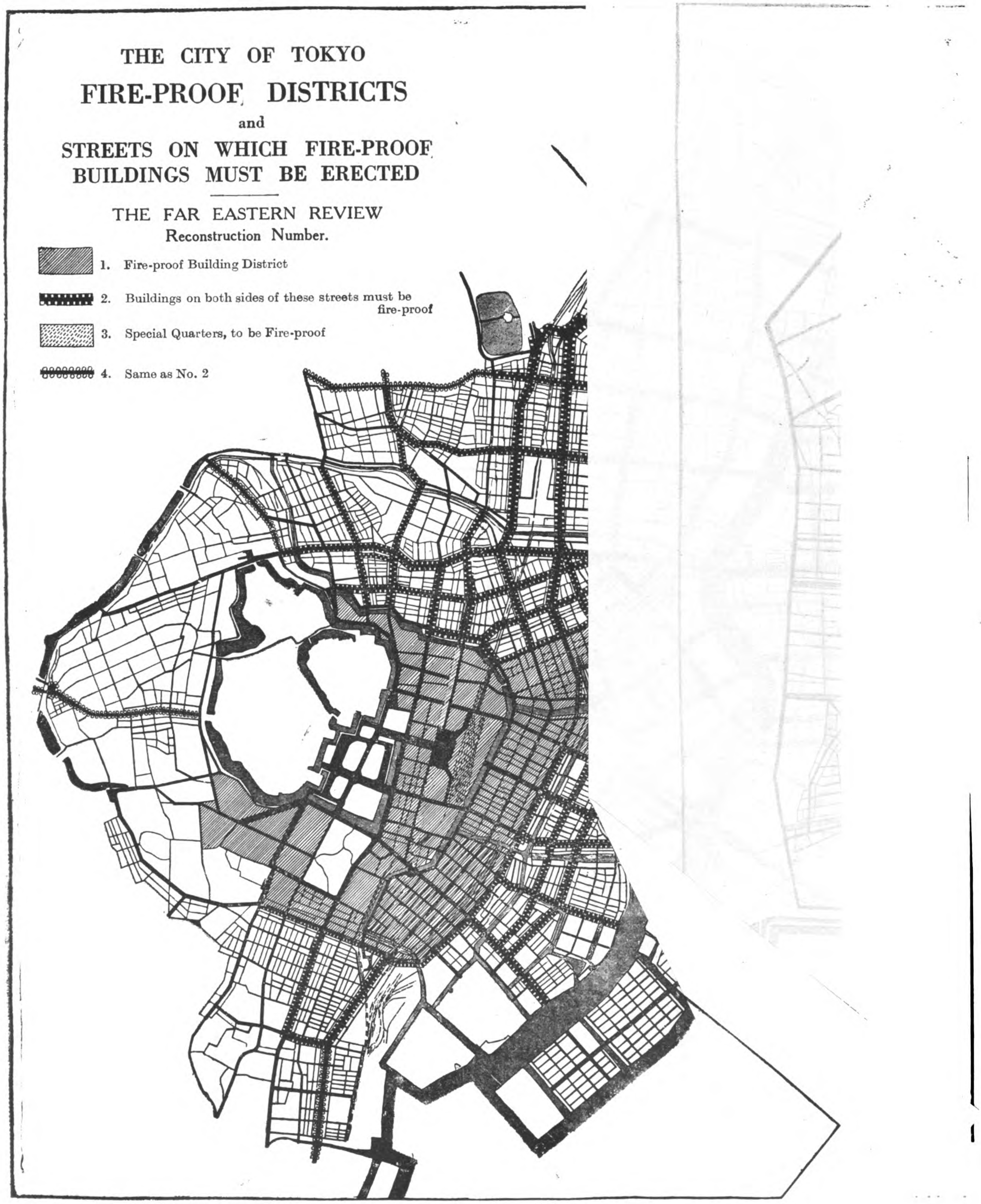


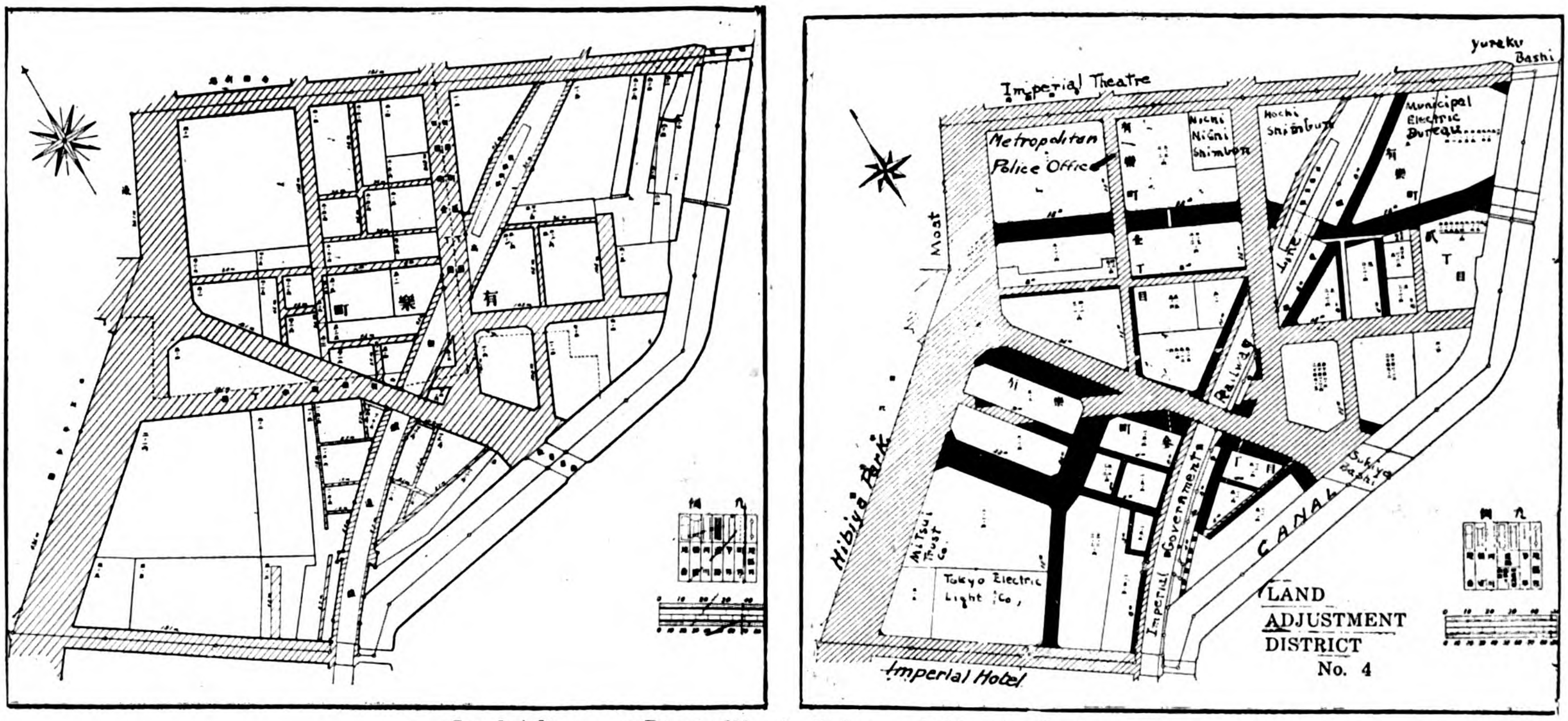


Showing Land Readjustment and Replotting in District No. 6, before and after, Heavy Black Lines Indicate New Streets and Widening of Old Ones. This Map also shows how the New Primary Schools are being erected next to Small Parks

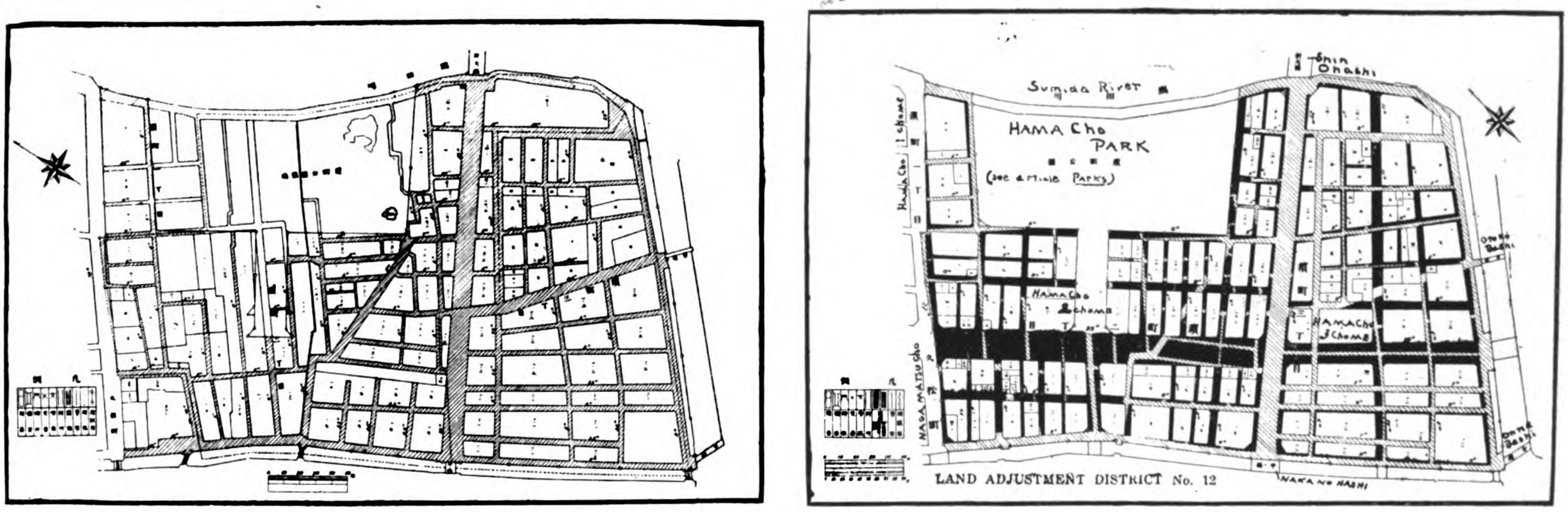
which cause endless misery and confusion. The new city should be fire-proof, at least it was planned that its most important districts would never again be laid waste by fires originating in other quarters.

It was not many days after the fire, before property owners began to clear away the debris from their land and to knock together some sort of a temporary structure for their families and business. An Imperial Edict was then promulgated to stop *rebuilding* by prohibiting the construction of permanent structures in the burned district until the plans for *reconstruction* could be worked out. In December, 1923, under the title of the City Planning Law, another Edict was promulgated which determined the fundamental law of reconstruction, and in March, 1924, the Special Town Planning Committee's plans for reconstruction in Tokyo and Yokohama were approved by the Cabinet. These plans are based on the German, (Mayor Addicks system) of town building.

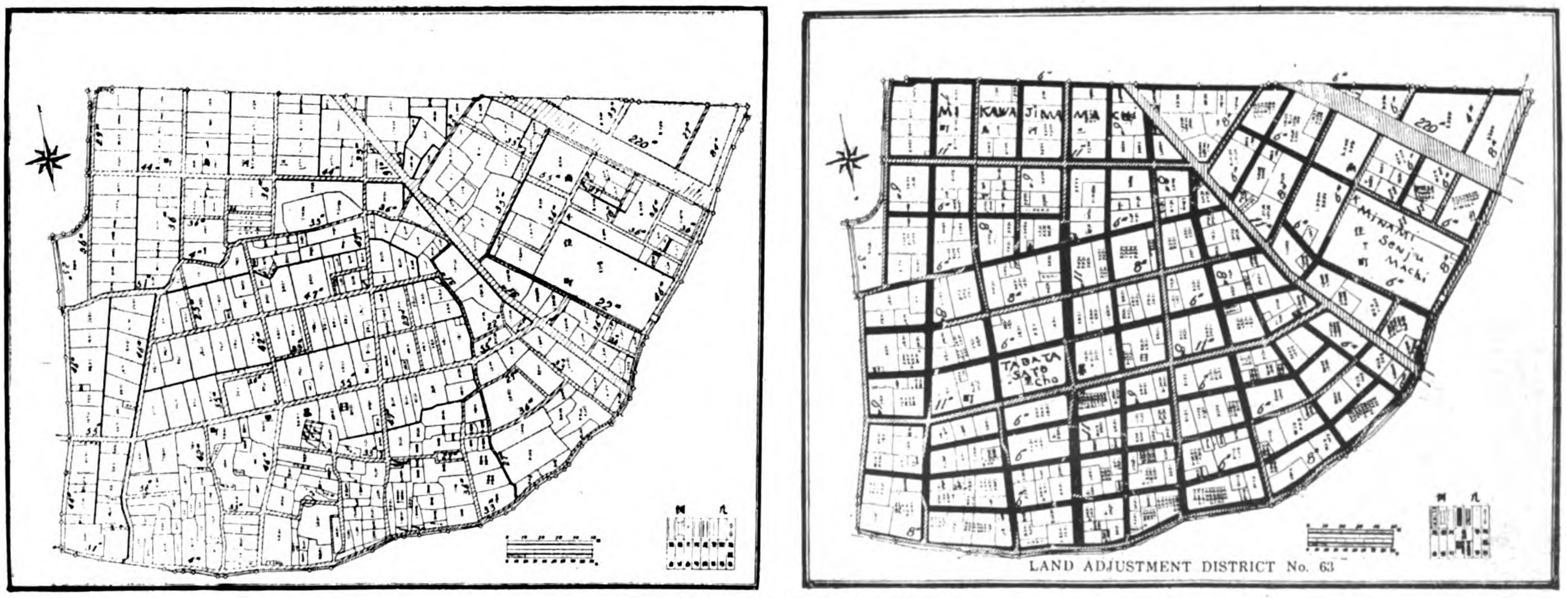

THE CITY OF TOKYO
FIRE-PROOF DISTRICTS
and
STREETS ON WHICH FIRE-PROOF BUILDINGS MUST BE ERECTED
THE FAR EASTERN REVIEW
Reconstruction Number.
1. Fire-proof Building District
2. Buildings on both sides of these streets must be fire-proof
3. Special Quarters, to be Fire-proof
4. Same as No. 2



Land Adjustment District No. 4: Before and After Replotting



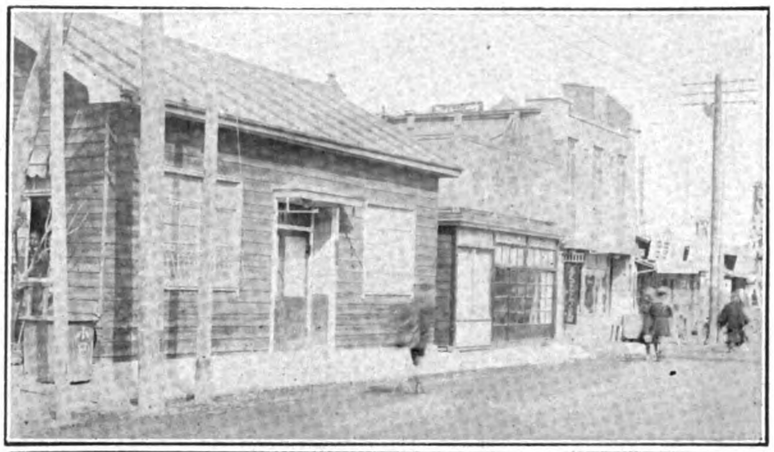
Land Adjustment District No. 12

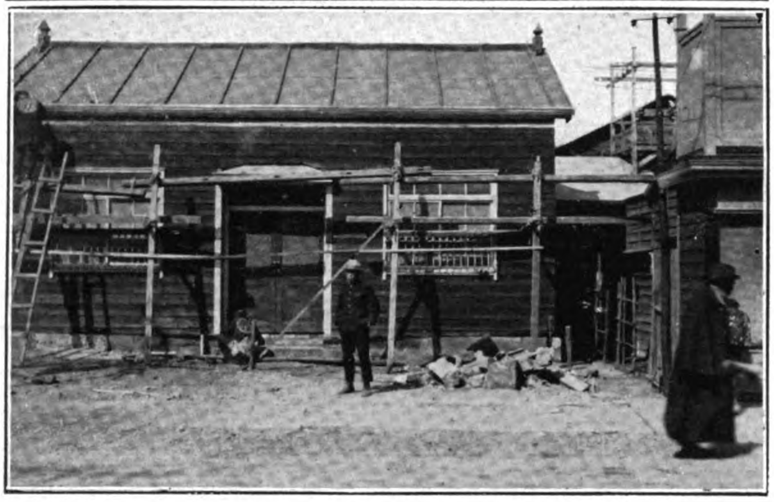


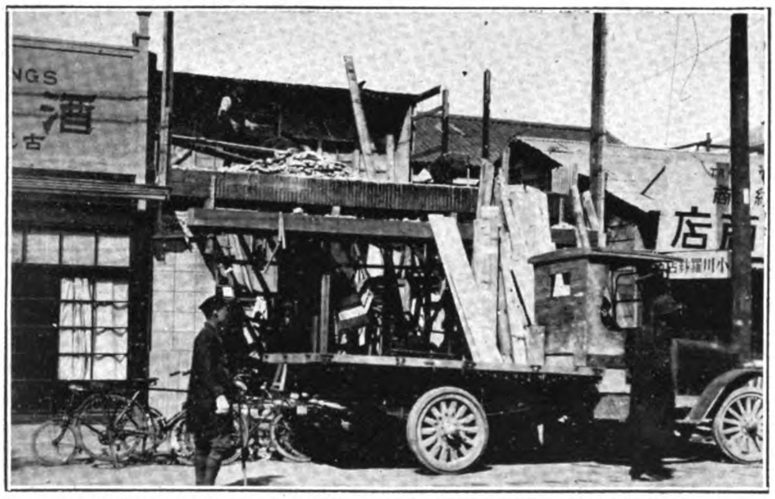
Land Adjustment District No. 63

TYPICAL REPLOTTING OF TOKYO'S STREETS

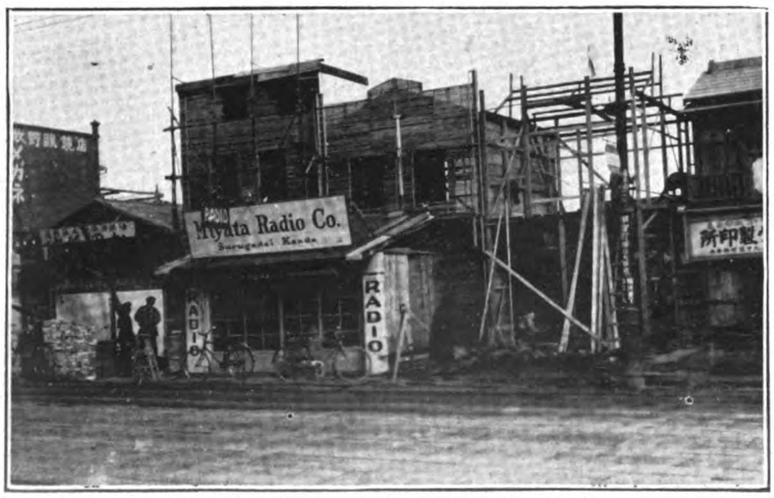
Plans Show Districts Before and After Replotting. Heavy Black Lines Indicate New Streets and Avenues and Widening of Old Ones



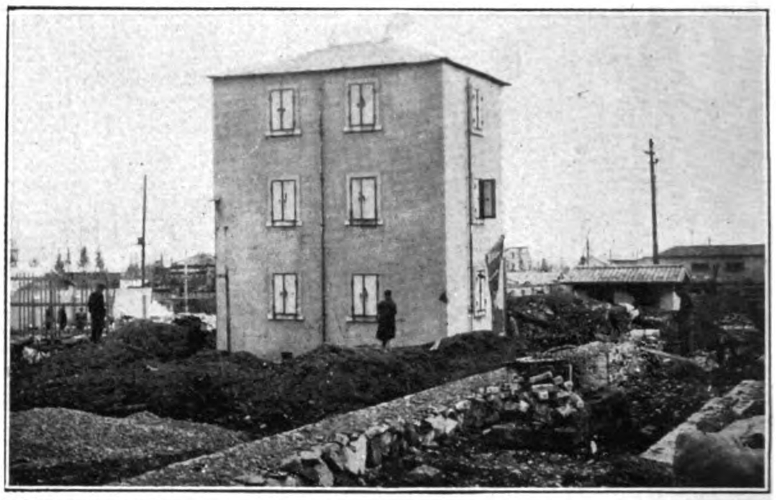




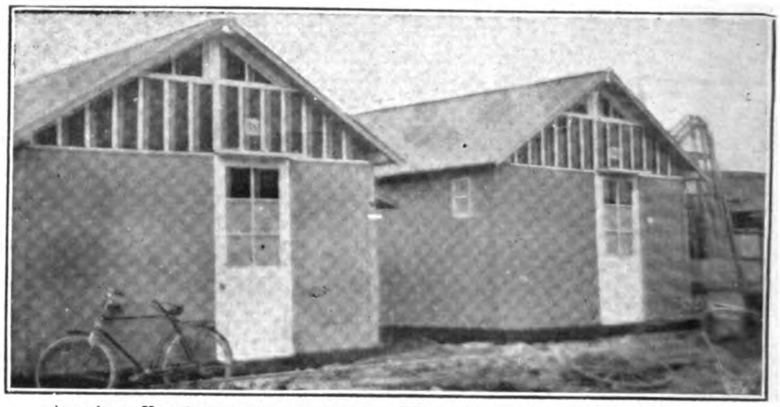
Typical Street in 6th District under Process of Replotting: Top, shows Street before Realignment. Centre shows light Wooden corner Building moved back, Bottom shows the demolition of the three storied Stucco front building which could not be moved



Main Street in 6th District to be widened to 22 meters and paved. The Radio Shop shows how easily Some People are able to meet Readjustment problems



Moving a Storehouse in the 6th District to New Site. This Structure withstood the Quake and Fire



American Knock Down House Costing Y600, Erected by the Reconstruction Bureau as temporary Barracks in 6th District

Type of Shop Building moved in 6th District to make Room for Street Widening

The Reconstruction plans provide for radical changes in drainage and sewer systems, water supply, tramway system, sub-surface structures, roads and land plotting. The sums required for complete changes are so enormous that it is questioned if they can ever be carried out. The appropriations to cover the period 1923-1929, however, are based on investigations made by the financial leaders of the nation who have ascertained definitely the burden the people can carry in order to rehabilitate the capital city. The authorities are determined that nothing shall stand in the way of making Tokyo one of the finest cities in the world, and the work to be accomplished before the end of 1929 by no means represents the total which undismayed determination will eventually achieve. Plans are already being drawn which will extend the town building work in Tokyo to 1945.

The most urgent work in Tokyo is the construction of a new street system which will straighten out the rambling alleyways, be wide enough for automobile traffic and afford space ample to stop the spread of fires. To do this, all roads now less than 18-ft. wide in the city limits should be eliminated. The law provides that one-tenth of any plot of land required for road work may be condemned for public use without compensation to the owners. This was a revolutionary measure for Japan and not without its opponents amongst the property owners, but as the value of their holdings will eventually increase and cover these losses, it has not been difficult to persuade them to conform to the provisions of the law.

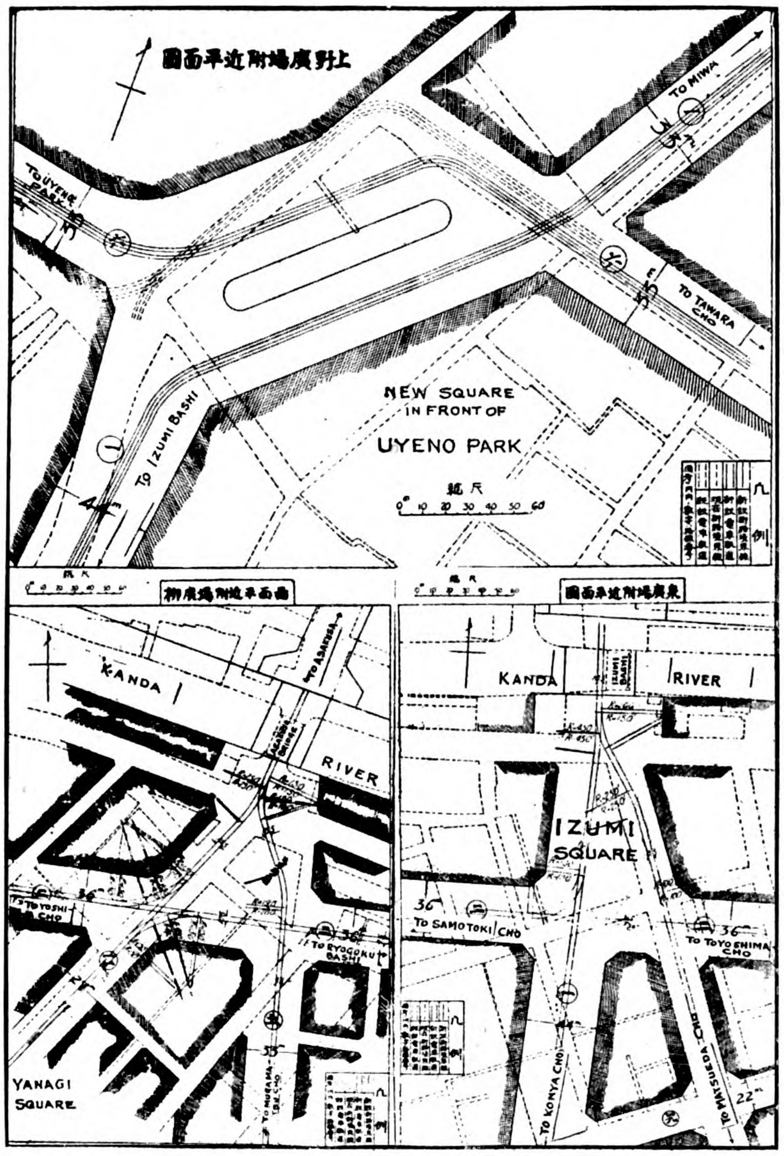
The Road Section of the reconstruction bureau has prepared a map for its guidance showing every house in Tokyo and the location of all gas, sewer, and water mains, high tension wiring, canals, roads, etc. The name of every land owner and lessor of land is separately registered, together with information as to the value of their holdings and details concerning the rights of occupancy acquired by owners before the fire. These rights of occupancy are the great stumbling block in the way of a speedy adjustment of land districts. They are based on a legal fiction not supported by law but by custom, that a person who occupied land and carried on business or had his dwelling on it before the earthquake, should not be deprived of the opportunity to use that site again because of reverses forced on him by the disaster. Such rights are tenaciously maintained even though the land has not been occupied since the earthquake, and there is no intention or ability of ever doing so again.

To construct the new main arteries of traffic in Tokyo some 680,000 *tsubo* of land are needed. Most of this is land on which rights have accrued. For the narrower streets another 620,000 *tsubo* is required, a total of 1,300,000 *tsubo*; in addition to such land as is required for parks and canal construction.

Some idea of the magnitude of the task confronting the Reconstruction Bureau can be understood from the fact that 680,000 *tsubo* means, in the burned districts, land on which 150,000 people lived. The total of 1,300,000 *tsubo* therefore displaces 300,000 people, who must find other homes. In some of the burned districts more than 50,000 *tsubo* must be purchased, and with land at Y. 1,000 a *tsubo* before the earthquake, this means financial difficulties.

The burned area has been divided into 66 so-called Land Adjustment districts in which great changes in the size and form of lots must be carried out to conform to the new road building plans. The national government will bear the full costs of adjusting properties in fifteen districts, and the reconstruction bureau will carry out the work in the other 51 districts. The national government will grant a subsidy up to two-thirds of the costs, and lend the balance on long term loans and low interest charges to the city, which will assume the responsibity of carrying out the program.

Surveys of all districts have been completed, and in sixteen, the negotiations with landowners, lessors, and "right" holders are finished. The surveys revealed many strange conditions of ownership which were difficult to



Laying Out New Squares for Tokyo; Top shows Outline of the New Plaza in front of Uyeno Park, Below two New Squares in Kanda-ku. The Old Streets and Building lots are shown by dotted lines, the New Squares and Street alignment are the Shaded Lines

Nishi Horidome Canal; Filled in and the Reclaimed Land used for Compensating Owners whose Properties have been Condemned in other Sections

adjust. To assist the authorities in a task which at times seemed hopeless, a committee composed of 16 to 20 members was organized by law in each district, half being government officials (the reconstruction bureau and the municipality), and half land-owners, lessors and "right" holders. These committees first fix the land values, then trace the new streets and proceed to re-plot the entire district. Owners of land, in so far as it is possible, are assured of locations in the new plots similar to those they own. That is to say, the owner of a corner plot will have a corner in the corresponding new plot, and so on. All land in excess of 10 per cent. condemned for street improvement, is paid for at the values determined by the committee. It often happens that the readjustment wipes out entire lots, and in such cases the owner is compensated with a similar lot in some other locality. To provide the reconstruction bureau with land which may be used for this exchange of property, the Nishi Horidome Canal in Nihonbashi Ward where land has a value of Y.1,000 a *tsubo* (about 28 yen a sq. ft.), has been filled in. Owners not satisfied with compensation offered for their holdings in other districts, may be required to accept lots in this newly reclaimed area.

Lessors and "rights" holders who are transferred from plot to plot, are granted the same rights in the new location that they held in the old, and in case it has not the same value because the locality is not so desirable the loss is made up by a cash payment. Often tenants and owners can not agree on the value of their respective rights and the work of the committees is held up while they haggle over details. In such cases it has been found convenient to transfer both the landowner and the lessor to the new location and let them fight it out.

In connection with Land Adjustment scheme efforts, are being made to zone the city into distinct residential, industrial and business districts and although plans have been adopted it is feared that many difficulties will be encountered in carrying them through.

Besides Tokyo, the reconstruction bureau has under its jurisdiction eighty other cities, towns and villages. The zoning system is to be applied to Tokyo, Yokohama and 36 of these other villages and towns. In residential districts, no licenses will be granted in future for construction of factories employing more than 15 persons, or using more than 2 motors or any boilers; for garages housing more than 5 automobiles; theatres, cinemas, and other amusement places; crematories, slaughter houses, garbage disposal places, or other objectionable structures. In business districts, buildings which obstruct traffic; factories employing more than 50 persons, or using more than 10 motors; garbage disposal places; and other objectionable structures will not be permitted. In industrial districts, establishments manufacturing articles detrimental to the health of the community will not be permitted; these are to be located in a special district well outside the city. Along the banks of the Sumida River at its mouth, a special warehouse district is to be created.

The residence districts cover the high lands in the north part of the city, from Uyeno to Asukayama, Oji, and in the south part from Meguro to Takanawa. The business district covers practically all Asakusa, Shitaya, Kanda, Nihonbashi, Kyobashi, Kojimachi, and half of Shiba Wards. In the residential and business zones, along both sides of all main roads, special business districts may be built. The industrial zones are located east of the Sumida River extending to the Arakawa, and south of Shinagawa to Osaki (on the way to Yokohama), and in other parts of the city where the bay or canals are convenient for transportation.

In the business zones, notably in Kojimachi Ward (where Marunouchi is fast becoming the business centre of the city), and in Kanda, fire-proof districts are to be constructed. From the new Diet buildings in Nagata Cho in Kojimachi Ku, to the Ginza, and along that street to Iwamura Cho in Kyobashi Ku, and inside this line to the Inner Moat around the Palace, the entire district is limited to fire-proof and earthquake proof buildings. In the other parts of Kanda, Kojimachi, Kyobasji, Honho, Fukagawa, Asakusa and Shitaya, fire-proof buildings must be built within 90-ft. from main streets. It is expected that these measures will make it possible to build up new Tokyo so that fires will no longer be able to spread from district to district without a chance to stop them at wide streets.

Actual work of moving houses to make way for street construction has been commenced in Districts 4-6-12-16-42-49 and 64. In the sixth district more than 444 houses have been removed, of which 301 have either been completely moved away or torn down. The cost of moving these houses, Y.348,000, was borne by the Bureau, and a total of Y.189,400 was paid in compensation to owners whose land was condemned in excess of the statutory limit of 10 per cent. The actual area of land which the Bureau had to buy in this district, which is largely in the back streets of Kanda between Ochanomizu Bridge and the main car line between Jinbo Cho and Oshima Cho, was 947 *tsubo*, which the district committee valued it at Y.200 a *tsubo*. Street work in this district will cost Y.575,735. A glance at the maps of this district before and after land adjustment will show what has been done.

One of the most important districts to be adjusted is the fourth, which lies in Kojimachi Ward, near Hibiya Park, covering land up to the Imperial Hotel, on the South, and the Imperial Theatre on the North; and East to West from the Outer Moat to the Canal running from Yuraku Bashi to Sukiya Bashi. In this district alone, the sites of more than 500 houses are affected, and 4,500 *tsubo* must be bought. Work on this district has been started and when it completed this quarter of the city, which tourists see more often than any other, be as modern as any city in the world.

These changes in Tokyo have not yet been applied to sections of the city untouched by the fire. In time, however changes will be made in them also while the decision not to build more roads less than 18-ft. wide will materially better land plot conditions in the then sections.

The Budget appropriations for Land Adjustment in Tokyo and Yokohama are:

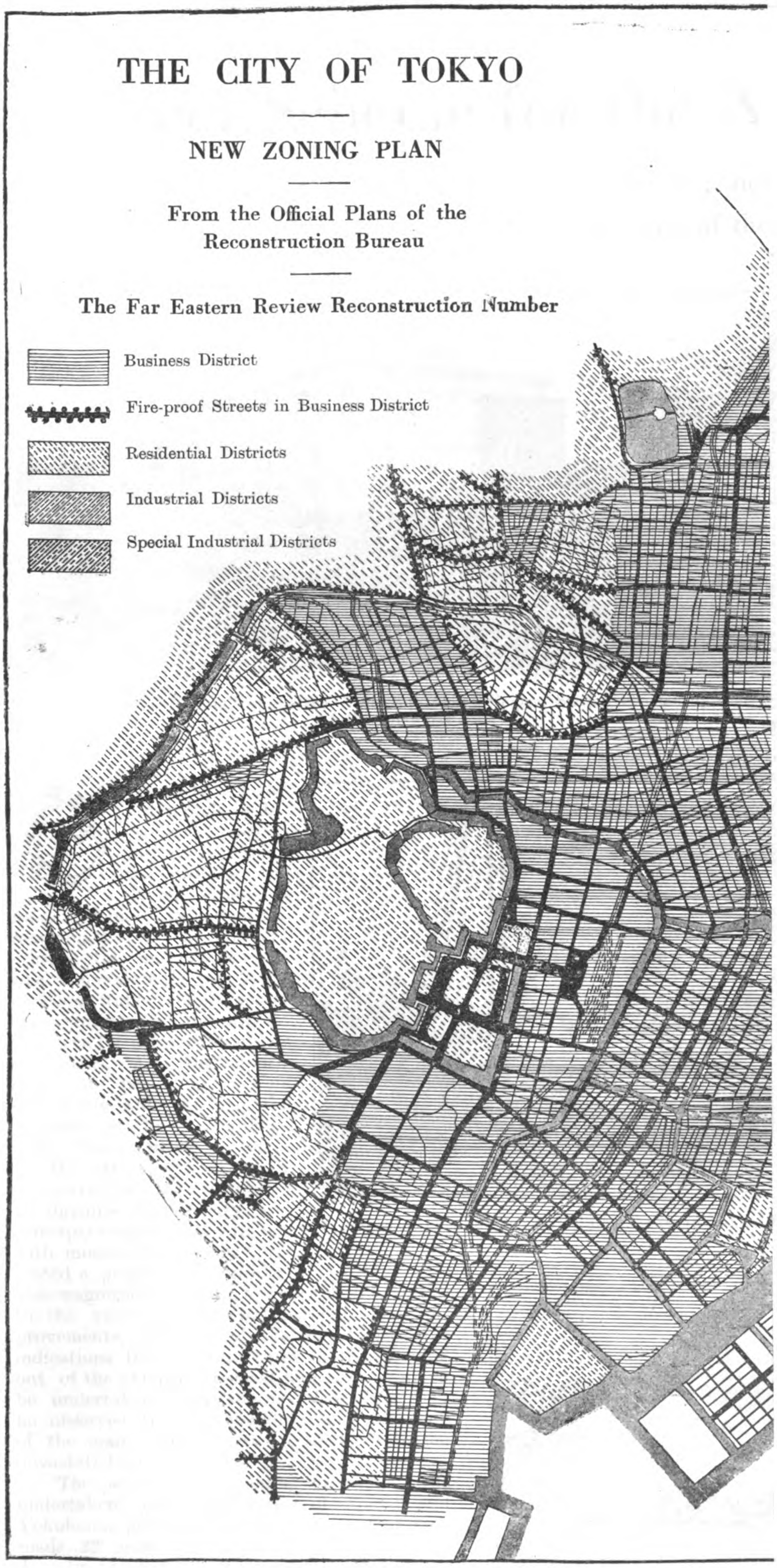
	For construction in districts under jurisdiction of National Government	Ditto Municipal Jurisdiction Subsidy, 2/3rds of costs	Loan from National Government
Tokyo	Y.8,750,000	Y.22,634,000	Y.11,317,000
Yokohama ...	2,561,000	2,786,000	1,393,000
Total ...	Y.11,311,000	Y.25,420,000	Y.12,710,000

The total expenditure authorized in Tokyo is Y.49,441,000; in Yokohama, Y.6,740,000; making the grand total for adjustment of land plots, Y.49,441,000. Besides this about Y.80,000,000 will be spent in building roads which are necessitated by the land adjustment programs in the two cities.

In Yokohama, the land adjustment work will extend over 12 districts, five of which will be under the jurisdiction of the reconstruction bureau, and seven under that of the Municipality. Landowners who must submit to a slicing up of their plots will be compensated by permission to remove to properties of persons killed in the earthquake and fire whose heirs have not yet claimed possession.

The zoning system and the fire-proof district plans also apply to Yokohama, but the details have not yet been satisfactorily worked out.

Springfield Road Roller, used in Street Construction Work in Tokyo

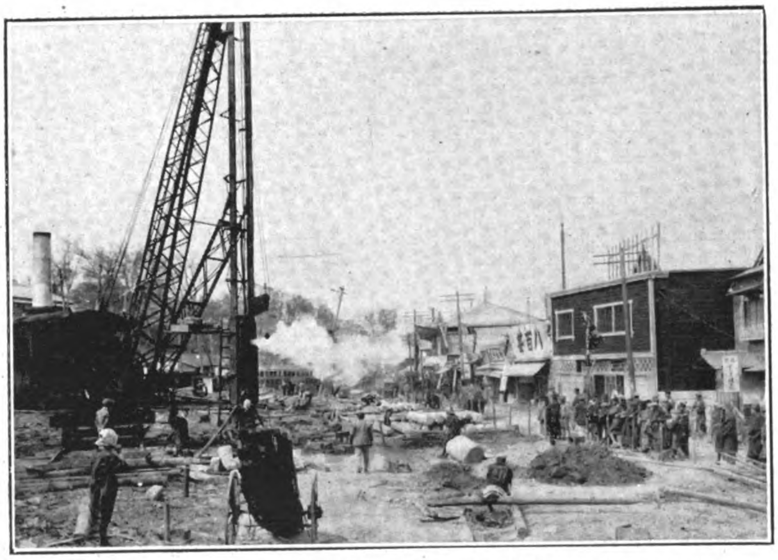

THE CITY OF TOKYO
NEW ZONING PLAN
From the Official Plans of the Reconstruction Bureau
The Far Eastern Review Reconstruction Number
Business District
Fire-proof Streets in Business District
Residential Districts
Industrial Districts
Special Industrial Districts

Street Scheme for the New Metropolis

A Splendid System of New Thoroughfares, Avenues and Cross Streets Will Replace the Narrow Winding Alleyways of the Old City

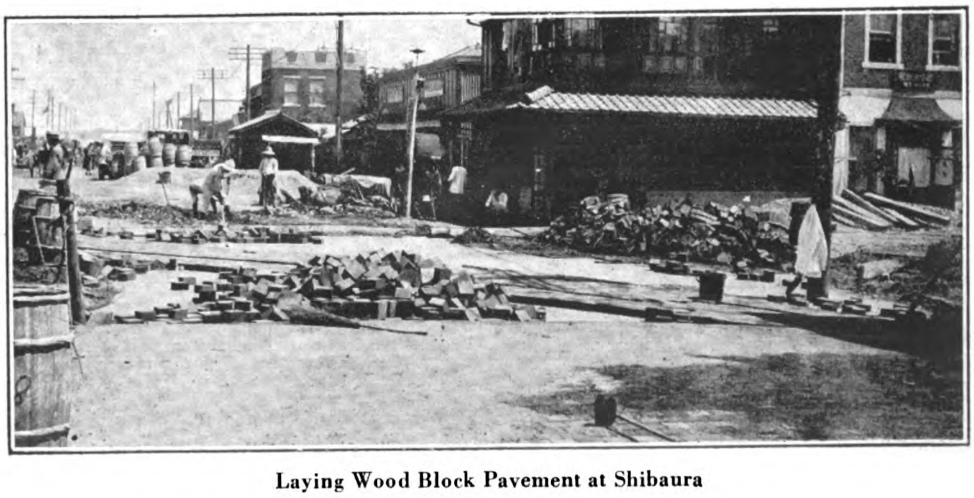
New Avenue leading from Palace Grounds to Tokyo Central Station Created by Filling in Moat

THE advent of the automobile in Japan, and especially its increasing use within the larger cities, is more and more displaying the inadequacy of the present crushed stone and gravel roads to accommodate the rapidly increasing traffic conditions of this country, and the imperative need for permanent streets and roads. Also, the importance of providing streets sufficiently wide to stop the advance of fires, combined with the radical changes in the street system made necessary by the rebuilding of Japan's capital city and principal seaport in accordance with modern ideas, has presented a problem of considerable magnitude. Japan, however, is fully awake to the vital necessity for making these improvements, and one of the most noticeable indications to-day of progress in the carrying out of the extensive reconstruction program to be undertaken during the next five years may be observed in the rebuilding and repairing of the main traffic arteries located within the devastated area.



One of the Many Street Building Scenes in Tokyo: Uyeno Park

The present road building program to be undertaken within the cities of Tokyo and Yokohama provides that the work of improving roads 22 metres and above in width will be done by the National Government, while roads between 11 and 22 metres will be rebuilt by the respective Municipal Road Bureaux having jurisdiction over this class of work within the cities in which the improvements are to be made. In addition, the Electric Bureau will construct five roads within the Tokyo district in connection with the program for the extension of the present surface car system operated by that bureau.



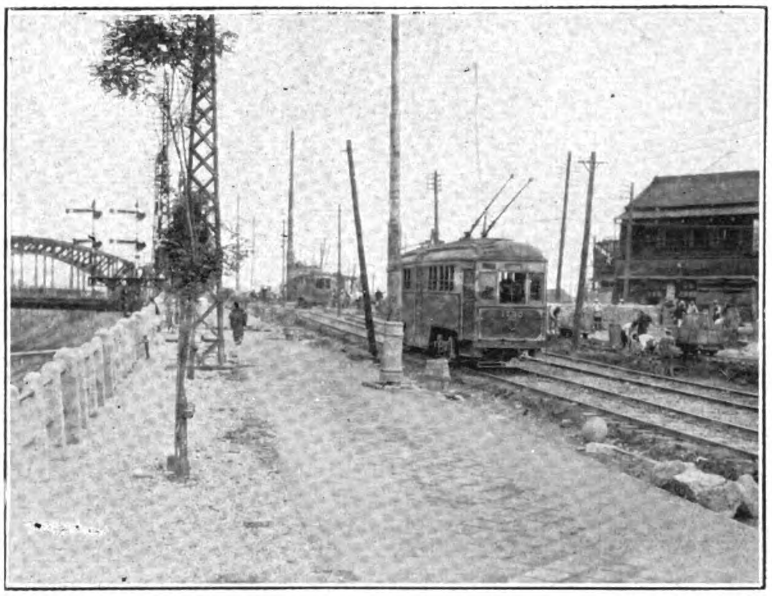
Laying Wood Block Pavement at Shibaura

In July 1923 there were 2,780,000 *tsubo* of roads in Tokyo, or 11.6 per cent., as compared with the total area of the city, amounting to 23,970,000 *tsubo*. The proposed road Building program approved by the Reconstruction Bureau will, upon completion, bring this percentage up to 26, which, compared with that of the principal cities of the world, is as follows: Paris 25; Berlin 26; Philadelphia 29; Vienna and New York 35; and Washington 40.

The total road building program for the city of Tokyo alone consists of a combined length of new roads amounting to 505,373 metres and comprises an area of 2,595,000 *tsubo*. Details of this road construction program are as follows:

	Length *Metres*	Area *Tsubo*
Main Avenues: To be built by the National Government ...	118,534	973,000
Secondary Roads: To be built by the Municipality	138,621	534,000
Secondary Roads: To be built as part of the Land Adjustment scheme (both by the National Government and the Municipality)	248,218	1,088,000
Total ...	505,373	2,595,000

The following schedule outlines the extent of the work to be undertaken by the Reconstruction Bureau in providing Tokyo with new streets and roads, and indicates as well the progress made up to December 31, 1924.



ROAD BUILDING IN TOKYO

At Shinagawa, where the National Tokaido Highway Commences — **Road Foundation Work, Shibaura**

Road Number	Location	Width *Metres*	Length *Metres*	Percentage of Work Completed
1.	Shinagawa to Honshiba, 1 chome, Kobiki Cho, Edobashi, Iizumi Bashi, Kurumazaka and on to the line of the Joban Railway, Senju	22-44	13,596	—
2.	Kudan Zaka Shita to Minami Jonbo Cho, Ryogoku Bashi, crossing Sumida River to Kameido	27-36	6,200	—
3.	Gofukubashi to Eitai Bashi and Sawaumi Bashi Sunamachi	33	5,255	—
4.	Muraku Cho, 1 chome, to Owaricho, Kobiki Cho, 3 chome, Tsukiji 3 chome, Tsukishima, thence cross Sumida River, which latter construction will be a separate undertaking	27-36	2,270	—
5.	Tsukiji 3 chome to Irifune Cho, Kamejima Cho, Hama Cho 3 chome, Asakusa Bashi, Minami Moto Machi, Kita Tawara Machi and Kanasugi Shita Machi...	33	8,048	10%
6.	From the front of Uyeno Park to Komagata Machi, Oshiage	33	3,640	5%
7.	From the East of Tokyo Station to Shimomaki Cho, and Kamejima Bashi, Echizenbori, 1 chome	22-44	1,110	—
8.	Eiraku Cho, 1 chome, to the Vicinity of the Moat at Moto Chiyoda Cho	73	200	100%
9.	Sakurada Mon to the front of the Diet Buildings	55	580	—
10.	Aioi Bashi, south to Wakura Cho, Aioi Cho and Nakanogo Take Cho	25-33	5,050	—
11.	North side of Tokyo Station to Zenigame Cho and Shin Tokiwa Bashi, Kodenma Cho, 1 chome, and to Asakusa Bashi ...	27	1,580	—
12.	Kanda Bashi to Ogawa Machi, Yushima 4 chome, Hongo 1 chome and Hongo 3 chome...	27-33	2,075	—
13.	Hitotsubashi, Minami Jinbo Cho to Ikidonozaka	27	1,973	—
14.	Otemachi, 1 chome, Kijibashi to Iidabashi	27-36	2,605	—
15.	Toranomon, through Nishi no Kubo to Kamiya Cho	27	970	—
16.	Sakurada Hongo Cho to Shiba Park ...	33	1,055	—
17.	Kajibashi, Yanago Machi, Danjo Bashi to Eitai Bashi	22-33	1,718	—
18.	Shibaguchi 1 chome, Toranomon to Akasaka Mitsuke...	33	2,745	—
19.	Kijibashi, Kamakura Gashi Dhirobe Gashi to Shimbashi...	22-27	4,064	—
22.	Fujimi Cho (Kojimachi) to Ichigaya Mitsuke	27	930	—
21.	Kudanzaka to Fujimi Cho, 1 chome, Hanzomon and New Diet Buildings at Nagata Cho, Kojimachi-ku	27	2,540	—
22.	Yushima 4 chome, Nicho Machi, Kuramae Katamachi, Hoonji Bashi to Kameido ...	22-27	5,480	—
23.	Asakusa Tamachi 2 chome to Kanasugi Shita machi	22	782	—
24.	Yokoami Cho, 1 chome, to Ryogoku ...	33	163	—
25.	Kobiki Cho 2 chome to Tsukiji 4 chome...	27	200	—
26.	Minami Moto Machi to Umaya Bashi, Kurofune Cho	27	363	—
27.	Fukuzumi Cho to Ogi Bashi, Sunamura ...	22	3,163	—
28.	Hamacho, 3 chome, to Nakasu Machi, Higashi Ogi Bashi and Suna Machi ...	22	3,981	—
29.	Hama Cho, 3 chome, Shigo Hashi to Tokuemon Cho, Hikugawa Bashi, Oshima Machi	22-27	3,226	—
30.	Nakanogo Motomachi to Terajima Machi...	2	1,920	—
31.	Yamanoshuku Machi to Imado Bashi ...	22	385	—
32.	Asakusa Zaimoku Cho to Yoshinobashi, Minami Senju to the line of the Joban Railway	22-25	2,655	—
33.	Otomachi 1 chome, to Shita Saya Cho, Arame Bashi, Hama Cho, 1 chome, to Ryogoku Bashi	22	2,980	—
34.	Ryukan Bashi to Konya Cho, Mikura Bashi, Take Cho, Iriya Cho	22	3,960	—
35.	Dosan Cho, Kamakura Gashi, Shohei Bashi, Tenjincho, 2 chome, to Ikenohata, Shichikencho...	22	3,500	13%
36.	Imairi Cho, Atago Cho to Akabane Bashi...	22	1,920	—
37.	Minowa Machi to Shirahige Bashi... ...	22	1,637	—
38.	Iriya Cho to Yamanosuku Machi and in front of Asakusa Station, Nakanogo and Narihira Cho...	22	2,836	—
39.	Arame Bashi to Shimbashi Koami Cho, 4 chome	22	380	—
40.	Nishi no Kubo, Kamiya Cho to Utagawa Cho	22	910	—
41.	Nishi Ogawa Machi to Misaki Cho, 3 chome and the Artillery Arsenal	22	580	—
42.	Nagata Cho, 2 chome	22	354	100%
43.	Tameike Machi to Tamachi 7 chome ...	27	180	—
44.	Ikedonozaka to Hongo 1 Chome	27	580	—
45.	Higashi Kuromon Cho to Uyeno, Hirokoji	36	145	—
46.	Suda Cho, Manseibashi	36	110	—
47.	Kiba Machi to Heikyu Cho	22	80	—
48.	Shiba Park to Hamamatsucho, 1 chome...	27	611	—
49.	Kiji Bashi to Motoshiro Cho, 2 chome, Toshima Cho...	22	1,845	—
50.	Muramachi Cho to Toshima Cho	22	573	—
51.	Yushima Tenjincho, 3 chome, to Umaya Bashi, Oshiage	22	3,877	41%
52.	Ikenohata, Naka Cho	22	300	—
53.	Etchujima Machi to Hamazono Machi ...	22	1,025	100%

The combined length of these 53 roads amounts to 118,900 metres, of which plans for 22 per cent. have been finished and surveys for 73 per cent. completed.

The following specifications approved by the Reconstruction Bureau, will govern all future road construction undertaken as a part of the general reconstruction program :

1.—The metric system will be used in designating the width of roads.

2.—Existing roads not entering into the reconstruction plan will be left undisturbed.

3.—Roads along which high speed railways are to be built must be at least 27 metres wide.

4.—Roads on which surface tram lines are to be built must be at least 22 metres wide.

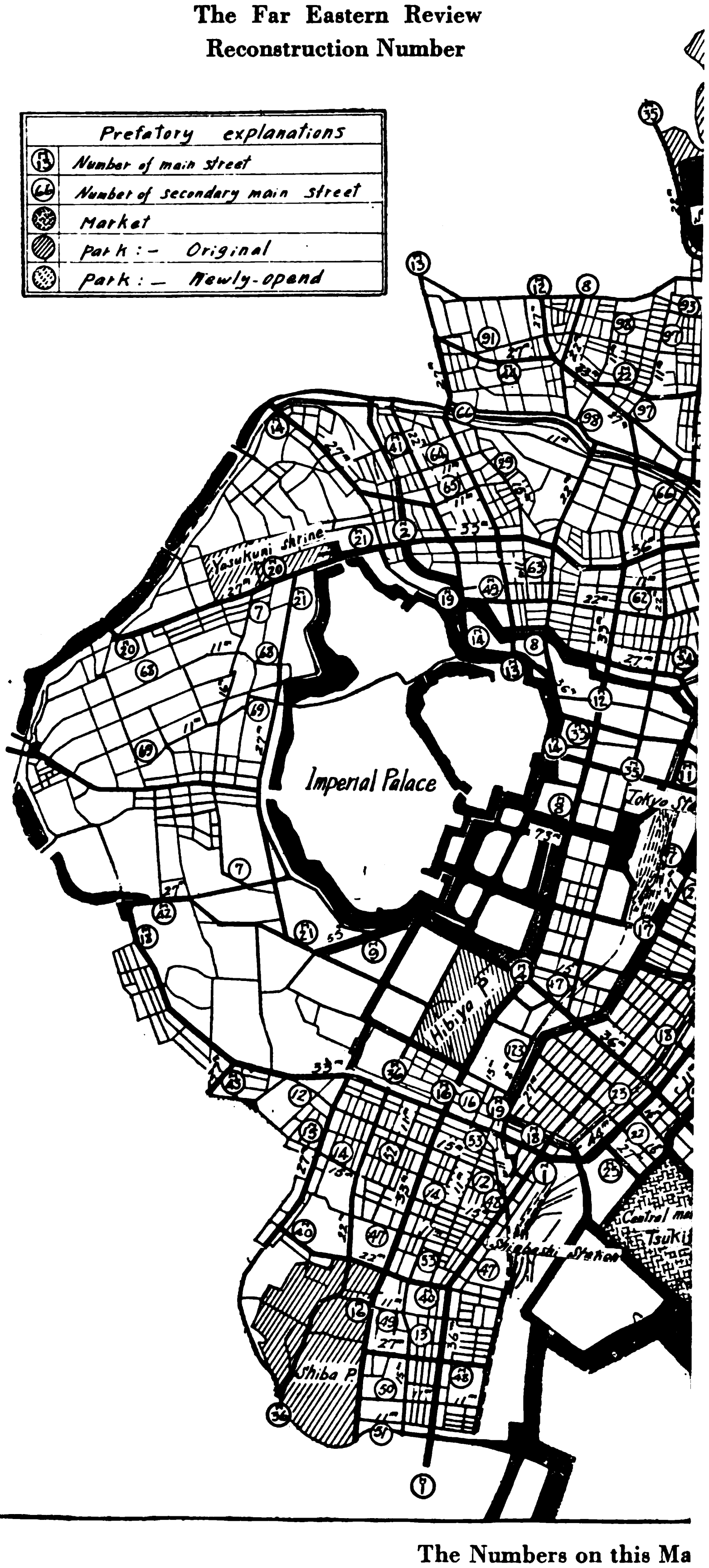
5.—All roads planned in connection with the " Greater City Scheme " are to be constructed.

6.—Licensed tramways, especially those which have already purchased land for right-of-way privileges, shall be constructed.

THE CITY OF TOKYO

NEW STREET PLAN OF THE RECONSTRUCTION BUREAU

The Far Eastern Review
Reconstruction Number



The Numbers on this Ma

7.—The amount of sub-surface construction to be installed under roads shall in all cases be as limited as possible.

8.—Any widening of existing roads must be accomplished by increasing the width on both sides of the road to be altered.

9.—Only in those cases where it is absolutely necessary will it be permitted to disturb any structures of a permanent nature which successfully withstood the effects of the earthquake.

10.—Secondary roads of less than 22 metres in width and curved, and which cross other roads of similar width, shall be altered as little as possible in forming a part of the new road prgram.

11.—Roads built beside rivers and canals shall be so constructed as to provide sufficient space for the erection of storehouses and factories along the banks of such waterways.

12.—Efforts shall be made wherever possible to do away with crossings or street intersections consisting of more than two roads, In the event this is found to be impracticable, a suitable square shall be provided so as to permit the careful regulation of traffic.

13.—So far as possible, bridges shall not be built in such a way as to form an angle with the line of direction of the roads approaching it from either side.

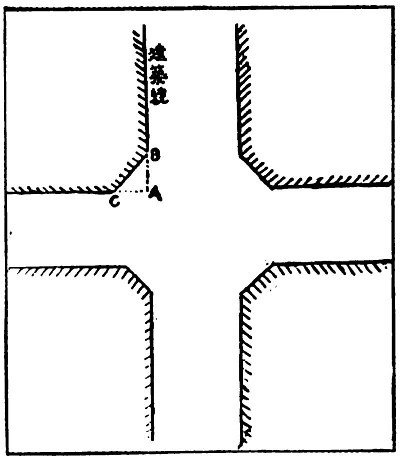
14.—Large drainage ditches shall be so covered that they may be utilized as a part of the road proper.

15.—All main roads shall be built of a width greater than that of any of the branches which may enter into it.

16.—The width of all main roads shall be from 2 to 4 times greater than the width of that portion of the road actually used by wagon traffic. Special attention should be given this condition in such districts as Nihonbashi-ku, in order that streets running through such congested districts may be provided with sufficient space to permit the building of sidewalks.

17.—The approaches to all bridges must be widened.

18.—The corners at road crossings shall be so constructed as to form an octagon at the street intersection in accordance with the sketch illustrated below :



(*a*) Roads of 6 to 9 metres in width may be built with corners parallel to the streets.

(*b*) Roads of 8 to 11 metres in width shall be built with corners 3 metres long.

(*c*) Roads of 11 to 22 metres in width shall be built with corners 4 metres long.

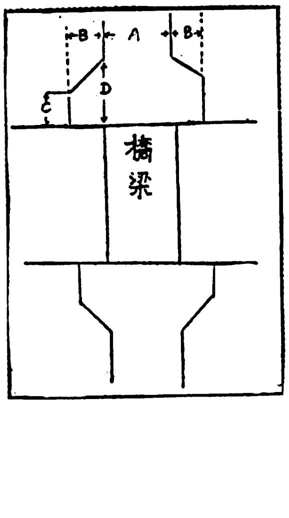
(*d*) Roads above 22 metres in width shall be built with corners 12 metres long.

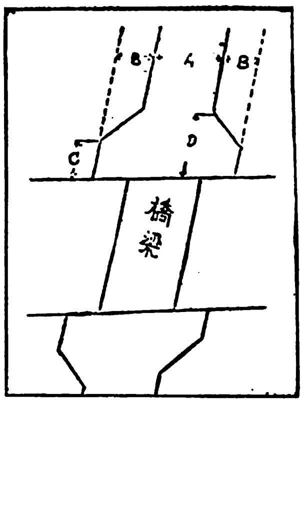
(*e*) These corners at all tram crossings shall be at least 8 metres long.

(*f*) The corners of streets intersecting in such a manner as to form obtuse angles at the crossings need not be built in accordance with the provisions of this article.

19.—Bridge approaches shall be laid out in various widths between 8 and 18 metres. The absolute minimum, however, must not be less than 6 metres in width.

The following sketches illustrate the standard dimensions to which all bridge ap proaches must conform, with the exception of those bridges having roads approaching at an angle, in which case these standards may be ignored.





"B" to be ½ "A" (smallest width 8 metres ; largest 18 metres)
"C" to be ½ "A" „ „ 6 „ „ 11 „)
"D" to be twice "C" (smallest width 12 metres; largest 24 metres)

All roads 11 metres and over in width shall be constucted so as to provide sidewalks on both sides of the road, and in accordance with the following schedule of dimensions :

Road Width	*Street Width*	*Width each Sidewalk*
36 metres	24 metres	6 metres
33 „	22 „	5.5 „
27 „	18 „	4.5 „
25 „	16.6 „	4.2 „
22 „	14.6 „	3.7 „
20 „	13 „	3.5 „
18 „	11 „	3.5 „
16 „	10 „	3 „
15 „	9 „	3 „
11 „	6 „	2.5 „

Where tram lines are in operation or are to be constructed along roads 22 metres wide, the above dimensions for this width road will be altered to 16.6 metres for the street width and 2.7 for the width of each sidewalk.

The horizontal slope at the intersection of all wagon roads shall be built to conform with the following grades indicated opposite the several kinds of road surfaces to be laid :

Road Surface	*Vertical Section*		
	(Within 1-50)	(Above 1-50) (Below 1-25)	(Above 1-25)
Asphalt			
Wood Block ..			
Concrete			
Brick			
Stone	1-40	1-60	1-80
Tar-Concrete ..	1-35	1-50	1-70
Tar-Macadam ..	1-30	1-45	1-60
Gravel	1-25	1-35	1-50

Where the vertical slopes of two adjoining roads vary by more than 1 in 100, the curve shall be constructed in accordance with the following standards :

Variation in Slope	*Length of Curve*
1-100 to 1-102	10 Metres
1-102 to 1-103	20 „
1-103 to 1-104	30 „
1-104 to 1-105	40 „
1-105 to 1-106	50 „
Above 1-106	60 „

Should the parabola or vertical curve be below 10 metres, the surface of such roads will be laid flat.

All ditches to be constructed along the sides of the roads must be built parallel to the line of the road itself.

Stone curbings between wagon roads and sidewalks must not be less than 9, or more than 20 centimetres in height, and, wherever possible, will be 11 centimetres high, which dimension will be regarded as the standard for this work.

Trees will be planted along the sides of all roads 25 metres or more in width. These trees will number 24,000 in accordance with the amount provided for by the budget.

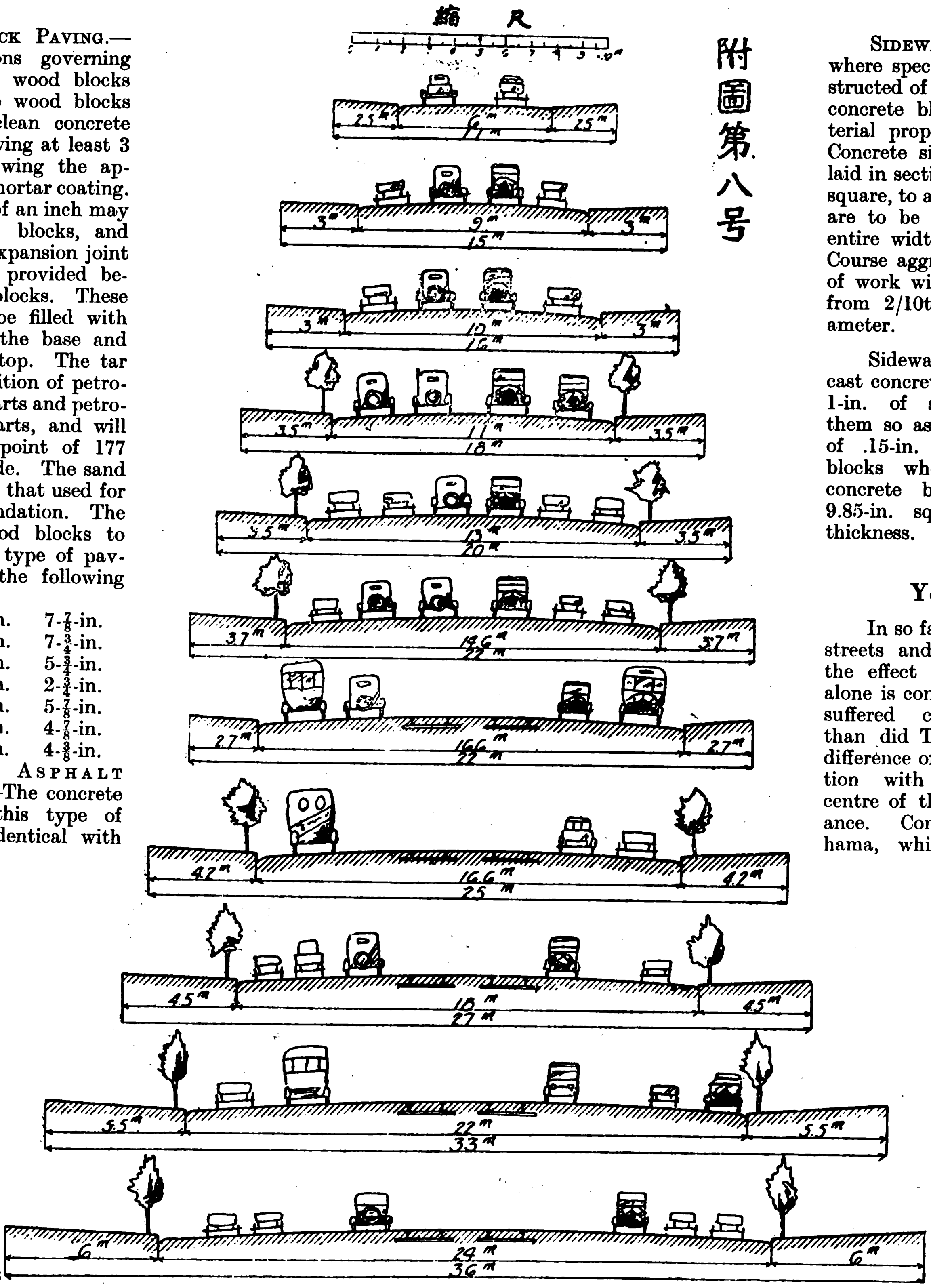
Roads to be paved in accordance with the present road building program will be surfaced with either wood blocks, asphalt blocks, sheet asphalt, rock asphalt, asphalt concrete or water-bound macadam. All roads irrespective of the nature of the surfacing will be laid on a concrete foundation of the following specifications :

After excavating to the standard depth specified, the surface will be hard rolled, using a road roller of not less than 8 tons weight. On this surface, 5-in. of good soil mixed with gravel will then be laid and rolled in, following which another layer, also 5-in. in depth, will be laid and hard rolled. The concrete foundation to be laid on this surface will be 6-in. in depth and will be of a 1 : 3 : 6 mixture, while the mortar coating over the concrete base will consist of a 1 : 3 mixture and will be laid at least 3/10 ths of an inch thick. Course agregate for the concrete work will consist of gravel not more than 1-in. in diameter, and sand will be of a hard gritty quality free from loam.

Wood Block Paving.—The specifications governing roads laid with wood blocks require that the wood blocks be laid on a clean concrete foundation, allowing at least 3 days' time following the application of the mortar coating. A space of 0.15 of an inch may be left between blocks, and every 36-ft. an expansion joint of 1/2-in. will be provided between rows of blocks. These interstices will be filled with 2-in. of tar at the base and 1-in. of sand on top. The tar will be a composition of petroleum asphalt 7 parts and petroleum pitch 3 parts, and will have a melting point of 177 degrees Centigrade. The sand will be similar to that used for the concrete foundation. The sizes of the wood blocks to be used for this type of paving will be of the following dimensions :

3-5/8-in.	3-3/4-in.	7-7/8-in.
3-5/8-in.	3-3/4-in.	7-3/4-in.
3-5/8-in.	3-3/4-in.	5-3/4-in.
3-5/8-in.	3-3/4-in.	2-3/4-in.
3-5/8-in.	2-3/4-in.	5-7/8-in.
3-5/8-in.	2-3/4-in.	4-7/8-in.
3-5/8-in.	2-3/4-in.	4-3/8-in.

Petroleum Asphalt Block Paving.—The concrete foundation for this type of paving will be identical with that on which wood block paving will be laid. The petroleum asphalt blocks will be 5-in. wide by 1-ft. long by 2-in. in thickness, and will be laid end to end, allowing no spaces between them. Fine sand will then be sprinkled over the surface of the blocks in the quantity of 0.2 cubic foot of sand to 1 *tsubo* of paved area.



Standard Plans for Tokyo's New Streets

Asphalt Concrete Paving.—Not sooner than 10 days following the completion of the concrete foundation the asphalt surface for roads surfaced with this material will be laid to a depth of 1.8-in. The asphalt to be used for this work will be of a grade having a melting point of 140 degrees Centigrade, and will be applied in the quantity of 2 *sho* (about 1 standard gallon) per *tsubo* of road surface. After rolling, this surface will be sprinkled with a fine grade of sand to a depth of about one-tenth of an inch.

Macadam Roads.—Roads paved with gravel, crushed rock, etc., shall be provided with a concrete foundation similar to that specified for wood-block paving. The surfacing materials for this type of road must be laid in such a manner as to produce a finished depth of at least 6 inches following the rolling with a 10-ton macadam road roller. Fine gravel and pulverized stone will then be used for the top surfacing, which after rolling may or may not be bound with tar having a melting point of 177 degrees Centigrade.

Sidewalks. — Sidewalks where specified are to be constructed of concrete or pre-cast concrete blocks made in material proportions of 1 : 2 : 4. Concrete sidewalks are to be laid in sections or frames 3-ft. square, to a depth of 3½-in., and are to be laid flat across the entire width of the sidewalk. Course aggregate for this class of work will consist of gravel from 2/10ths to 1-in. in diameter.

Sidewalks laid with pre-cast concrete blocks shall have 1-in. of sand spread over them so as to fill the spaces of .15-in. left between the blocks when laid. These concrete blocks are to be 9.85-in. square by 2-in. in thickness.

Yokohama

In so far as the damage to streets and roads caused by the effect of the earthquake alone is concerned, Yokohama suffered considerably more than did Tokyo, due to the difference of 18 miles in location with respect to the centre of the seismic disturbance. Consequently, Yokohama, while not having a road construction program which could be in any way compared with the extensive plans laid out for Japan's capital city, has, however, a very much deserved and badly needed road program, consisting of 129,893 metres in length and comprising 421,000 *tsubo* in area. Details of this construction program are as follows :

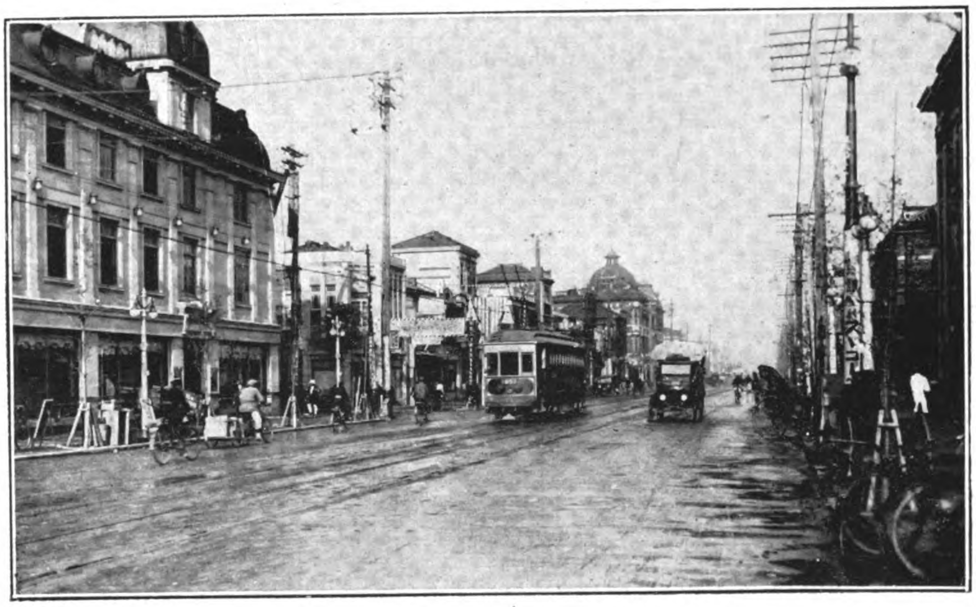
	Length *metres*	Area *tsubo*
Roads to be built by the National Government ...	30,534	215,000
Roads to be built by the Municipality	12,814	67,000
Roads to be built as part of the Land Adjustment Scheme (both by the National Government and by the Municipality).	86,545	139,000
Total	129,893	421,000

Of the roads to be built by the National Government, 77 per cent. of the surveys have been completed and 14 per cent. of the plans, and work has already been commenced on the first avenue extending from Takashima-Cho along the reclaimed land.

The following schedule outlines the extent of the work to be undertaken by the Reconstruction Bureau in providing Yokohama with new streets and roads, and indicates as well the progress made up to December 31, 1924.

Road Number	Location	Width *Metres*	Length *Metres*	Percentage of Work Completed
1.	Kyobashi Cho to Hodogaya Iwama	18-36	8,505	0.03
2.	Bentenbashi to Bankoku Bashi	27	627	—
3.	Honcho 4 chome, to Ooka Machi	23-25	4,520	—
4.	Oe Bashi to Honmoku ...	23-25	4,710	—
5.	Aoki Cho 7 ken cho, to Rokkaku Bashi	22	2,182	—
6.	Hodogaya Tanimachi, to Minami Yoshida Machi, Yotsume	16-22	3,737	—
7.	Hiraoka Bashi to Senshu Bashi	18-22	2,785	—
8.	Idogaya to Hodagaya Machi Iwama	18-22	1,421	—
9.	Sakuragi Cho 1 chome to Hinode Cho, 1 chome ...	16	546	—
10.	Hiranuma Machi to Yokohama Station	22	567	—
11.	Kanagawa Machi, Jubancho, to HigashiKanagawa Station	27	229	—
12.	Hiranuma Machi to Sencho	22	709	—

The building of new roads will be the chief work of the Reconstruction Bureau. For the construction of main avenues the national government will appropriate Y.282,840,000. For the construction of new streets to be laid out in connection with the land adjustment scheme, a further Y.41,760,877 will be granted as subsidies. It will also lend Y.43,510,402 to the local governments, making a grand total of Y.368,112,079 to be expended on the new roads scheme. To this, must be added Y.23,497,100 granted as loans and subsidies to the local governments for repairing roads and bridges damaged by the earthquake and fire.



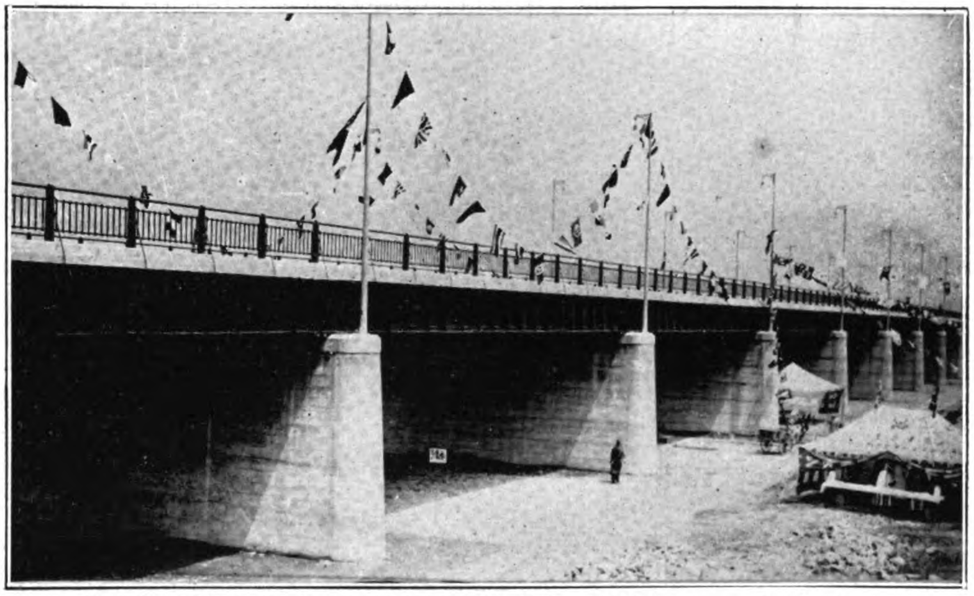
THE STREETS OF TOKYO
Top: Looking down from Uyeno Park
Center: The New Ginza
Bottom: Minamidenma-cho from Kyobashi

The total expenditure on new streets in Tokyo will be Y.318,310,000. Of this amount, Y.60,852,000 will be charged against the municipality, and one half (Y.30,426,000) paid by the national government as a direct subsidy. This makes the national government's expenditure on new roads in Tokyo, Y.281,884,400. The municipality will, however, pay interest on the Y.30,426,000 to be advanced by the national treasury. On road repairs, Y.16,-055,100 will be spent in Tokyo, the national Government paying Y.6,689,625, lending the balance to the municipality and advancing the interest charges in the form of further loans. This brings the national government's share of the costs of new roads and road repairs in Tokyo to Y.288,574.025, spread over a five-year period, 1923-24 to 1928-29.

In Yokohama the national government will spend Y.25,382,400 on new main roads, and grant the municipality a loan of Y.3,009,000 and subsidy of Y.3,009,000 for the same purpose. Yokohama will be obliged to assume the interest charges on this loan. An additional Y.7,442,000 has also been granted the Yokohama municipality for road repairs, the national government assuming, in the form of a subsidy, 5/12ths of the total, Y.3,100,833. The balance, Y.4,341,167, will be loaned to the municipality by the national treasury, which will also advance the interest charges. This brings the national government's expenditure in Yokohama (Y.28,391,400 for new roads and Y.3,100,833 for repairs) to Y.28,391,400.

The prefectural governments of Tokyo and Kanagawa are also granted subsidies and loans from the national treasury to enable them to complete the construction of certain national roads planned before the earthquake, as well as certain subsidiary roads. The grants to Tokyo prefecture aggregate Y.17,083,204, of which Y.7,583,506 is a subsidy, and Y.9,499,698 a loan from the national treasury on which the prefecture must

assume the interest charges. To Kanagawa prefecture Y.1,318,075 has been allotted for completing that part of the first national road between Tokyo and Yokohama within its borders. Of this, Y.500,000 has been set aside for building the important bridge over the Rokugo (Tama) river at Kawasaki. The nation will pay Y.742,371 as a subsidy for this work, the prefecture assuming the interest charges on the balance, Y.575,704, which will be advanced to it in the form of a loan from the national government.



New Steel Girder Bridge carrying the 4th National Highway over the Arakawa River at Senju

Tokyo Pefecture's Road Plans (*See Map*)

In 1919 a scheme for the constuction of a belt road around Tokyo from north to south and east to west, together with subsidiary roads radiating into the country and the city, was approved by the prefectural assembly at a total cost of Y.18,047,500 spread over a period of 8 years. This was later extended, and approved in October 1921 by the Department of Home Affairs, at a total cost of Y.43,885,452, spread over 8 years from 1921 to 1929.

This new plan embraced the construction of 14 first-class roads, 72-ft. wide, with a wagon road of 54-ft. and sidewalks 9-ft. wide on both sides of it; 8 second-class roads, 60-ft. wide; and 11 second-class roads, 48-ft. wide. One-third of the costs are covered by a subsidy by the national government, in addition to the subsidy of one-half granted for the construction of national roads, of which four are being built by Tokyo prefecture.

The Home Department approved a scheme which gives the prefecture the right to levy taxes on all property for 360-ft. on both sides of the proposed roads up to 10/75ths of its value, to help defray the costs of construction. Holders of ten-year leases and mortgages are also liable to this tax.

All the roads laid in accordance with this plan are to be macadamised. Foundations will be rolled about 3.5-in. thick, and the surface gravel bound with tar. Sidewalks will be built 6-in. deep, 3-in. foundation, 2-in. rolled in gravel, and a surface 1-in. thick. Concrete will, however, probably be used for all sidewalks laid in future. All bridges to be built in connection with these roads will be at least 18-ft. long, and built on permanent foundations of concrete and steel. Bridges 180-ft. long will all be built the same width as the roads.

National roads now being built by Tokyo prefecture are: 1st national road, between Shinagawa and the Rokugo river. Construction has been completed from Yatsuyama to Omori and opened to traffic for a distance of 2 miles.

4th National Road: from Senju Ohashi to Umejima Mura, a distance of 17,040 *ken*, of which 360 *ken* between Senju Ohashi and Shinkai Bashi is now in course of construction.

7th National Road: from Kameido Suijin Shrine to Asakusa Michi, known as the Chiba Kaido, construction to begin shortly. Total length, 1,140 *ken*.

9th National Road, called the Nakasendo, will be extended from Sugamo Machi to Itabashi Machi, a distance of 1,620 *ken*. Land is now being purchased for the road site.

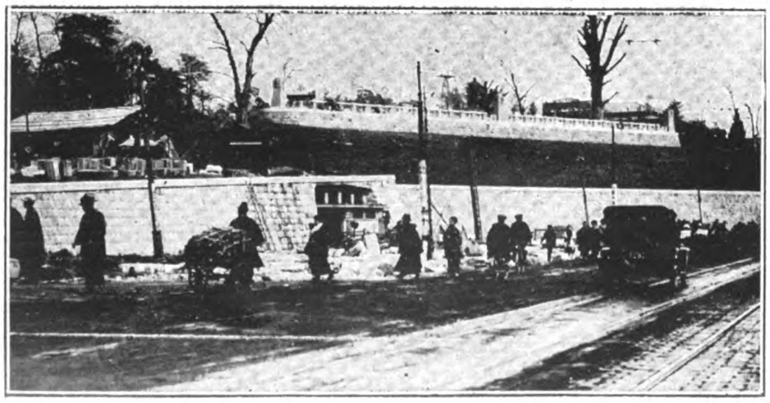
The estimated cost of these roads is Y.7,606,121, of which the national government will pay one-half as a subsidy. Costs of construction completed by the end of December, 1924, were Y.5,406,000.

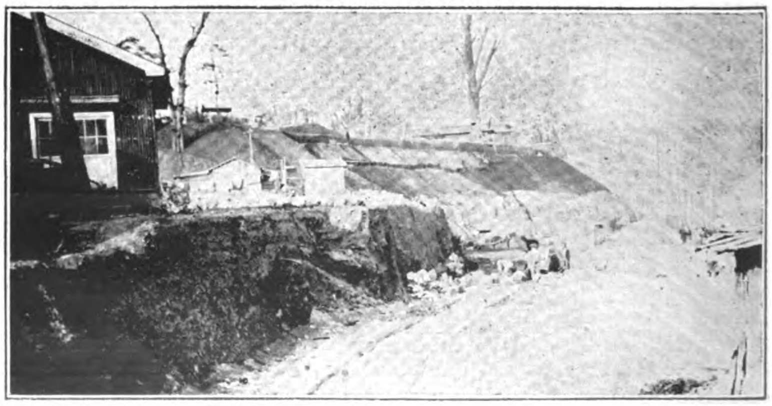
In pursuance of the plan for a belt road around Tokyo city, and subsidiaries thereto, Tokyo prefecture is constructing the following roads:—

1. From Shinagawa, Yatsuyama to Osaki Yazaeke, 6,000-ft., of which a large part has been competed. Cost of construction: Y.1,523,548.
2. From Meguro Machi office to Meguro Hikawa Shrine, 5,160-ft. Now under construction at a cost of Y.430,553.
3. Sendagaya to Yotsuya, 3,840-ft. Cost of construction Y.419,660.
4. From Sugamo, Ikebukuro, to Koshinzuka, 4,920-ft. Cost of construction, Y.812,994.
5. Kinomoto, Mikawajima, to Minami Senju, 3,980-ft., of which 2,530-ft. are now completed. Total cost of construction estimated at Y.361,034.
6. Komurai Azumacho to Kameido, 3,620-ft. Cost of construction, Y.1,585,508.
7. Osaki Machi to Osaki Station, 1,440-ft. now under construction. Total estimated cost of construction, Y.119,132.
9. Shibuya Machi to Meguro District Office, 3,040-ft., of which 2,160-ft. are now finished. Total cost of construction, Y.1,041,810.
9. Nishi Sugama to Ikebukuro, 4,800-ft. Cost of construction, Y.880,762.

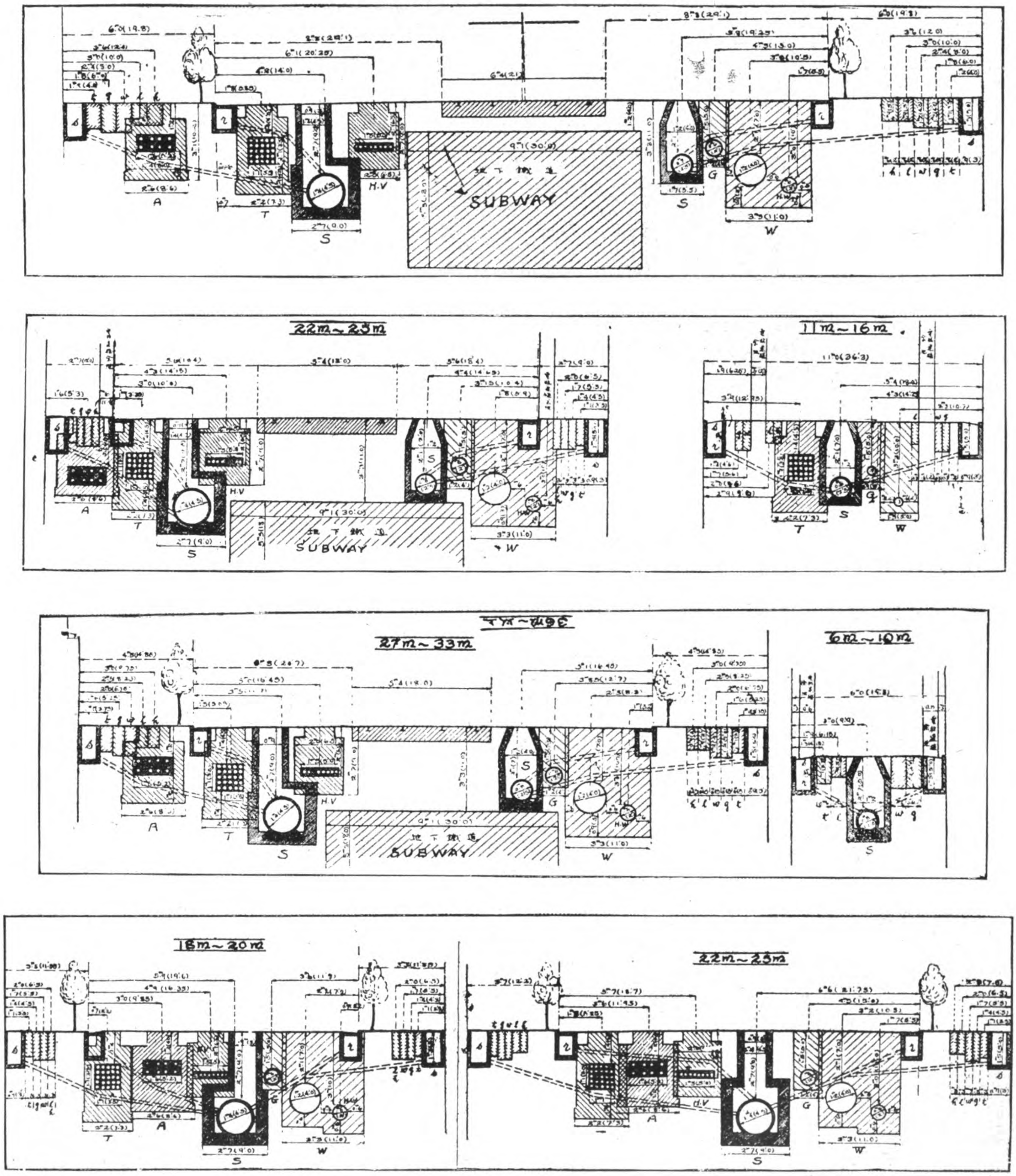
Sub-Surface Construction

The principal thoroughfares of Tokyo, with the existing mass of telephone, telegraph and electric light poles, etc., present a sight to-day which is far from being one of picturesqueness. Not only do these obstacles detract from the beauty of the streets of Japan's capital city, but they also seriously hinder the efficient handling of the constantly increasing traffic problems with which Tokyo is at the present time confronted. Also the fact that all work in con-





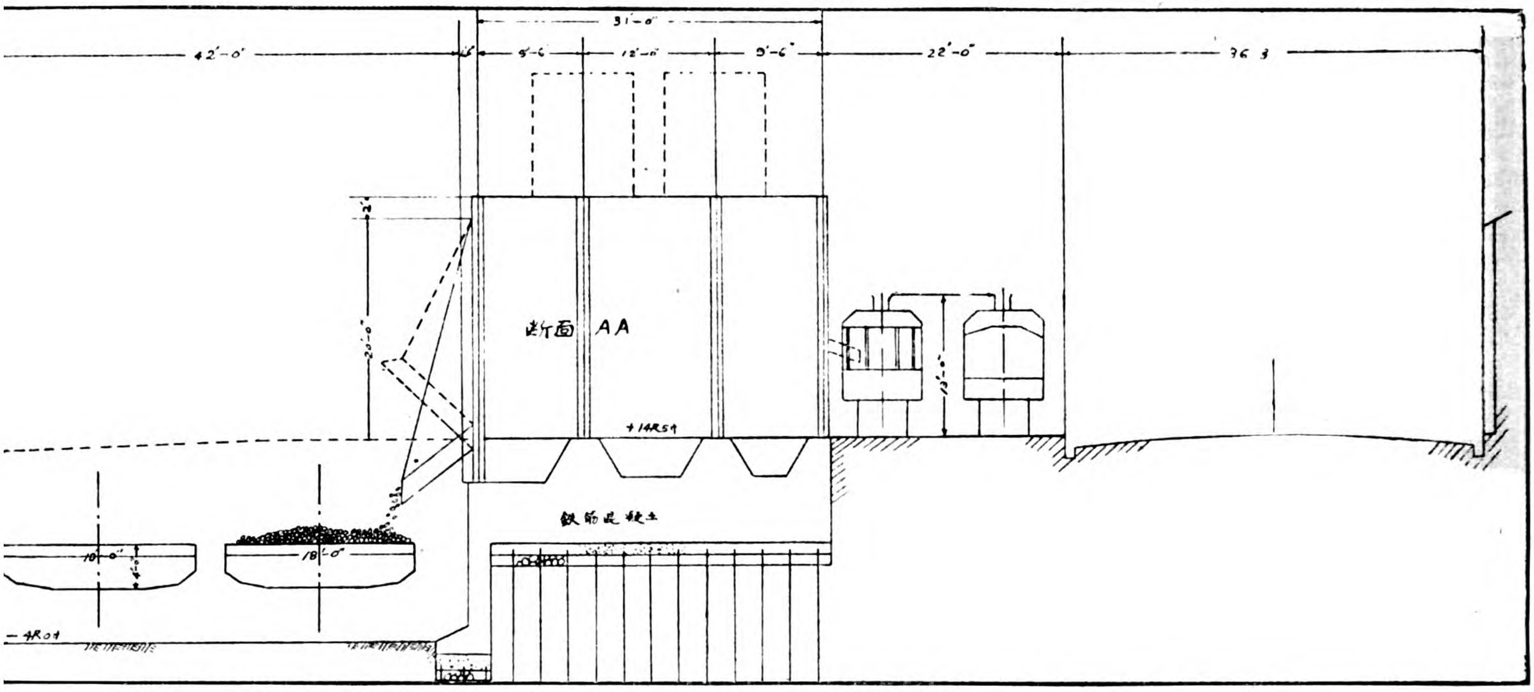
Street Wid ning to form New Plaza at Uyeno Park: Before and After



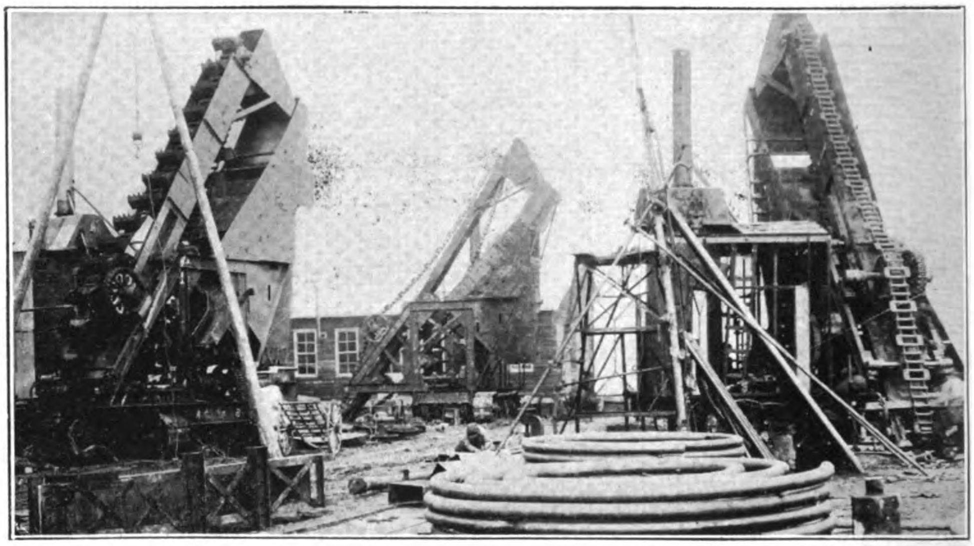
SUB-SURFACE PLANS FOR TOKYO'S NEW STREETS

T .... Telegraph and Telephone Wires
t .... Branch ,, ,,
H.V ...... High Tension Transmissson Lines
h .... ,, ,, ,, ,,
] .... Electric Light Branch Lines

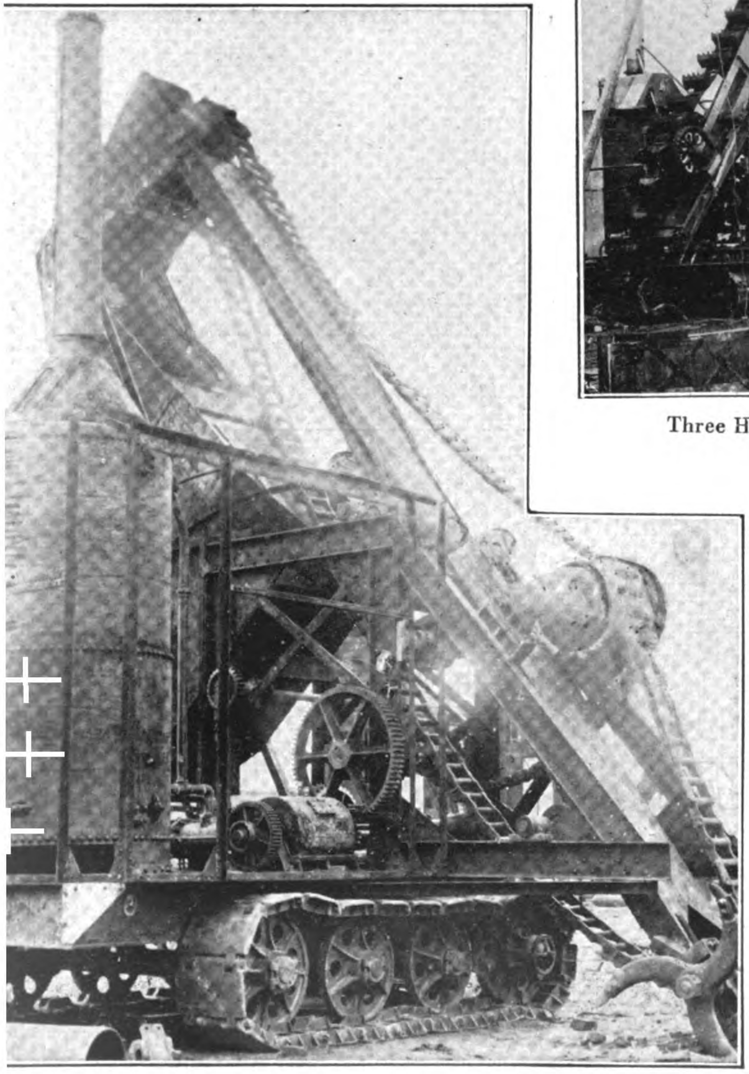
A .... Pneumatic Tubes; Diameter 2¼ in.
W ...w... Water Mains
S .... Sewers, (r) rain water, (s) sewage
G ...s ... Gas Mains and Pipes
Subways



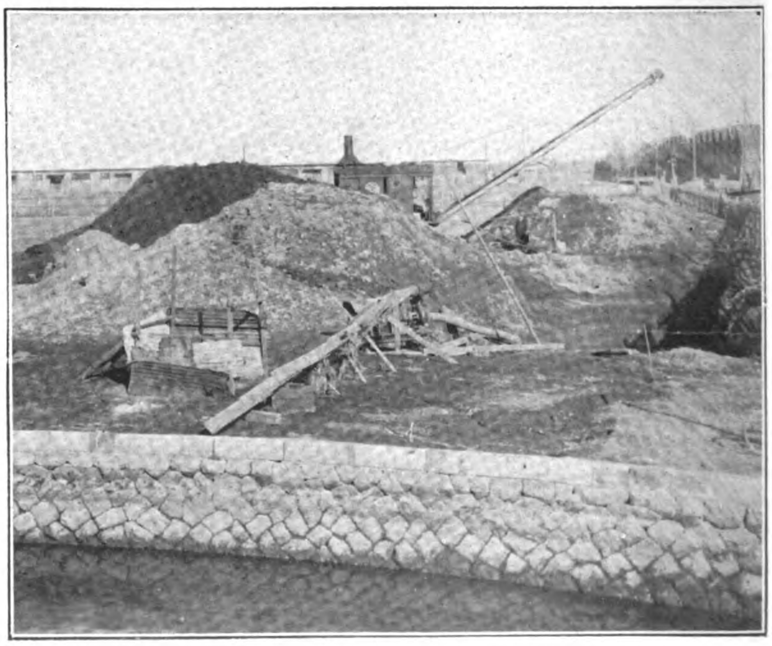
Iida-machi Gravel Storage Bins, Tokyo



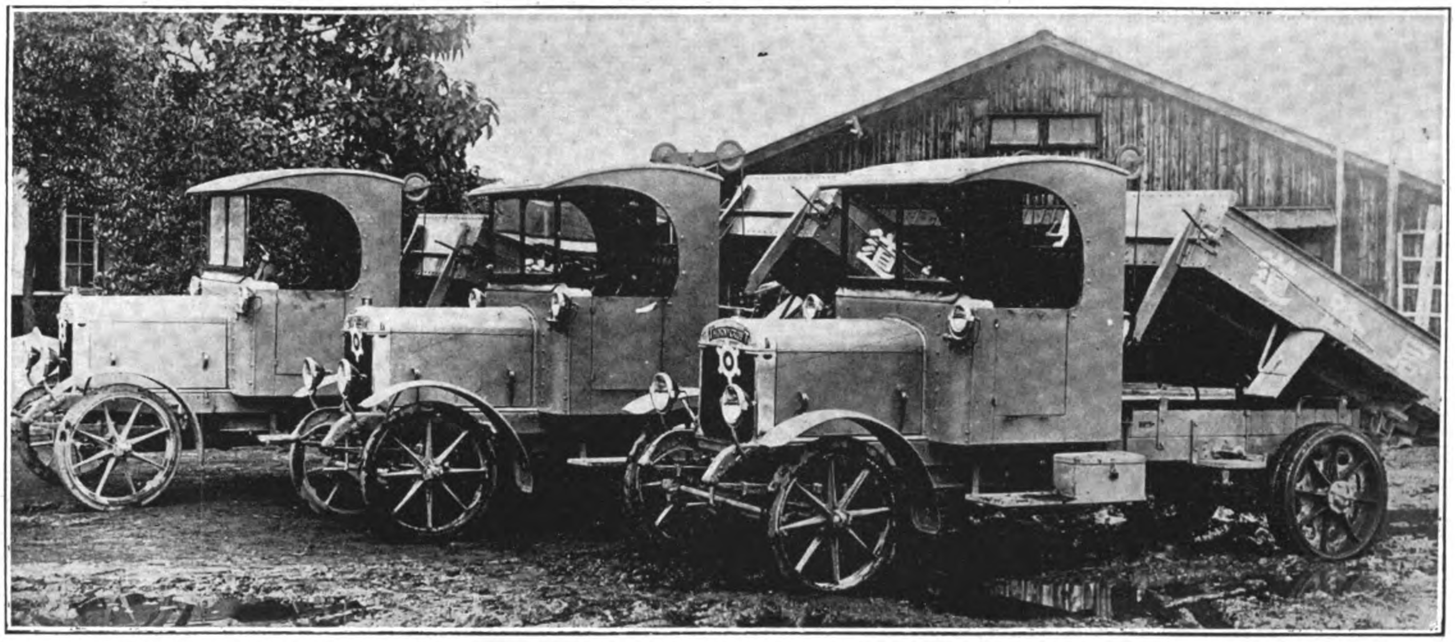
Three Hayashi Gravel Collecting Machines owned by Reconstruction Bureau



Three Hayashi Gravel Digging Machines built in Japan and used by the Reconstruction Bureau in Collecting Gravel from the River Beds



Minami Senju Gravel and Material Yard



Three Thornycroft type " BT " 2-ton Tipping Wagons in use by the Tokyo Municipal Roads Bureau for reconstruction work

nection with the repair and extension of the various types of sub-surface construction has always been carried out under the direct supervision of the particular department responsible for its maintenance and expansion, little thought has seldom been given to making an attempt at co-ordinating with the activities of other departments. As a result, one frequently found that streets which had been opened to traffic for but a week or two following a period during which work was being conducted by some certain department would again be closed to traffic while the activities of another department were undertaken. It is reported that Irvin S. Cobb once expressed wonderment as to whether New York would ever get out of the " trenches," and it is more than likely that most of Tokyo's permanent residents have at some time or other had ample justification for expressing similar wonderment.

The Reconstruction Bureau in order to correct these conditions has laid out a very complete and comprehensive program, requiring that all such future construction, wherever possible, be installed below the level of the ground and in accordance with the new standards of sub-surface construction illustrated in the sketches accompanying this article. All work of this character is to be submitted for the approval of the Reconstruction Bureau prior to installation and is to be completed before any work on the road itself is commenced. By following this procedure only an emergency will thereafter justify any disturbance of the road surface.

An estimate was made shortly before the September 1923 disaster for the purpose of determining the amount invested in Tokyo alone in this class of public utilities. The figure arrived at indicated a total of Y.149,450,000, the proportionate amounts represented by each of the various utilities engaged in making up this total being stated below :

Communications Department (telephone and telegraph lines)	Y.41,811,000
Police Bureau (telephones)	2,533,000
Tokyo City Electric Bureau (light and power lines)	27,622,000
Tokyo City Waterworks Bureau (water mains, etc.)	15,500,000
Tokyo City Sewer Bureau (sewers)	10,162,000
Tokyo Electric Light Co. (electric power lines)	39,822,000
Tokyo Gas Co. (gas mains)	12,000,000
Total	149,450,000

Of the total land area of Tokyo, comprising some 24,000,000 *tsubo* (1 *tsubo*=36 sq. ft.), approximately 11,000,000 *tsubo*, or nearly one-half of the entire city, was destroyed by the September 1923 fire following the earthquake. The damage sustained by that portion of the public utilities located within the devastated area of th ecity was estimated at Y. 112,353,000, or more than 75 per cent. of the total represented in the above table. Some idea of the extent of this damage may be obtained from the following detailed figures :

Communications Department	Y.31,209,000
Police Bureau	1,477,000
Tokyo City Electric Bureau	17,116,000
Tokyo City Water Works Bureau	14,525,000
Tokyo City Sewer Bureau	8,786,000
Tokyo Electric Light Co.	28,512,000
Tokyo Gas Co.,	10,728,000
Total	Y.112,353,000

Not only has the progress in the work of repairing these damages been rapid, but additional installations made since the 1923 estimate of Y.149,450,000 was taken has increased the value represented by these public utilities to approximately Y.200,000,000, including both sub-surface and overhead construction.

A survey recently made by the Reconstruction Bureau estimates that a total of Y.2,034,000 will be required to complete the work of both repairing and installing underground certain of these utilities which are to be located along the new roads provided for in the advanced road building program of that bureau. This sum will be divided into two parts, Y.1,400,000 to be allocated to sub-surface construction, while the remaining Y.634,000 will be utilized in making the necessary repairs and alterations to the existing overhead construction. The enormous amount of work involved in this program may be partially visualized from the following figures giving in *ken* (1 *ken*=6-ft.) the extent of the roads along which this work is to be undertaken :

Telephones :	
(*a*) Underground	128,600 ken
(*b*) Overhead	2,158,000 ken
Police Telephones :	
(*a*) Underground	2,200 ken
(*b*) Overhead	15,400 ken
Tokyo Electric Light Co. :	
(*a*) Underground	7,500 ken
(*b*) Overhead	30,700 ken
Light and Power Supply Lines :	
1—Municipal Electric Bureau	
(*a*) Underground	101,400 ken
(*b*) Overhead	800 ken
2-Tokyo Electric Light Co.	
(*a*) Underground	171,500 ken
(*b*) Overhead	372,000 ken

Main Transmission Lines :	
1—Municipal Electric Bureau	
(*a*) Underground	6,300 ken
2—Tokyo Electric Light Co.	
(*a*) Underground	81,200 ken
Tokyo City Water Works Bureau :	
(*a*) Water mains	102,400 ken
Tokyo City Sewer Bureau	
(*a*) Sewers	293,400 ken
Tokyo Gas Company	
(*a*) Gas mains	548,600 ken

This type of construction, especially that to be placed underground, will require the expenditure of considerable time and money. One example of this may be cited in quoting the estimated cost involved in adjusting the water mains and branches to conform to the new standards recently prescribed by the Reconstruction Bureau. This work alone will cost Y.20,000,000, although the appropriation set aside by the Diet to carry out this particular undertaking amounted to Y.7,000,000, or but 35 per cent. of the total estimated cost. The 2,000,000 *ken* of roads which will be constructed within the next five years will entail a cost estimated at Y.145,000,000. Of this amount approximately 30 per cent. or Y.43,500,000 will be devoted to the construction of sub surface structures.

Gravel Requirements for Reconstruction.

For reconstruction work alone it is estimated that 200,000 cubic *tsubo* (43,200,000 cubic feet) of gravel will be required during the five-year period extending from 1924 until 1929. This material will be used entirely for the surfacing of unpaved roads and for use as course aggregate in connection with reinforced concrete construction.

Before the earthquake the total annual requirements of the city of Tokyo averaged between 140,000 and 170,000 cubic *tsubo* (1 cubic *tsubo*=216 cubic feet), of which quantity the municipality was the largest individual consumer. Most of the gravel formerly used in this district was obtained from the beds of rivers located adjacent to the city. Constant working of these rivers, however, has practically exhausted the available supply, and Tokyo is now confronted with the necessity of seeking new gravel deposits, located at such distances from the city as to materially increase the ever-difficult problem of transportation. Freight has always been the chief item contributing to the high cost of gravel sold for Tokyo delivery, and of the present selling price, averaging between Y.34 and Y.35 per cubic *tsubo*, transportation charges alone represent Y.25 of this amount. Moreover, the price tendency is distinctly upward.

Prior to the earthquake the principal rivers from which Tokyo's gravel requirements were obtained, together with an average of the amount produced by each over a period of one year, were as follows :

Location	*Transported by Rail*	*Transported by Water*
Tamagawa (Tama river)..	80,000 cubic tsubo	33,000 cubic tsubo
Arakawa (Ara river) ..	15,000 ,, ,,	— ,, ,,
Tonegawa (Tone river) ..	5,000 ,, ,,	— ,, ,,
Sagamigawa (Sagami river)	7,000 ,, ,,	— ,, ,,
Total	107,000 cubic tsubo	33,000 cubic tsubo
	33,000 ,, ,,	
Grand Total	.. 140,000 cubic tsubo	

This total average, amounting to 140,000 cubic *tsubo* of gravel, consumed annually within the Tokyo district was absorbed as follows :

Tokyo municipality	63,000 cubic tsubo
Tokyo prefecture	10,000 ,, ,,
Government departments	7,000 ,, ,,
Private companies	60,000 ,, ,,
Total	140,000 cubic tsubo

Generally speaking, those companies engaged in fulfilling the local demands for gravel operate on a very limited capital and with an exceedingly small margin of profit, and are, therefore, not in a position to materially increase their output. Consequently, the enormous increase in gravel requirements for both Tokyo and Yokohama during the next five years has presented a problem of such importance as to require the Reconstruction Bureau to make special provision in order to insure an adequate supply of this material for use in the reconstruction of these two cities.

Ten central gravel storage bins will be erected by the Bureau at Iidamachi, Tokyo, at a total cost of Y. 1,000,000. These bins will be of reinforced concrete design, of 100 cubic *tsubo* capacity each, and cover an area of 2,000 *tsubo*. The gravel depot upon completion will be equipped to receive, store and discharge 300 cubic *tsubo* (64,800 cubic feet) of material daily. The cars containing the material will be shunted direct to the bins over an elevated line to be constructed from the steam tram terminal at Iidamachi, the Tokyo terminus of the Central (Chuo) railway line, and will discharge at that point direct from the cars into the bins. Each bin will be equipped with shutes permitting the gravel to be discharged either into barges lying in the canal passing through Iidamachi or into waiting motor trucks located on the road side of the depôt.

In order to obviate any possibility of experiencing a shortage of gravel due to delay in transportation, the Reconstruction Bureau has concluded arrangements with the Imperial Government Railways for the purchase of 200 steel hopper type cars of 30 tons capacity each.

In addition to this equipment, 100 barges of a capacity of 20 to 25 tons each will be purchased for use in transporting gravel to convenient locations so as to facilitate local distribution. More than 70 motor trucks, the majority of which are G. M. C. and Mack trucks of 2½ tons capacity, are operated by the Reconstruction Bureau at the present time in transporting sand, gravel and other materials from the several material storage yards to the various locations where construction work is in progress.

Due to the excessive cost of land within the city limits, the Reconstruction Bureau has found it impossible to erect storage bins of sufficient capacity to accommodate a supply of gravel which will meet the severe demands bound to obtain from time to time during the progress of reconstruction. To offset this situation, a storage yard has been established at Minami Senju, where accommodations are provided for the storage of an additional 20,000 cubic *tsubo* of gravel. The material will be carried to this storage yard in barges, where it will be unloaded by means of a Goliath travelling crane equipped with clamshell buckets. These two distributing centers, combined with the storage yard to be established on the site recently procured in Shibaura, will not only complete a system of central storage points which will considerably accelerate the delivery of gravel in various parts of the city of Tokyo, but they will also assist in bringing about a reduction in the excessive transportation costs now existing in connection with shipments of this most essential of construction materials.

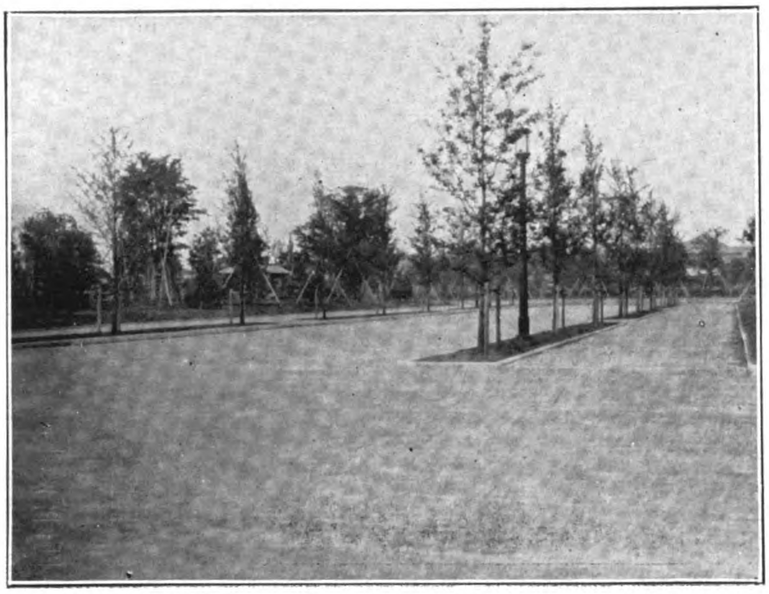
The photographs accompanying this article illustrate a machine invented by a Japanese, and designed especially for collecting gravel located in shallow water. Three machines of this type are now being operated by the Reconstruction Bureau.

Japanese Road Construction Companies

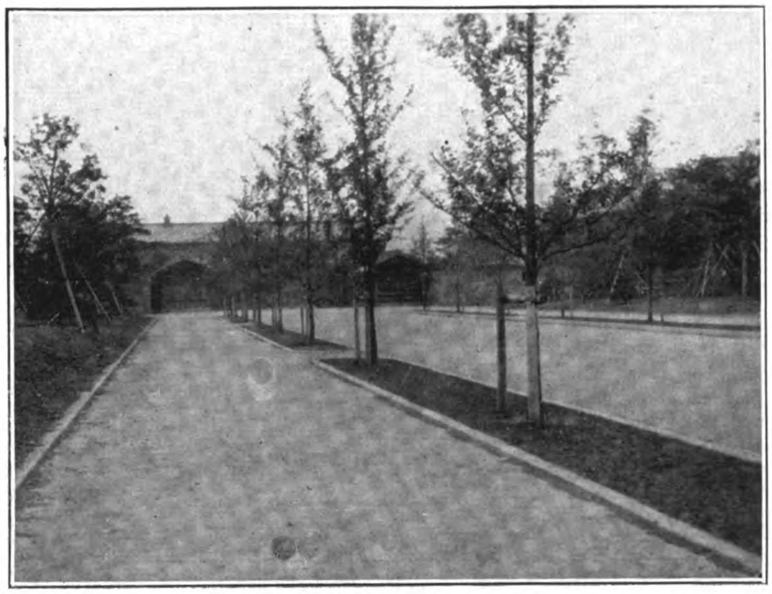
The problem of street paving in Tokyo is of the highest importance from every point of view. The municipal authorities realize the magnitude of this problem, and toward its solution a great deal of progress has been made. Naturally progress has been comparatively slow to date ; first, because proper construction equipment had to be decided upon and imported, and second, because the Japanese contractors had to readjust themselves and their organizations to what is a new business in Japan.

Many engineers have gone to America and Europe to study roads, machinery, methods and equipment, and at present Japan posesseses a wealth of knowledge on the subject that is just beginning to be put into practice. Many of these engineers have been sent by the Municipality of Tokyo and many others as employees of private concerns interested in paving contracting and desirous of having engineers properly trained in up-to-date methods.

Until quite recently it has been customary in Japan for the municipal, prefectural and imperial governmental bodies to do their own paving work, but there is now a tendency to let the work out by contract to construction companies who are able to operate more economically and efficiently. This system prevails in American cities, and in view of the trend in Japan to follow this example, various companies are being equipped in order to secure some of the paving construction in Tokyo during the next few years,



Road Paved with Sheet Asphalt on Block Base. Peers' School Entrance at Meiji Shrine. Laid December 1924 by Nippon Oil Co.'s Road Department.



Asphalt Sidewalks and Street at Entrance to Peers' Girls' School, Meiji Shrine Outer Garden. Laid December 1924 by the Nippon Oil Co.'s Road Department.

Notable among these large Japanese companies who have entered the paving field is the Nippon Oil Company. After careful study on the part of their engineers who had been sent to America, the Nippon Oil Co. made negotiations for the exclusive rights to the patents owned by Warren Brothers Company of Boston, Mass., the largest paving concern in the world. Under this arrangement the Nippon Oil Company is in a position to receive from Warren Brothers all technical advice and such assistance as may be required in the laying of Warrenite-Bitulithic and all other types of asphaltic pavement. The value of such a connection should do much toward securing first quality pavements in Tokyo and the Nippon Oil Company has organized and developed a road department capable of completing with dispatch the largest contracts for asphalt pavement. Toward this end the largest and most modern equipment has been imported, capable of doing things on a big scale; a paving laboratory has been installed in Tokyo capable of testing all paving materials as well as regulating the quality of the work done from day to day. To assist in the organization, and as technical advisers to its road department, the Nippon Oil Company has engaged the services of two expert American engineers trained in the asphalt paving business with the Warren Brothers Company.

To date, the Nippon Oil Company road department has received contracts for paving work in various parts of Japan, the most noteworthy contract being the paving of the Meiji Shrine outer gardens. This is to be paved with Warrenite-Bitulithic, using Japanese asphalt. The contract covers approximately two miles of wide street and four miles of asphalt side-walks, the largest single contract for paving ever let in Japan.

The Tokyo authorities have already laid large areas of pavement of many various kinds, but the final choice as the standard type of pavement for the city will undoubtedly be asphalt. Several varieties of asphalt have been tried in which the Japanese product has stood the tests. The asphalt produced by the Nippon Oil Company from Japanese crude oil has passed the most rigid tests for quality and has been found as satisfactory as the imported products. It is produced in large quantities and will help to make it possible for Tokyo to build first quality streets at a comparatively low cost. The adoption of asphalt as the standard type of pavement for Tokyo is economically a sound policy because all material that enters into the construction of an asphalt street is produced from crude products found in Japan. Nothing need be imported in the construction of asphalt pavements except machinery, which will, sooner or later, also be manufactured in Japan.

Already there are large areas of asphalt pavement laid in Tokyo, and that the plans for the future call for a great deal more of that material is a wise decision from an engineering and an economic point of view. The Japanese are asking why Tokyo should import wood for wood blocks or foreign asphalt when there is produced in Japan asphalt that compares favorably with the best asphalt in the world.

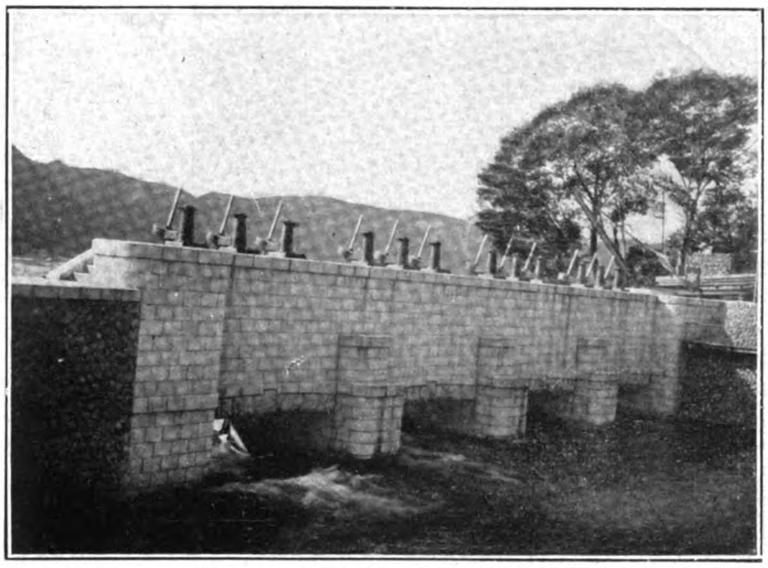
Asphalt Sidewalk, Meiji Shrine Outer Garden. Laid April 1925 by Nippon Oil Co.'s Road Department.

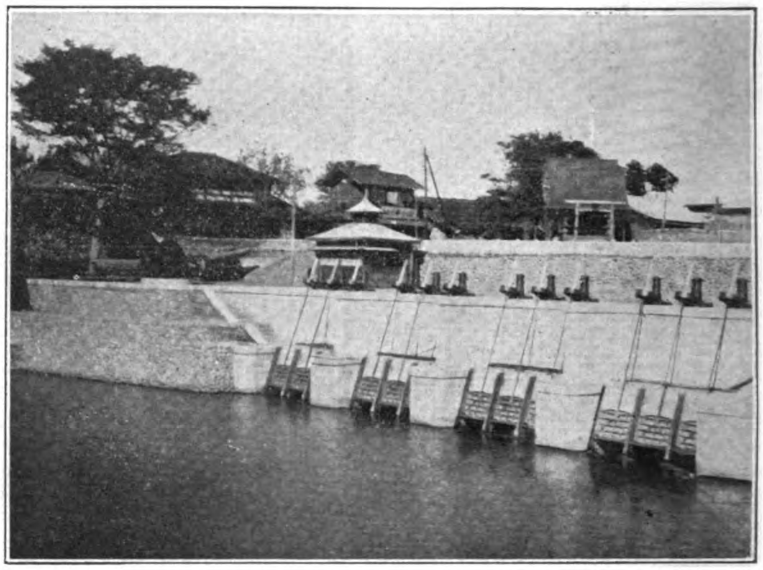
Powerful Radio Transmitter for Japan

THE radio transmitter ordered from the International General Electric Company by the Japanese Government dwarfs the usual powerful radio station familiar to the broadcast listener. The set, ordered through Mitsui & Co., puts 80 kilowatts of energy into the antenna—the majority of American broadcasting stations use one-half or one kilowatt, and the most powerful use only five kilowatts.

This vacuum tube transmitter is not intended for broadcasting, however, but for telegraphic communication between naval stations of Japan. It operates between frequencies of 15,000 and 43,000 cycles, with maximum efficiency at 24,000 cycles, or on a wave length of 12,500 meters. It will be possible to send upward to 100 words per minute, and the keying may be done at a point remote from the transmitter.

An 80 kilowatt vacuum tube transmitter is as powerful as a 300 k.w. arc transmitter, is more economical in operation costs, easier to use, and does not produce the "mushing" of arc sets which interferes so much with broadcast programs.





Intake at Hamura

The Tokyo Municipal Water Works

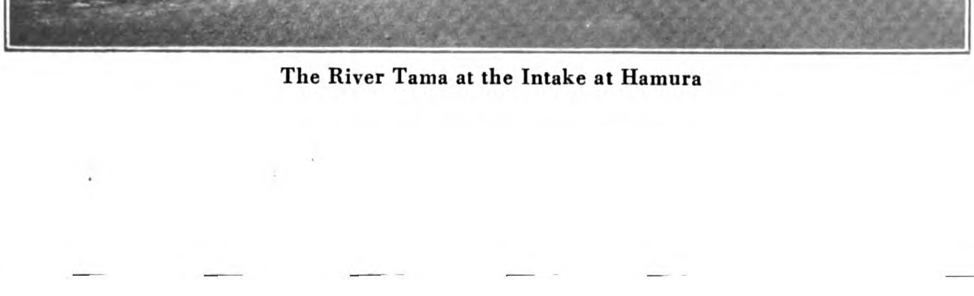
By Motoki Ono, Chief Engineer, Tokyo Water Works Department

THE water supply system of the City of Tokyo dates back to July 1590, when, on his entry into Yedo, the Shogun Iyeyasu commanded Tadayuki Okubo to devise a plan to provide the town with service water. In 1654, the Tokugawa government completed the cutting of an aqueduct 25 miles long to conduct the water of the river Tama to the capital. With certain modifications this ancient water supply is still utilized for the needs of the present day metropolis, engineering science having transformed the old open cut canal into a modern supply line, with mpounding and service reservoirs, filter beds, regulating stations and other refinements invented for the better protection of the public health.

The present water works system was originally designed by the Tokyo Street Improvement Commission with the assistance of Mr. William Kinmond Berton, adviser to the Home department, Major General H. S. Palmer of the British Army and Mr. H. Gill, then director of the Berlin Water Works.

The main source of supply is the Tama River and its tributaries, the intake being located at the village of Hamura and conducted to the Yodabashi reservoir and purifying plant on the outskirts of Tokyo. Along the twenty-five miles of canal mains there are eight stations for inspecting and regulating the flow of water. The Yodobashi purifying plant consists of four receiving and settling basins having a total capacity of 11,928,429 cu. ft., twenty four filter beds covering an area of 21 acres; a service reservoir and a pumping station.

The Yodobashi works is also equipped with sand washing apparatus, a coagulating plant and special railway facilities for coal delivery, etc. Construction was commenced in December 1892 and partially completed in January 1899, when the first water was turned into the distribution pipes. The revenue collected by the Water Works Bureau in 1922 was approximately £421,410.



The River Tama at the Intake at Hamura

One third of the filtered water from Yodobashi flows directly into the service reservoir and distributed to the higher districts of the city by six sets of steam plunger pumps. The other two-thirds flows by gravity into two service reservoir, one at Hongo and the other at Shiba, thence through the distributing pipes to the lower districts of the city.

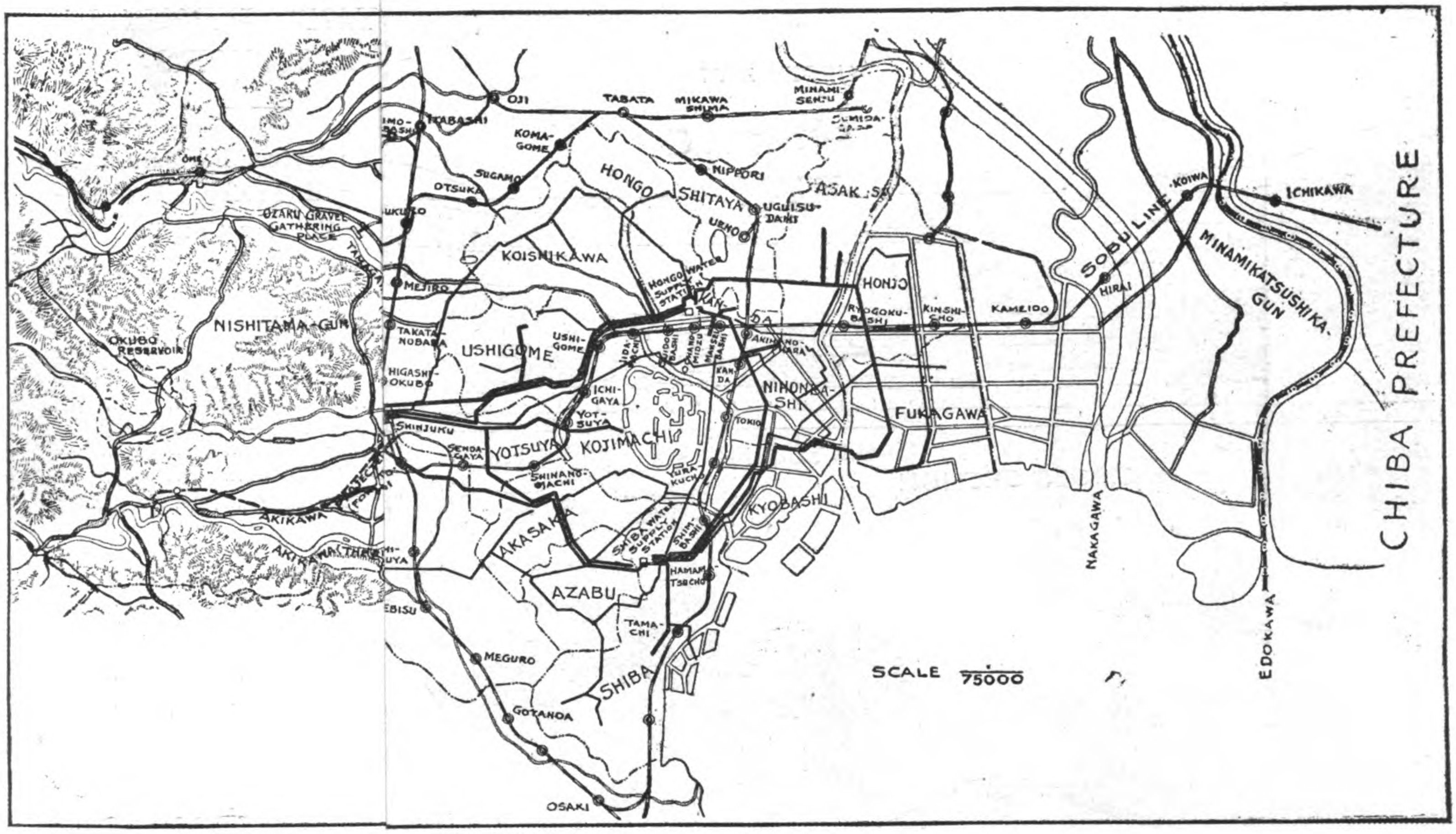
The total length of these distribution pipes is 517 miles, varying from 100 m.m. to 1,100 m.m. in diameter. Just before the earthquake in August 1923, water was supplied to 390,784 houses through 241,475 connections. The total supply capacity of the water works was originally based on 4 cu. ft. per capita per day for a population of 2,000,000, but the supply is now calculated to furnish 6 cu. ft. per day to a population of 1,500,000. The total cost of the water works system including the construction of the small extension works at Yodobashi was about £1,000,000.

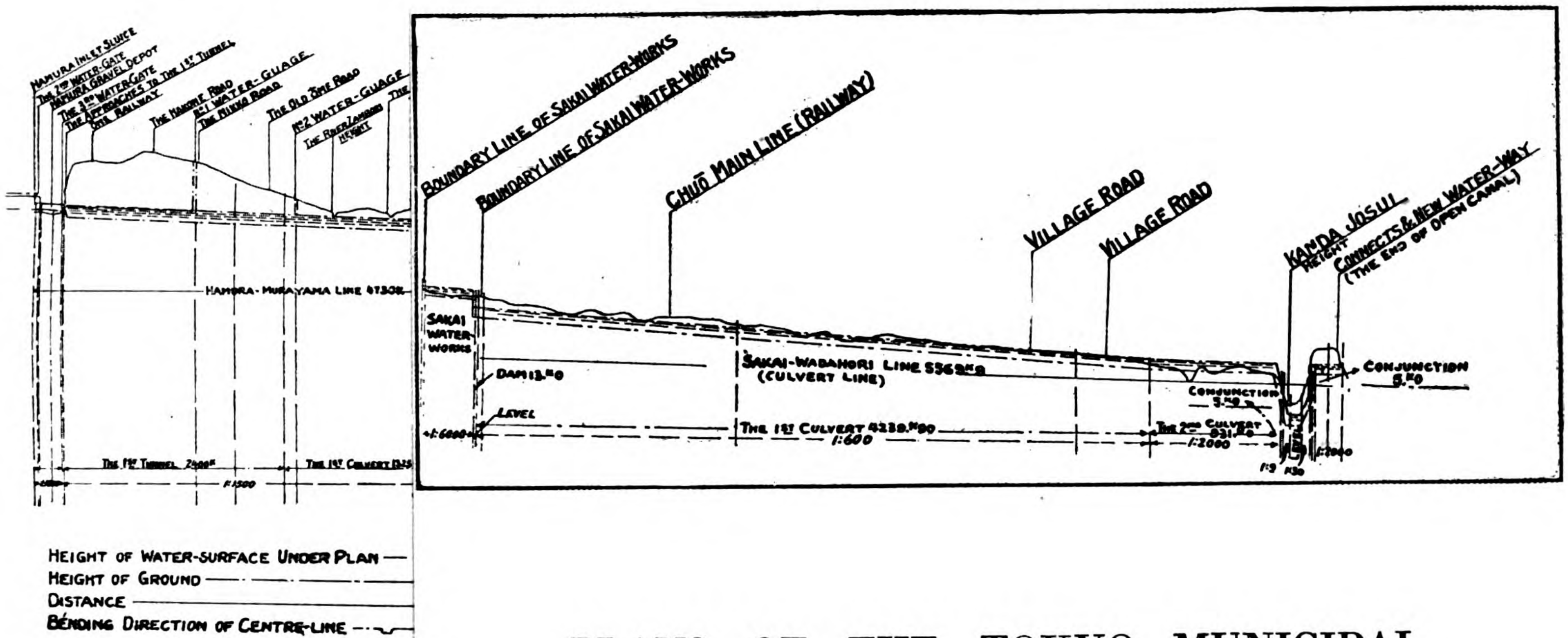
Preservation of Water Sources

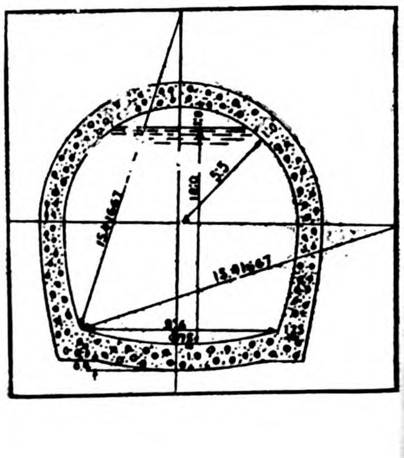
An extensive program of afforestation of public lands was initiated by the Imperial and Prefectural authorities in October, 1910 in order to preserve and protect the Tama River water shed. This work has since been extended to private lands in Kitatsuru and Yamanashi counties, and at present, the Water Works Board owns nearly 40,000 acres of forests in addition to sharing in the profits from several hundred acres of private forests planted in accordance with the forestry regulations.

Extension Plans

For the extension and improvement of the original water works scheme, new plans involving and expenditure of approximately £5,400,000 were drawn up by the Street Improvement Committee in December, 1911 and approved by the Home Minister in September, 1912. Although the war and the earthquake operated to delay the work, about eighty per cent. of the program has since been completed. The new extension scheme derives its water supply from the Tama River, with the intake not far from that of the original system. The water is to be stored in two





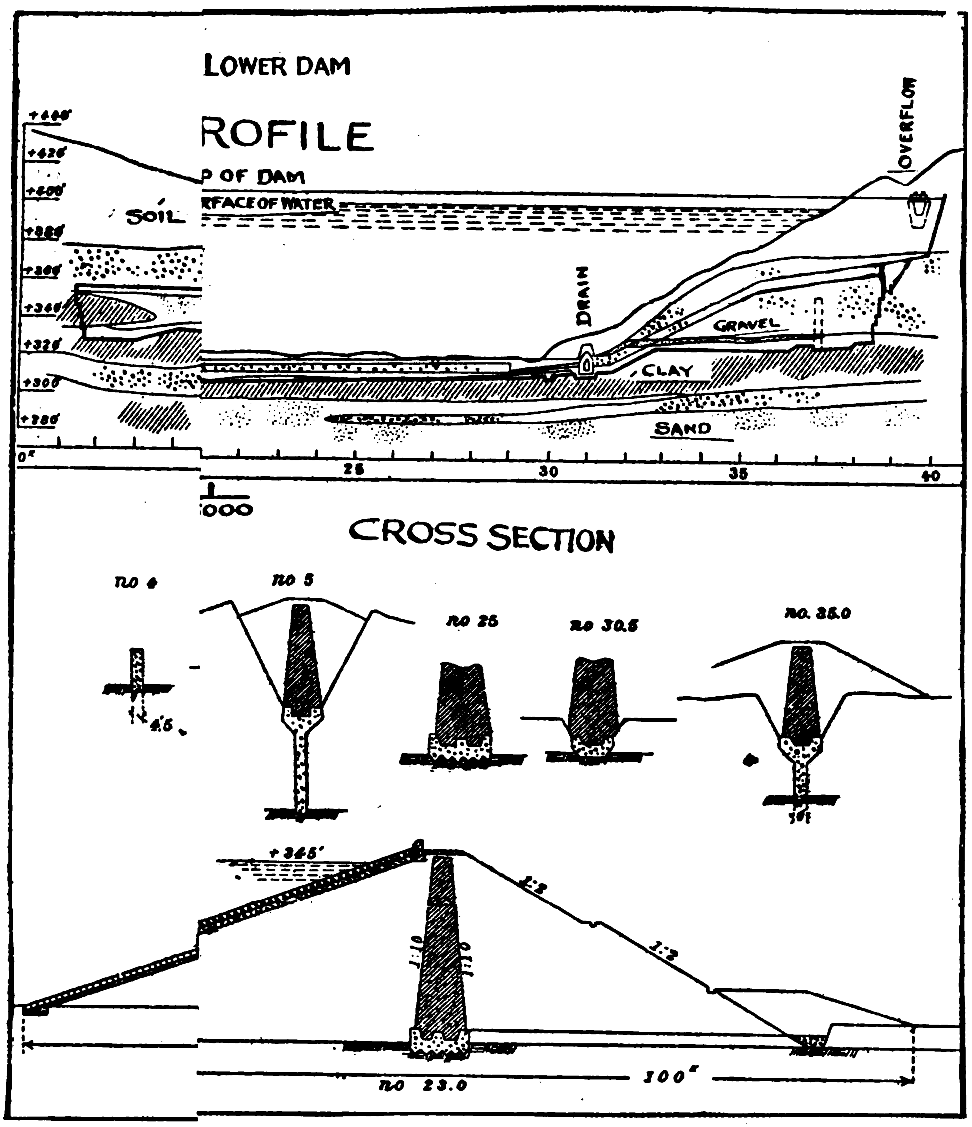


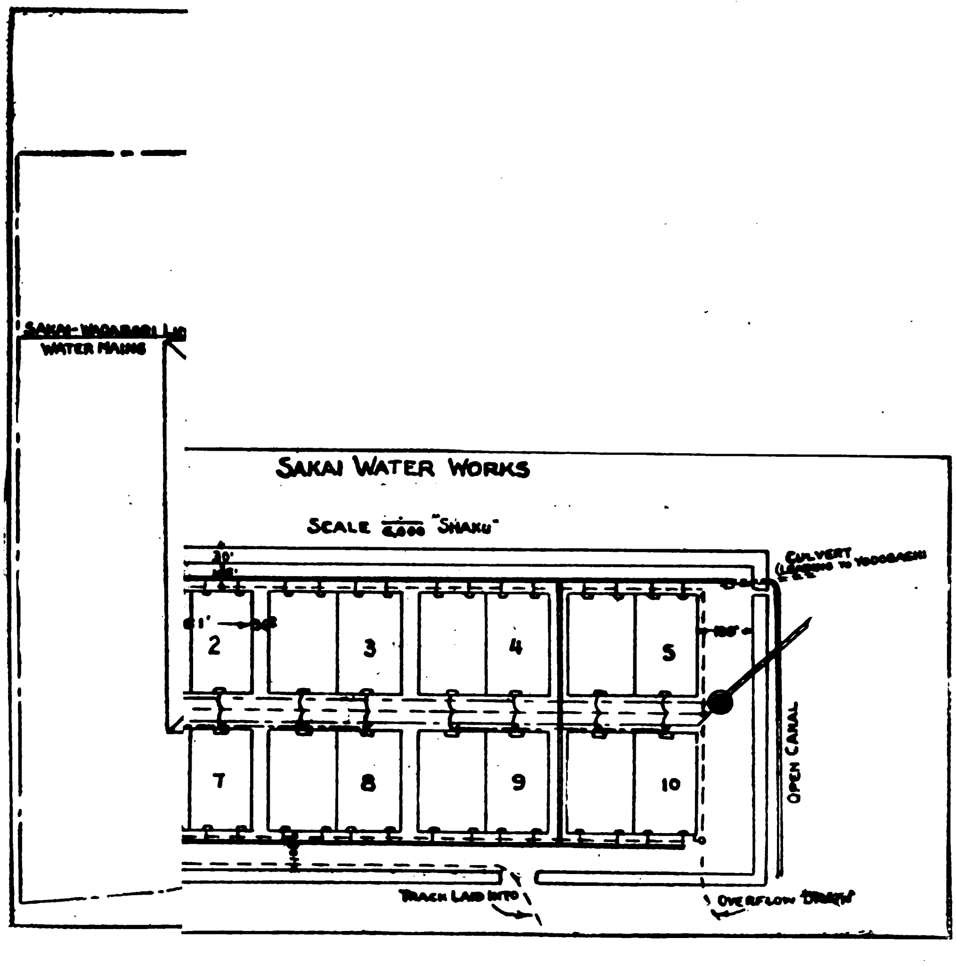
PLANS OF THE TOKYO MUNICIPAL WATER WORKS SYSTEM

Reconstruction Number of

THE FAR EASTERN REVIEW

June-July, 1925





MURAYAMA IMPOUNDING RESERVOIRS

Showing Geological Formation, Dam Sites and Profile of Dam Construction

Outline of Reservoir

	Tsubo (in Area)
BASIN	1,100,000
SUPERFICIAL AREA OF WATER WHEN FULL	482,000
DO. UPPER RESERVOIR	138,000
DO. LOWER RESERVOIR	344,000

DEPTH OF WATER WHEN FULL:
UPPER RESERVOIR ... ... 66 *shaku*
LOWER RESERVOIR ... ... 80 „

EFFECTIVE DEPTH:
UPPER RESERVOIR ... ... 50 *shaku*
LOWER RESERVOIR ... ... 62 „

	Cubic *Shaku*
VOLUME OF WATER WHEN FULL	... 648,450,000
DO. UPPER RESERVOIR	... 138,000,000
DO. LOWER RESERVOIR... ...	... 510,450,000
WIDTH (at the widest place) ...	...About 11 *cho*
LENGTH	...About 40 „
CIRCUMFERENCE	...About 2 *ri* and 25 *cho*

	Upper dam.	Lower dam.
HEIGHT (above the Bottom)	... 71 *shaku*	85 *shaku*
DO. (Above the base of dam)	... 80 „	100 „
LENGTH	...175 *ken*	323 *ken*
WIDTH OE TOP OF DAM	... 21 *shaku*	24 *shaku*
WIDTH OF BASE OF DAM	... 90 *ken*	100 *ken*

MAXIMUM CAPACITY OF WATER OUTFLOW INTO HAMURA-MURAYAMA LINE

600 cubic *shaku* per second

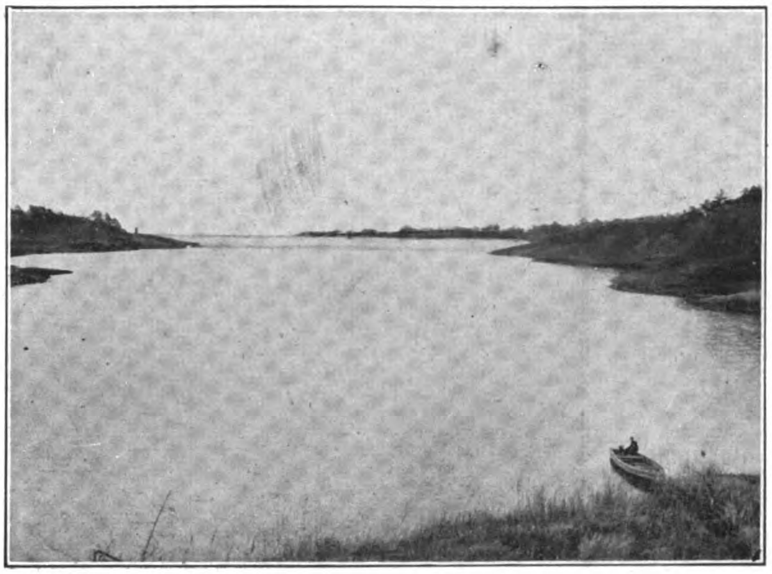
CAPACITY OF WATER TO OUTFLOW INTO HAMURA-SAKAI LINE

250 cubic *shaku* per second

COST OF CONSTRUCTION:

	Yen
EXPENDITURES FOR MURAYAMA RESERVOIR	7,457,993,000
EXPENDITURES FOR UPPER RESERVOIR	2,891,837,000
EXPENDITURES FOR LOWER RESERVOIR	4,359,834,000
MISCELLANEOUS EXPENSES ...	206,322,000

SHAKU = 0.994-ft.
KEN = 6 *shaku*
CHO = 1,200 yard
RI = 36 *cho*
TSUBO = A land measure of 6 *shaku* square.



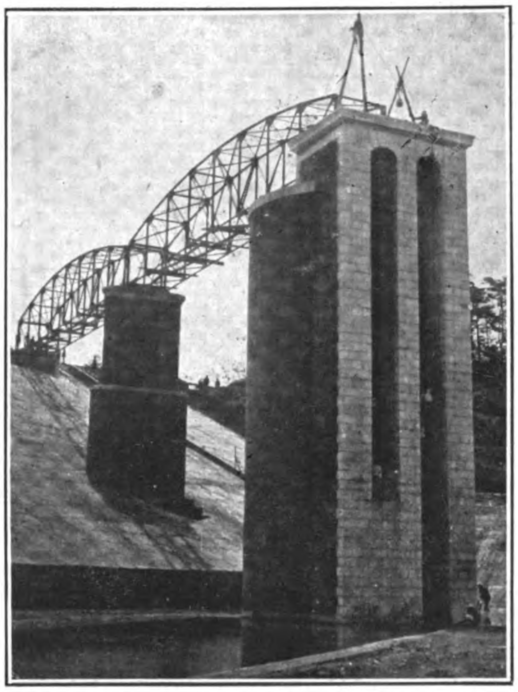
The Murayama Higher Reservoir

impounding reservoirs capable of delivering 6 cu. ft. per head per day for a population of 1,500,000.

General Description

Hamura-Murayama Line : From the intake at Hamura, an open canal, conduit and tunnel capable of conducting 600 cu. ft. per second will pass through the villages of Fussa, Kumagawa, Sunagawa and Nakato and discharge into the Muruyama impounding reservoirs. The length of this line is about 5.4 miles, the open canal having a gradient of 1,-1,000 with a depth of four feet and the conduit and tunnel a gradient of 1,-1,500 with a depth of 10-ft.

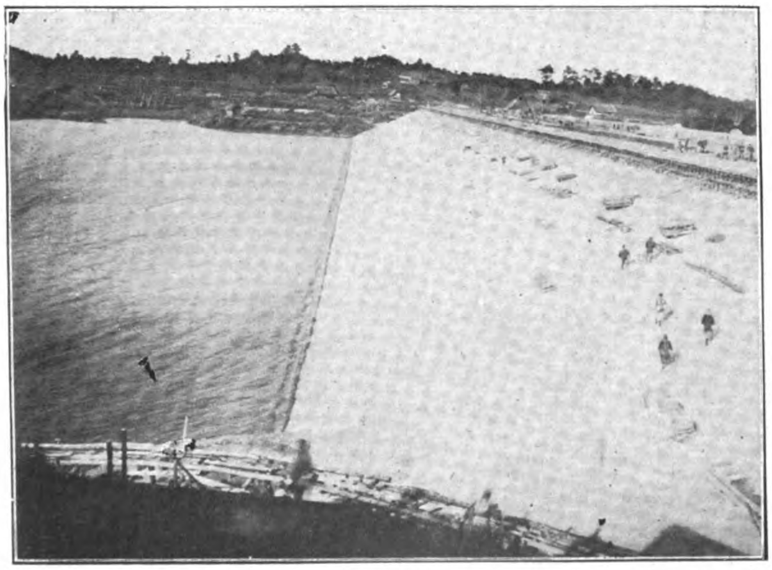
Muruyama Impounding Reservoir : The two reservoirs at Muruyama, designated as the upper and lower, are formed by means of two earthen dams, one at Imokubo and the other at Yakebe. The protecting dam for the upper reservoir has a height of 80-ft. above base line and 71-ft. above the reservoir bed. Its length is 1,050-ft. with a top width of 21-ft. Near the southern extremity of the dam where the reservoir forms a bay, an outlet tower has been erected. From the inside of the tower the water flows through a tunnel to the lower reservoir. A spillway near the outlet tower permits the overflow from the upper reservoir to pass to the lower reservoir by means of conduits and tunnels.

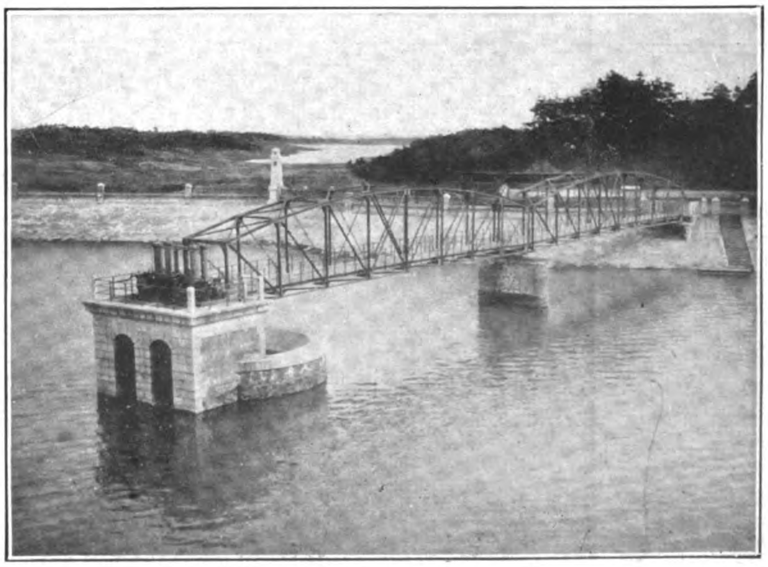


Intake Tower: Higher Murayama Reservoir

The maximum capacity of the lower reservoir is 510,000,000 cu. ft. The height of the dam above base line is 100-ft. and 85-ft. above the bed, with a length of 1,928-ft. and a top width of 24-ft. An outlet tower is erected in a bay at the southern end of the reservoir near the dam through which the water flows into the Muruyama-Sakai conduit. Near this tower is a waste weir or gate through which the overflow of the lower reservoir above high water level is conducted by an conduit, open canal and pipes to the Muruyama River.

Muruyama-Sakai Line : The tunnels and conduits between the Muruyama impounding reservoirs and the Sakai filter beds, designated as the Muruyama-Sakai line, pass through the villages of Shimizu,

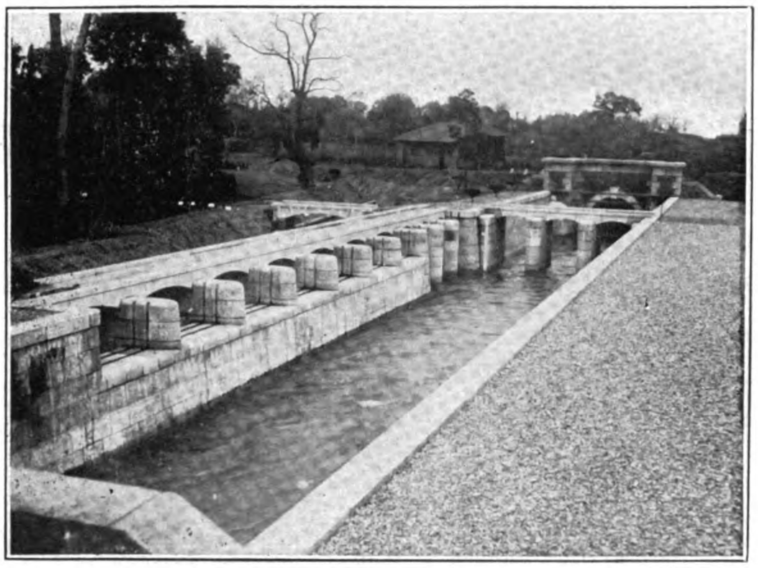




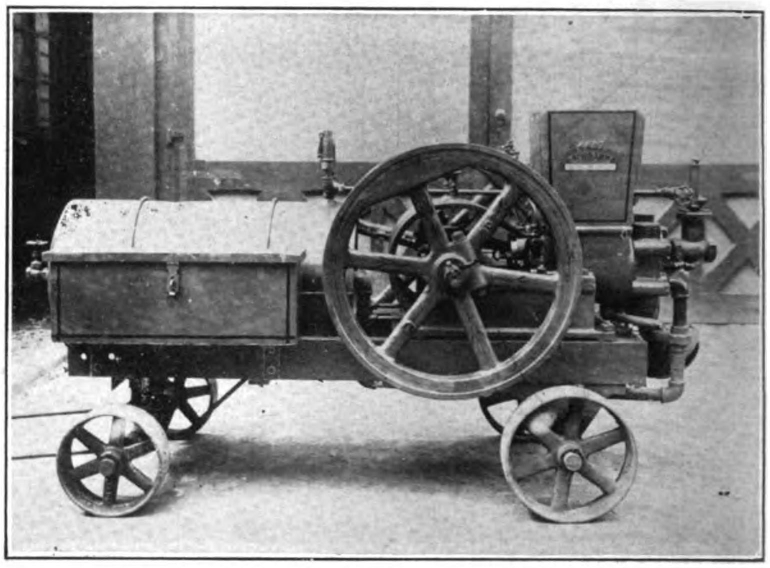
MURAYAMA HIGHER RESERVOIR

Concrete Block Pitching: Upper Dam

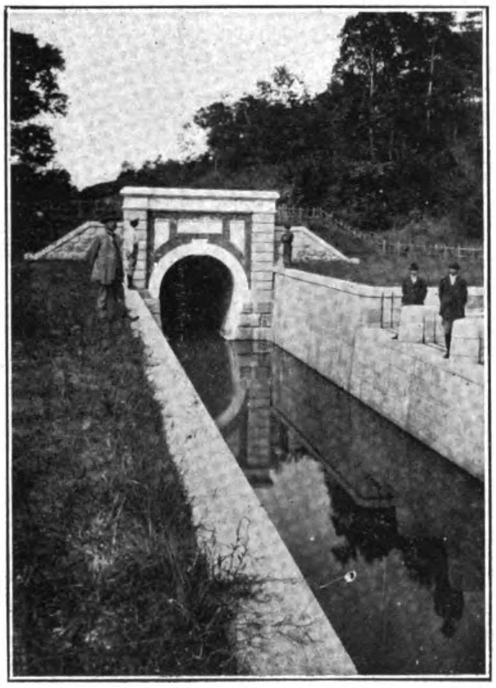
Intake Tower



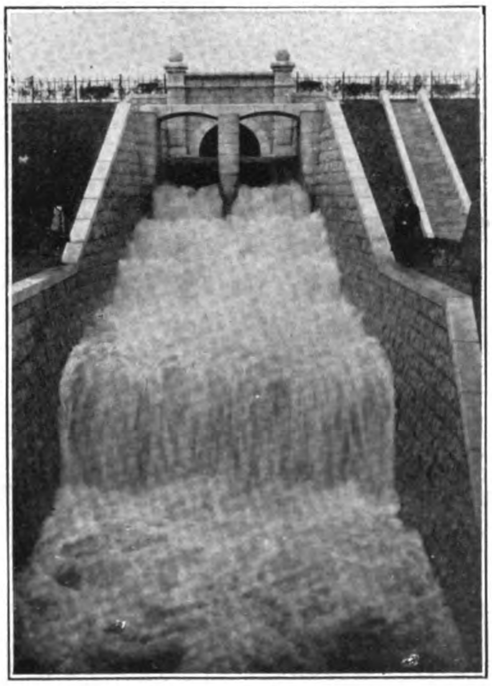
Waste Weir: Murayama-Sakai Line

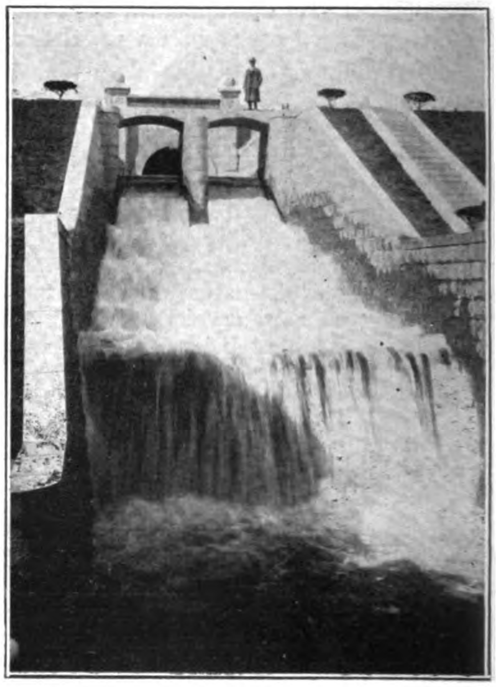


Calking Machine



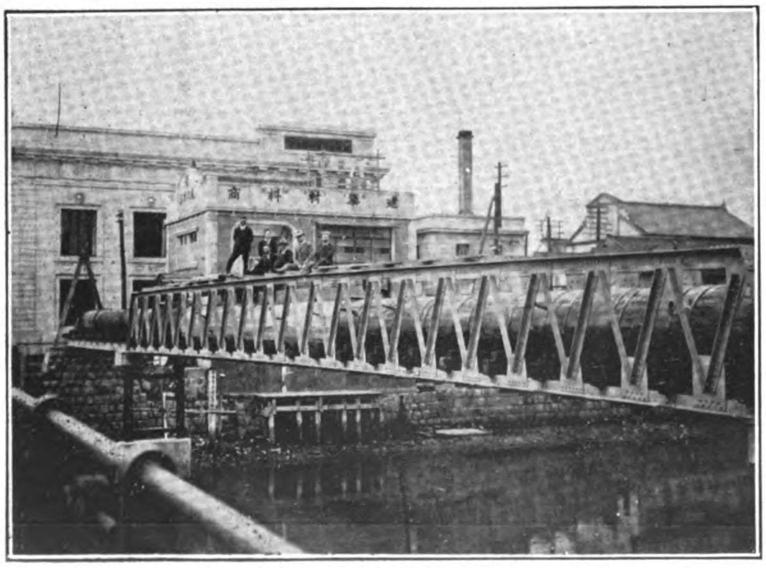
Waste Weir



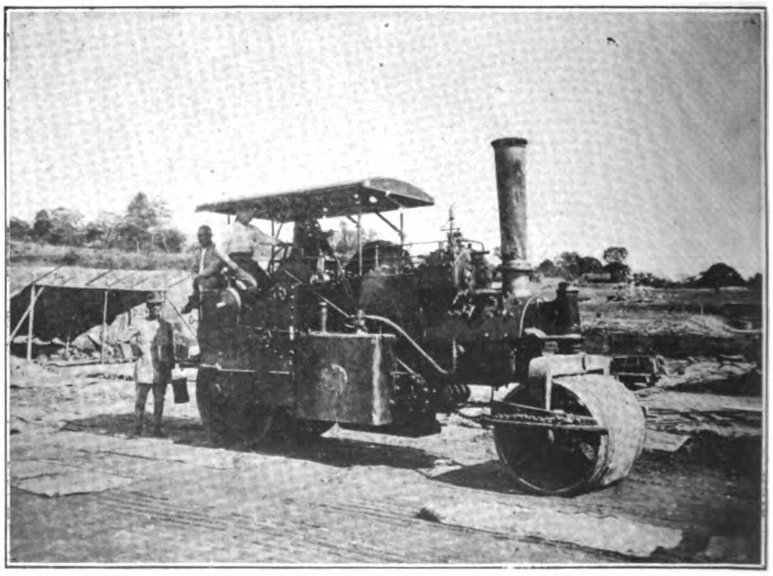


THE MURAYAMA-SAKAI LINE

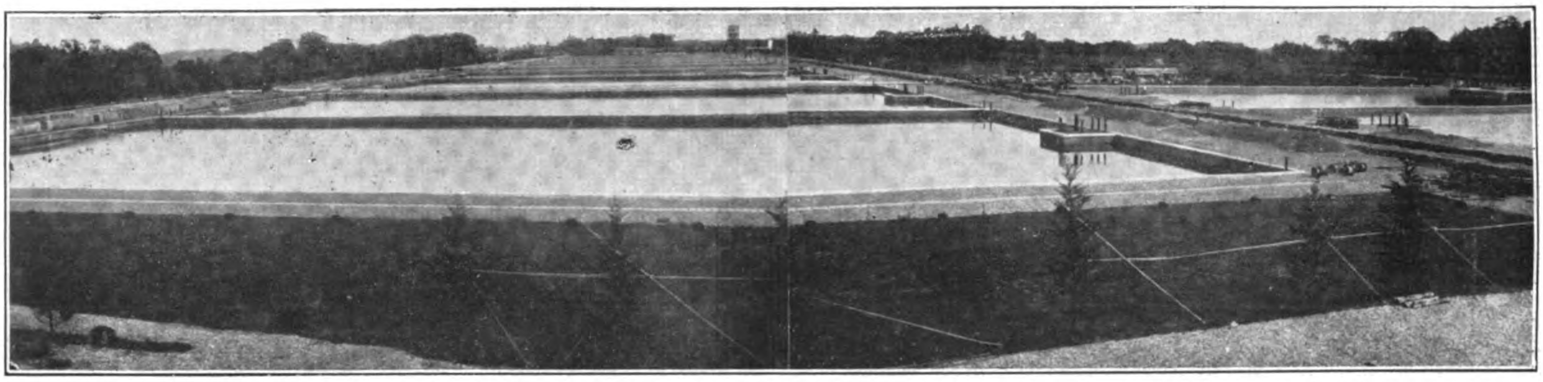
Water Falls for Reducing Pressure



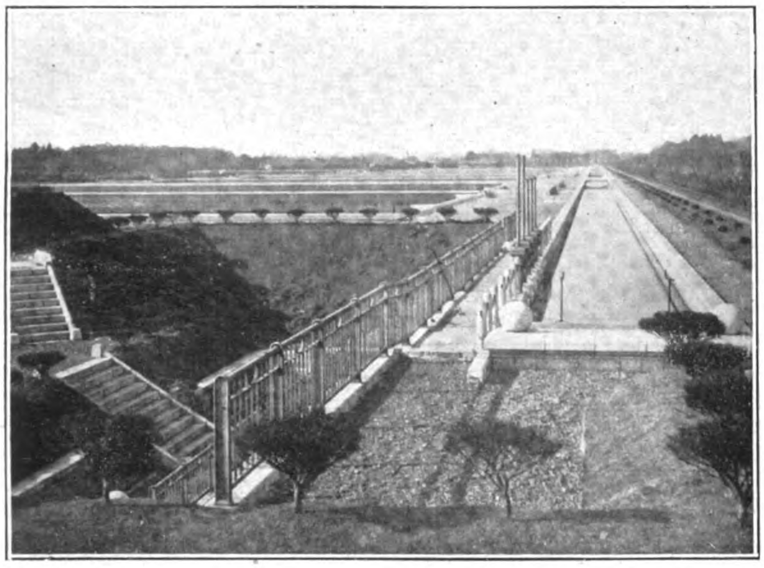
Bridge for Street Main

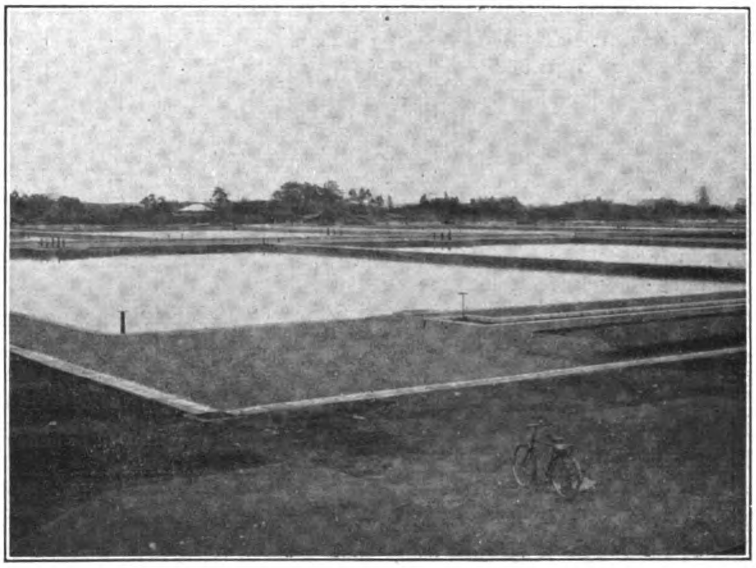


Steam Roller on Murayama Reservoir Dam

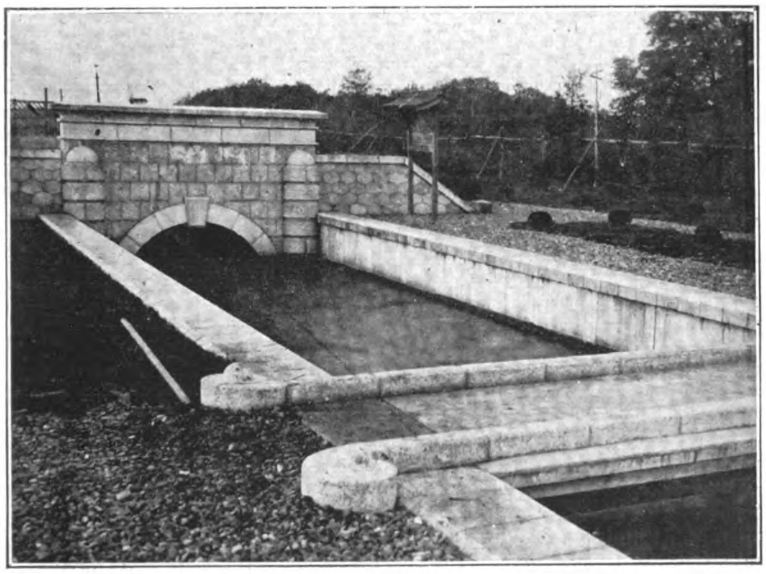


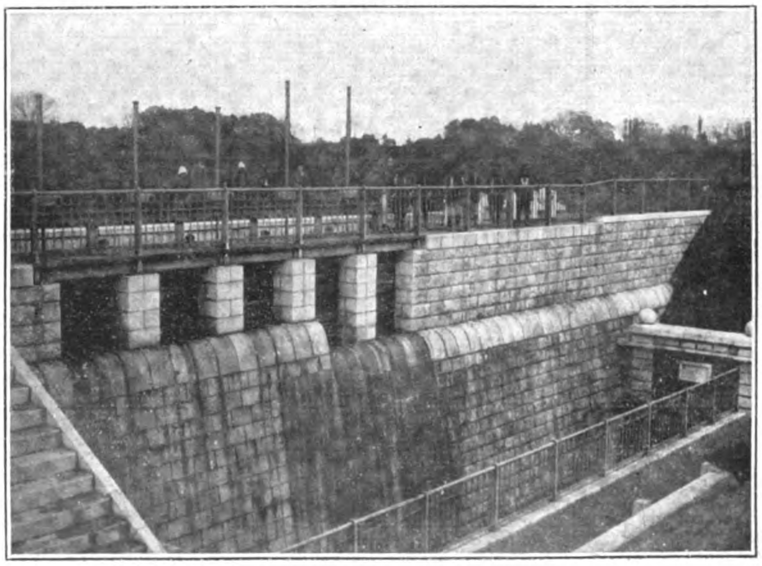
Sakai Filter Beds





Intake Canal and View of the Sakai Filter Beds





SAKAI FILTER BEDS

Inlet Open Canal

Submerged Weir at Terminal of Open Canal

Higashi, Muruyama, Koganei and Musashino. The length of the line is about 7 miles with a gradient of 1-1,000 and 1-1,200 according to the location. The water depth is 5.6-ft. for the tunnel and 6-ft. for the conduit with a flow of 250 cu. ft. per second.

Sakai Filter Beds: Huge filter beds are constructed at Sakai village, where over half the water from the Muruyama-Sakai line flows to the filter beds through cast iron pipes and after filtration carried to the Wadabori service rsservoir through mortar lined steel pipes, designated as the Sakai-Wadabori line. The other half is delivered to the existing Daita aqueduct from the conduit of the Sakai-Wadabori line.

The total area of the Sakai filter beds is 23 acres to be divided into 20 sections, (of which, 12 are completed), filtering 100 cu. ft. per second. The filtering rate is 10-ft. in 24 hours, permitting three sections to be held in reserve or utilized for washing or other purposes.

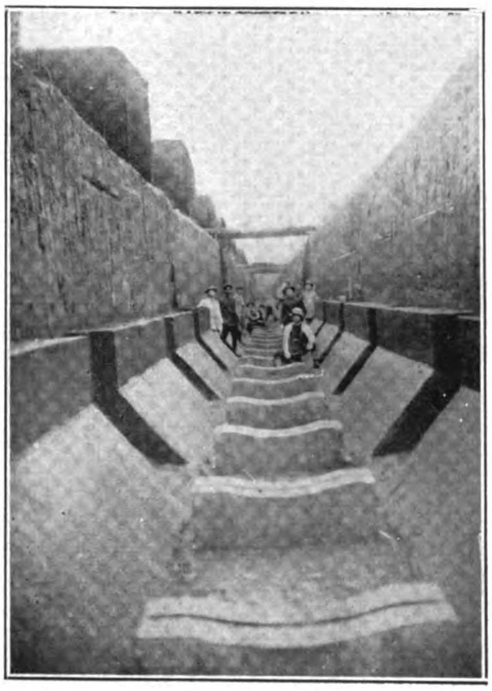
Sakai-Wadabori Line: The water from the Sakai filter beds is conveyed to the Wadabori service reservoir through a 6-ft. 3-in. mortar lined and concrete protected steel pipe and a concrete conduit, 6.7 miles long, at a flow in the pipes of 100 cu. ft. per second. The mortar lined steel pipes convey the clear filtered water to the Wadabori service reservoir and the

concrete conduit carries the unfiltered water to the Daita aqueduct. This unfiltered water from the Muruyama reservoir, largely the overflow from the submerged weir located at the terminal of the open canal at the Sakai filter beds, flows into a collecting canal. The concrete conduit has a length of 6.3 miles with a gradient of 1-500 for the first 3.48 miles and 1-1,800 for the remaining distance, with a water depth of 3.65-ft. discharging at the rate of 125 cu. ft. per second.

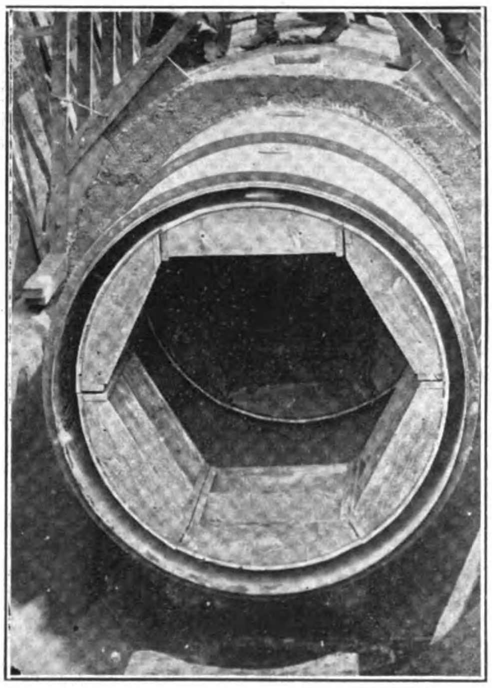
Wadabori Service Reservoir: This reservoir, located at Wadabori Village, and storing the filtered water coming from the Sakai filter beds, has a capacity of 3,000,000 cu. ft. The water level is 190-ft. above datum. The water from this reservoir is divided into two outlets.

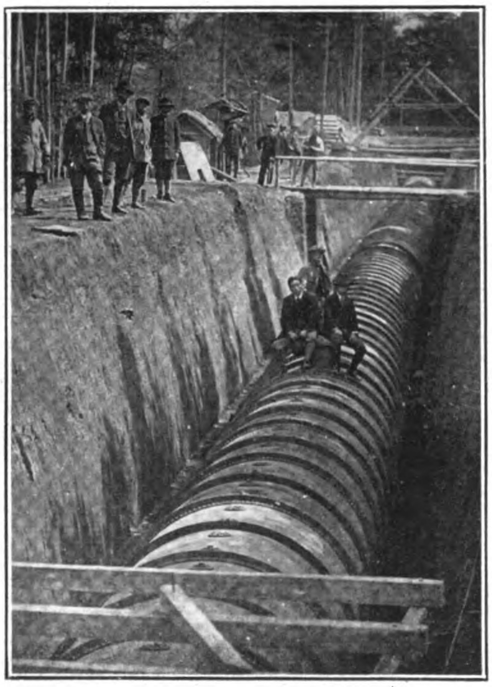
Supply Mains: Two supply pipes 1,500 m.m. in diameter will carry the water from the Wadabori service reservoir in two separate directions connecting with the present gravity distributing system. Another main 800 m.m. in diameter will branch off from Oiwake, Shinjuku, to Sugamo, and be distributed to the high level districts served by the Yodobashi pumping plant. The proposed new mains will vary in diameter from 400 m.m. to 1,500 m.m. with a total length of 48 miles.

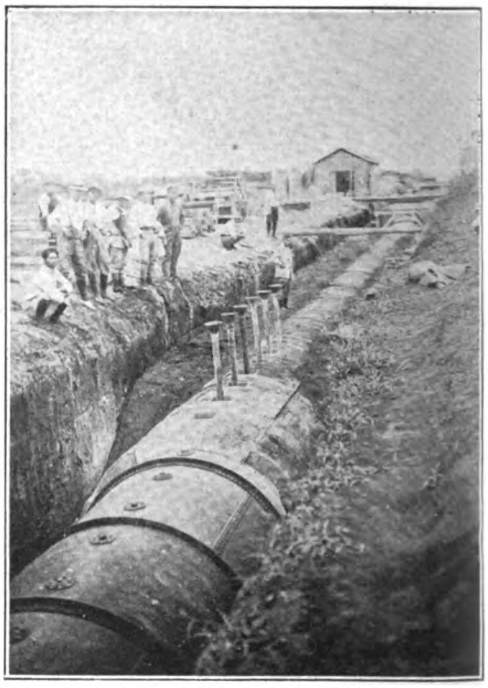
Street Sub-Mains: The length of streets and highways under which distributing pipes have still to be laid is estimated at 170 miles. Cast iron pipes will be used in all these streets as sub-mains.



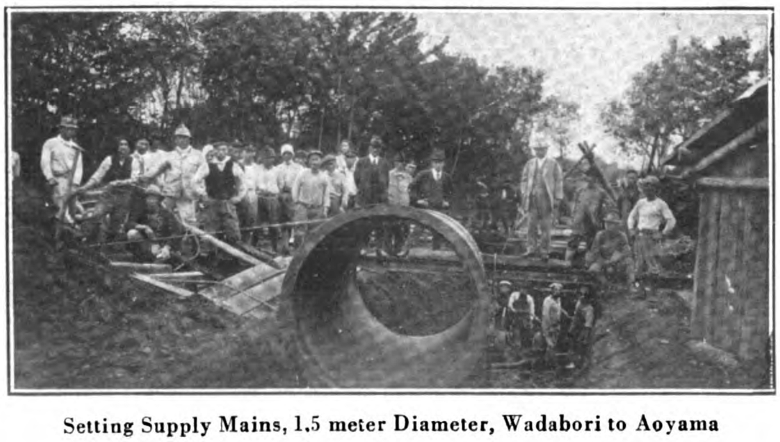
Concrete Cradle for Mortar Lined Steel Pipe on Sakai-Wadabori Line



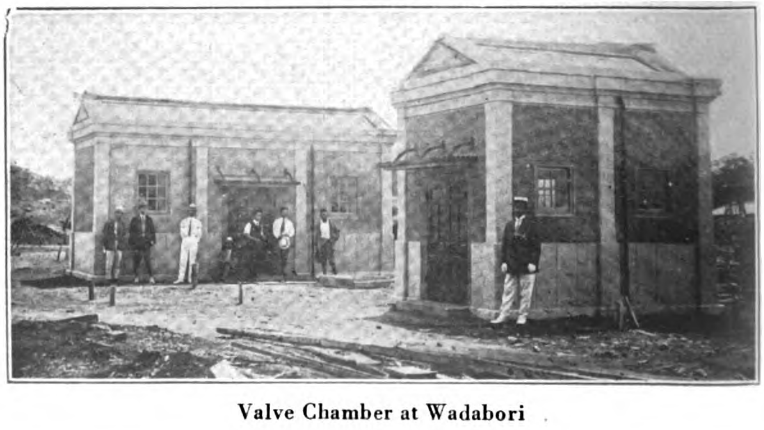




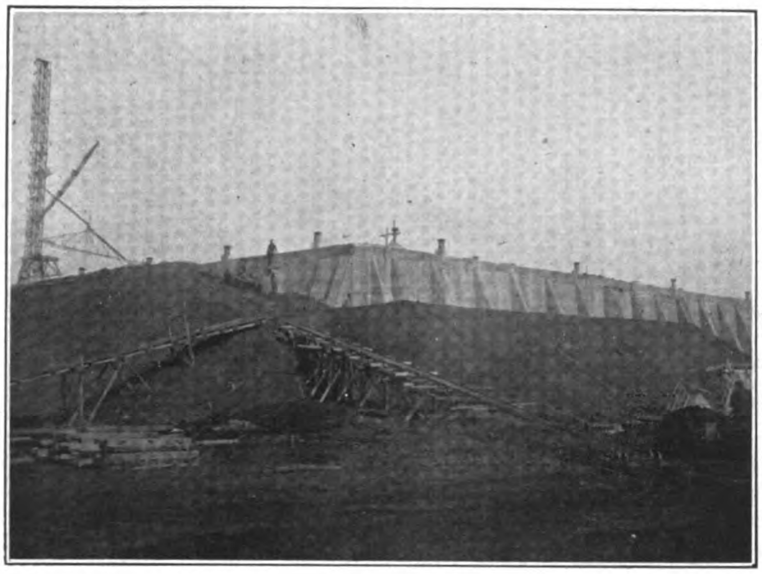
Laying and Grouting the Mortar Lined Steel Pipe of the Sakai-Wadabori Line

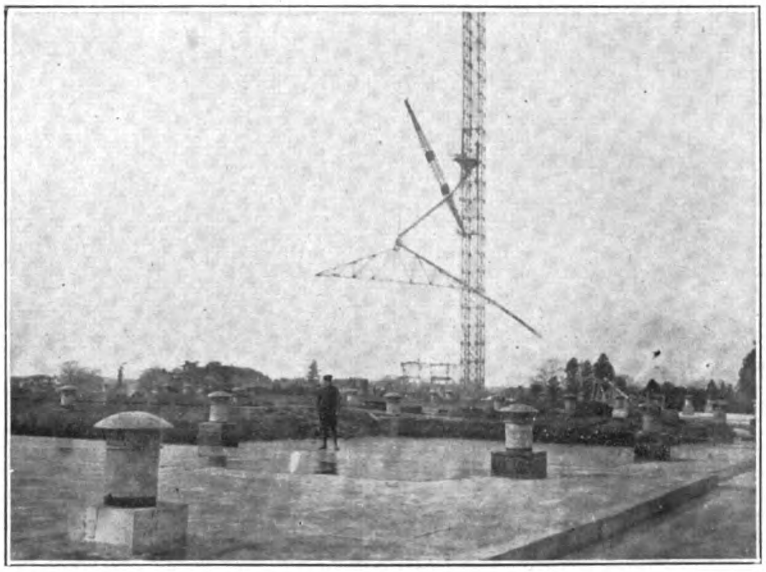


Setting Supply Mains, 1.5 meter Diameter, Wadabori to Aoyama



Valve Chamber at Wadabori

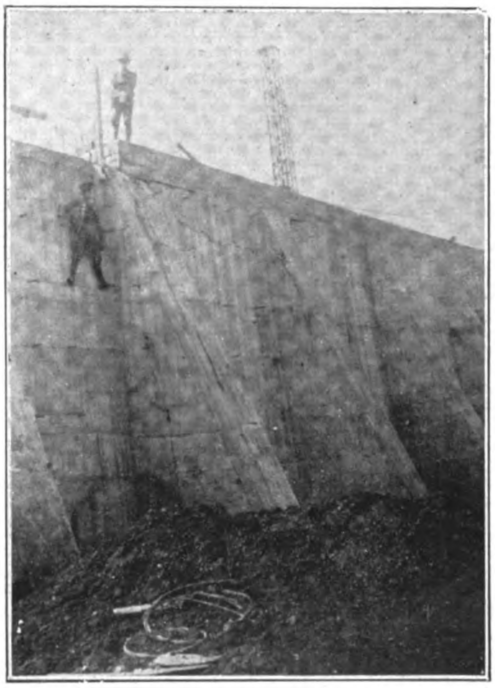




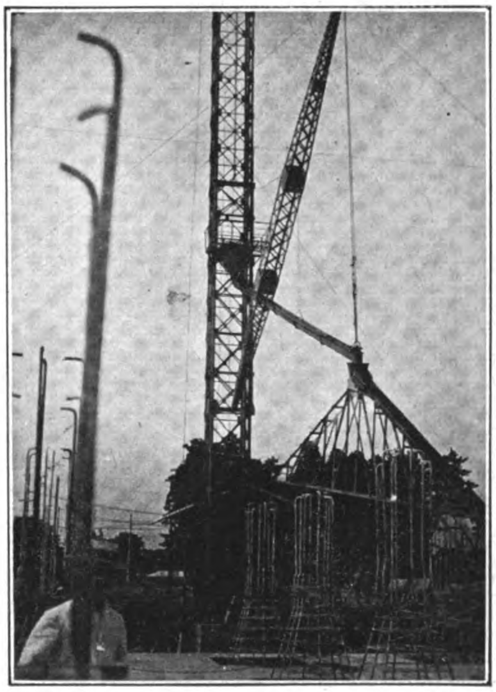
Wadabori Service Reservoir Showing Roofing

Earthquake Damage to Water Works System

The great earthquake caused considerable damage to the existing water works system of Tokyo. The Daita aqueduct, a concrete canal about 2½ miles long, conducting water from Daita to the Yodobashi station, was constructed about 36 years ago with embankments 10 to 50-ft. high. This canal was completely destroyed for a length of 120-ft while other parts settled, leaving another opening 120-ft. long. Large and small cracks occurred in about 240 places.



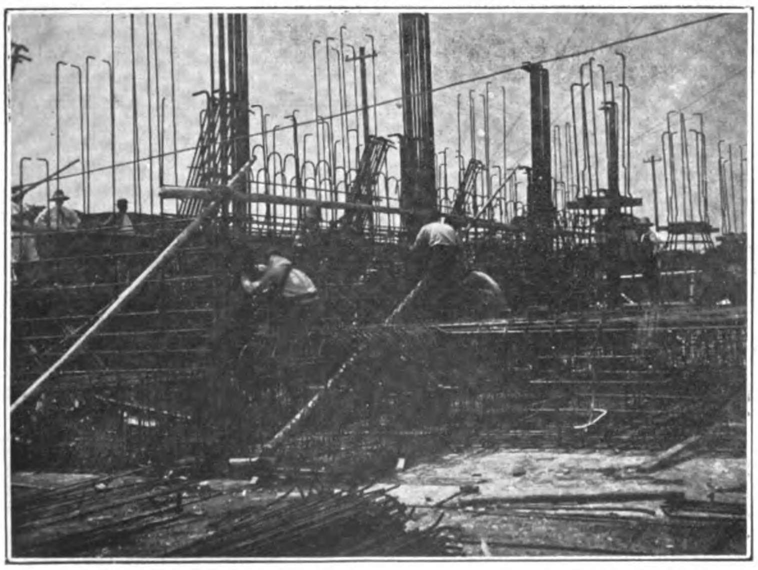
Cracks on Concrete Side Wall of the Wadabori Service Reservoir Made by Earthquake

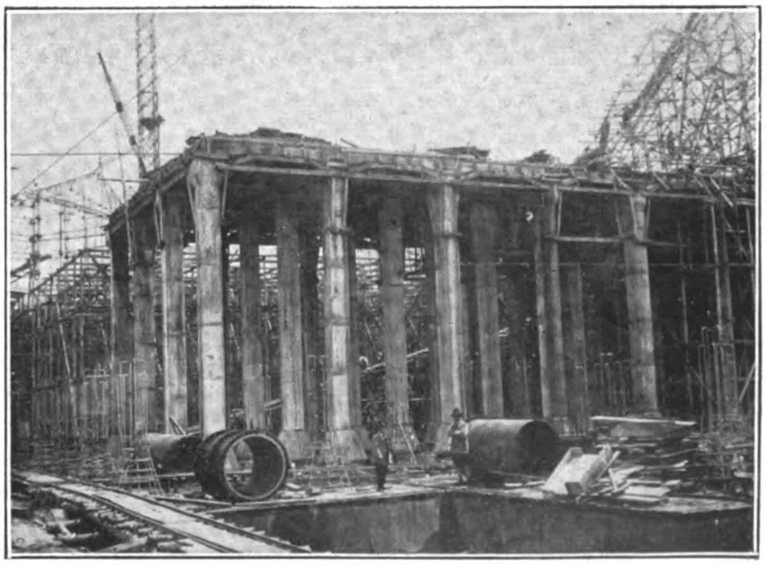


Construction Work on Wadabori Service Reservoir

At the Yodobashi pumping plant, the side wall and pitching of concrete blocks of one of the four basins was partly destroyed and 18 of the 24 filter beds badly damaged. Many cracks appeared on the side walls and beds of the service reservoirs while the pumping machinery was badly damaged and the two chimneys, 121-ft. high, were both broken off 10-ft. from the top. The plant was so badly damaged that it had to be closed down for repairs.

The distributing mains and the submains, (all socket and spigot cast iron

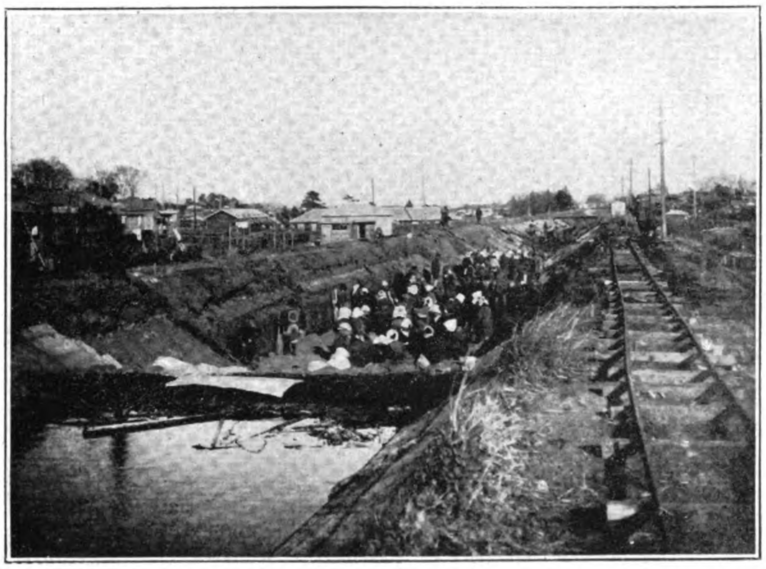
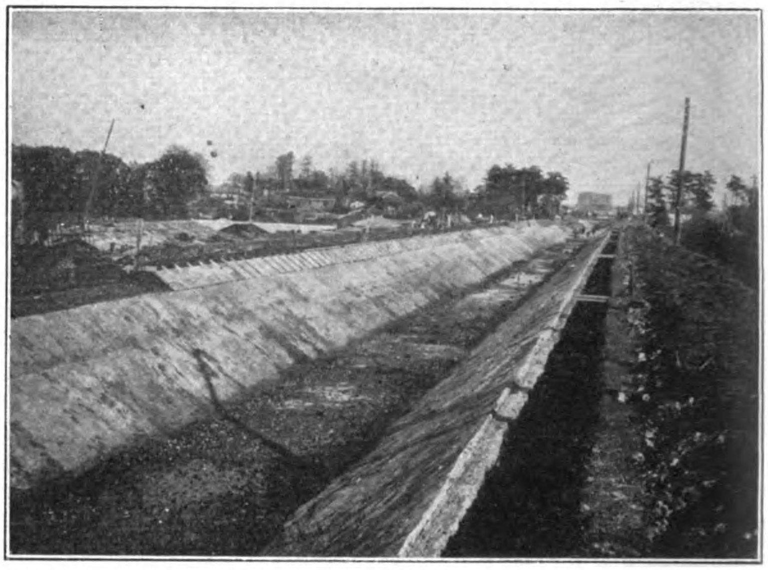




WADABORI SERVICE RESERVOIR

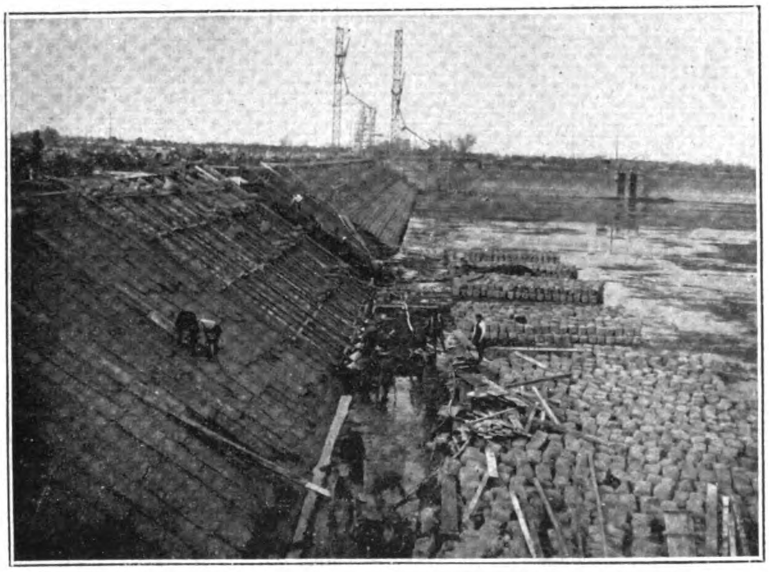
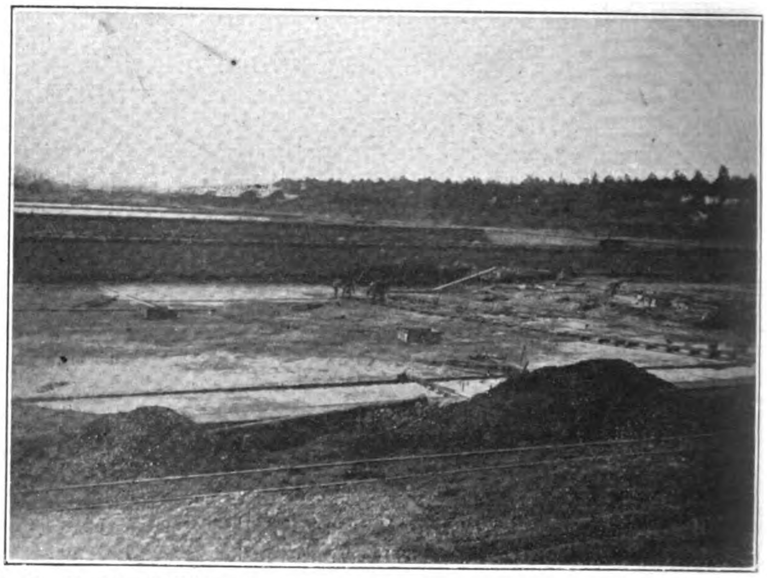
Arrangement of Reinforcing Bars

Pillars

Repairing Earthquake Damage to the Daita Aqueduct

pipes), suffered the greatest damage. The number of broken and bent joints were 235, with 159 broken hydrants and valves and 268,682 loosened joints. Within 30 days after the earthquake, 438 miles of pipes in the distributing system, all the mains, hydrants, etc., were fully repaired and in working order. Of 241,675 water taps, 64 per cent. (155,103) were destroyed by

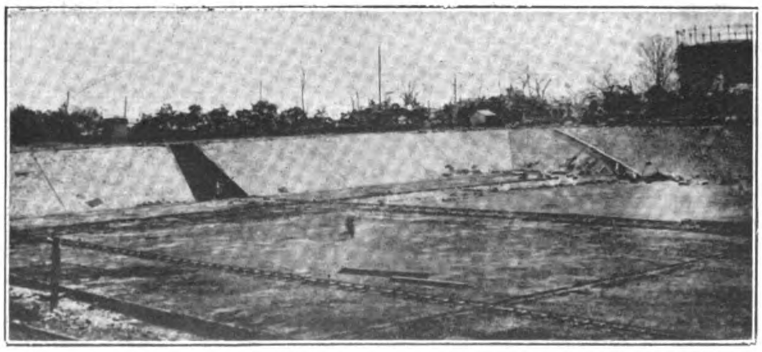
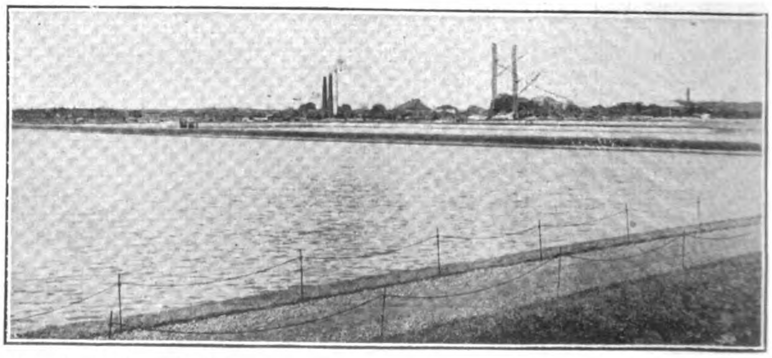
Repairing Earthquake Damages to the Yodobashi Filter Beds

the fire. By the end of September, 1924, 101,147 were replaced and working.

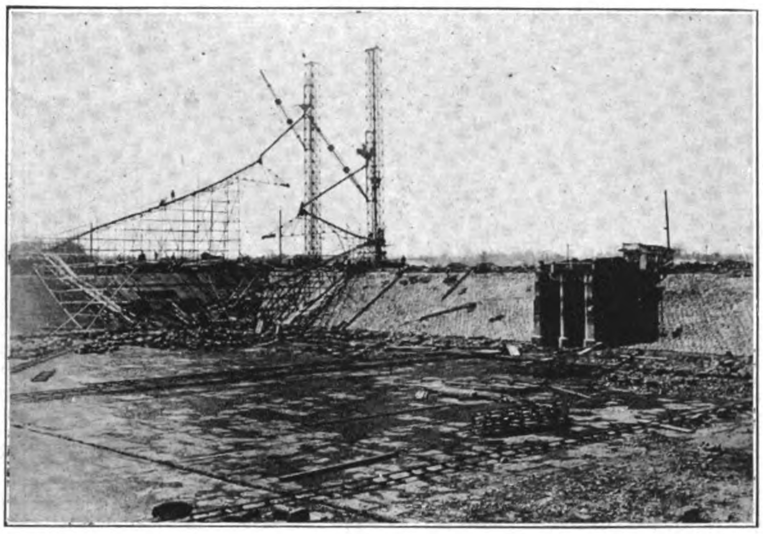
The upper dam of the Muruyama reservoir (completed three months before the earthquake), sunk 7-in. on its top surface while the 6-ft. by 6-ft. by $1\frac{1}{2}$-ft. concrete blocks on its pitch were moved and twisted a few inches and sunk about $\frac{1}{2}$-in. The wave protection wall in the reservoir was broken in three places ; 90 per cent. of the top drainage ditch destroyed ; the reclaimed land behind the dam sank 4-ft. in the centre and cracks 4-in. to 5-in. wide appeared at both sides. In addition, the drain ditch at the foot of the dam sank and was pushed and twisted off at many places.

The lower Muruyama dam, in course of construction, had been built up to 54-ft. from bed line (about half its total height). The force of the quake split it longitudinally for 200-ft. the fissure being 32-ft. deep.

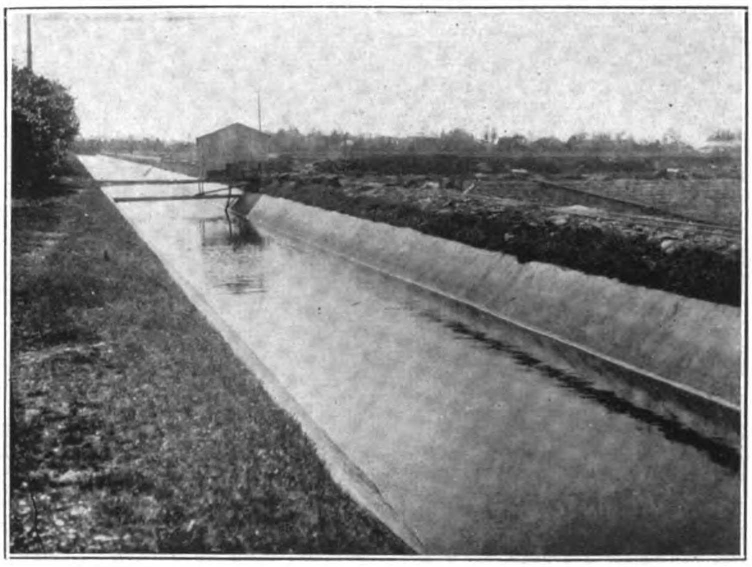
The partly reinforced horseshoe concrete conduit on the Muruyama-Sakai line developed several small hair cracks which were easily repaired. Twelve of the 20 filter beds at Sakai, completed before the quake, being heavily reinforced at the corners, stood the shocks without damage. The inlet open canal, however, was

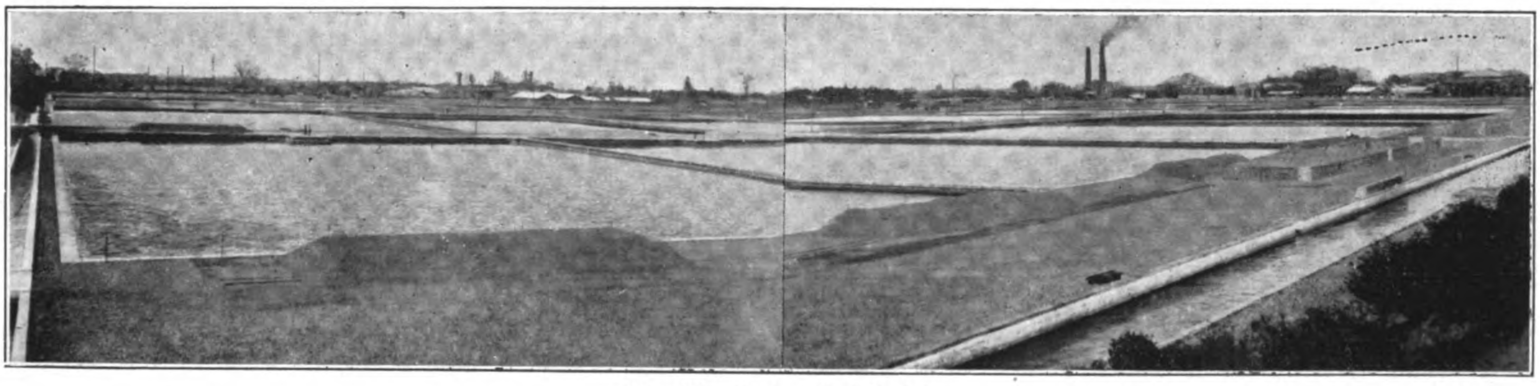
View of Settling Basin and Intake at Yodobashi



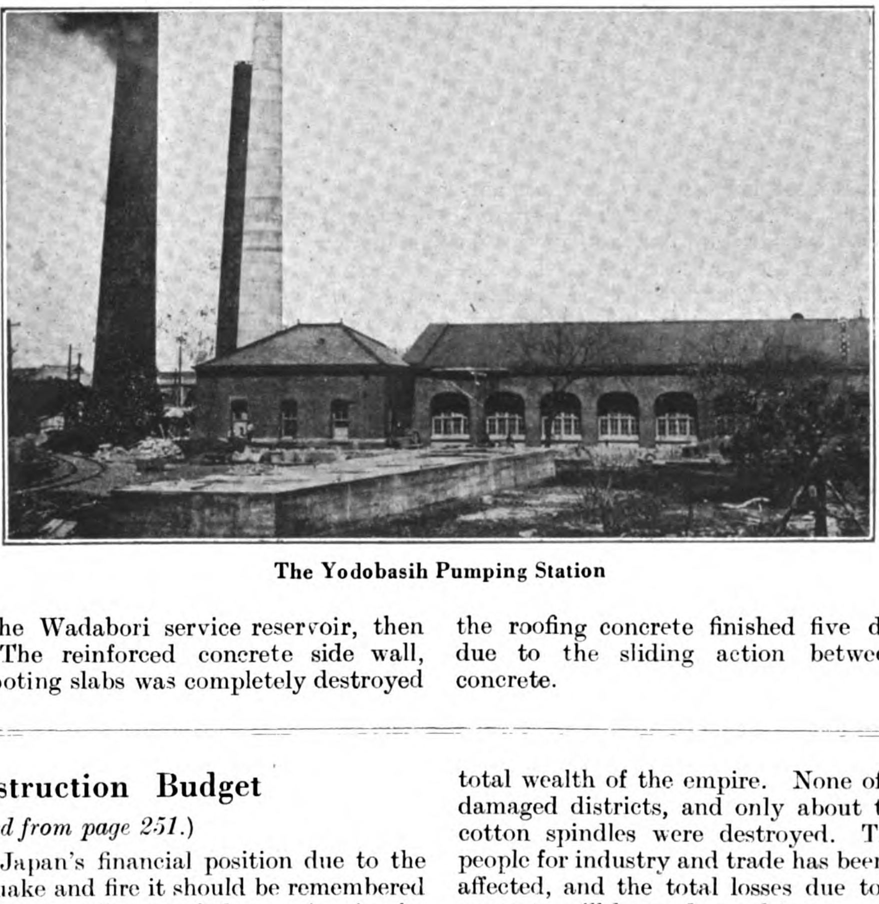
Repairing the Settling Basin at Yodobashi



The Concrete Daita Aqueduct



The Filter Beds at Yodobashi



The Yodobasih Pumping Station

broken at six branch points to the filter beds and developed a crack $\frac{3}{8}$-in. wide and 246-ft. long The outlet conduit was also broken at four branch points where connections were made to earthen pipes by concrete joints.

Many small longitudinal cracks appeared on the inside of the mortar lined steel pipe on the Sakai-Wadabori line and others on the outside concrete finish, from which it would appear that the hammering inside the pipe caused by the seismic shocks, loosened the cement from the steel.

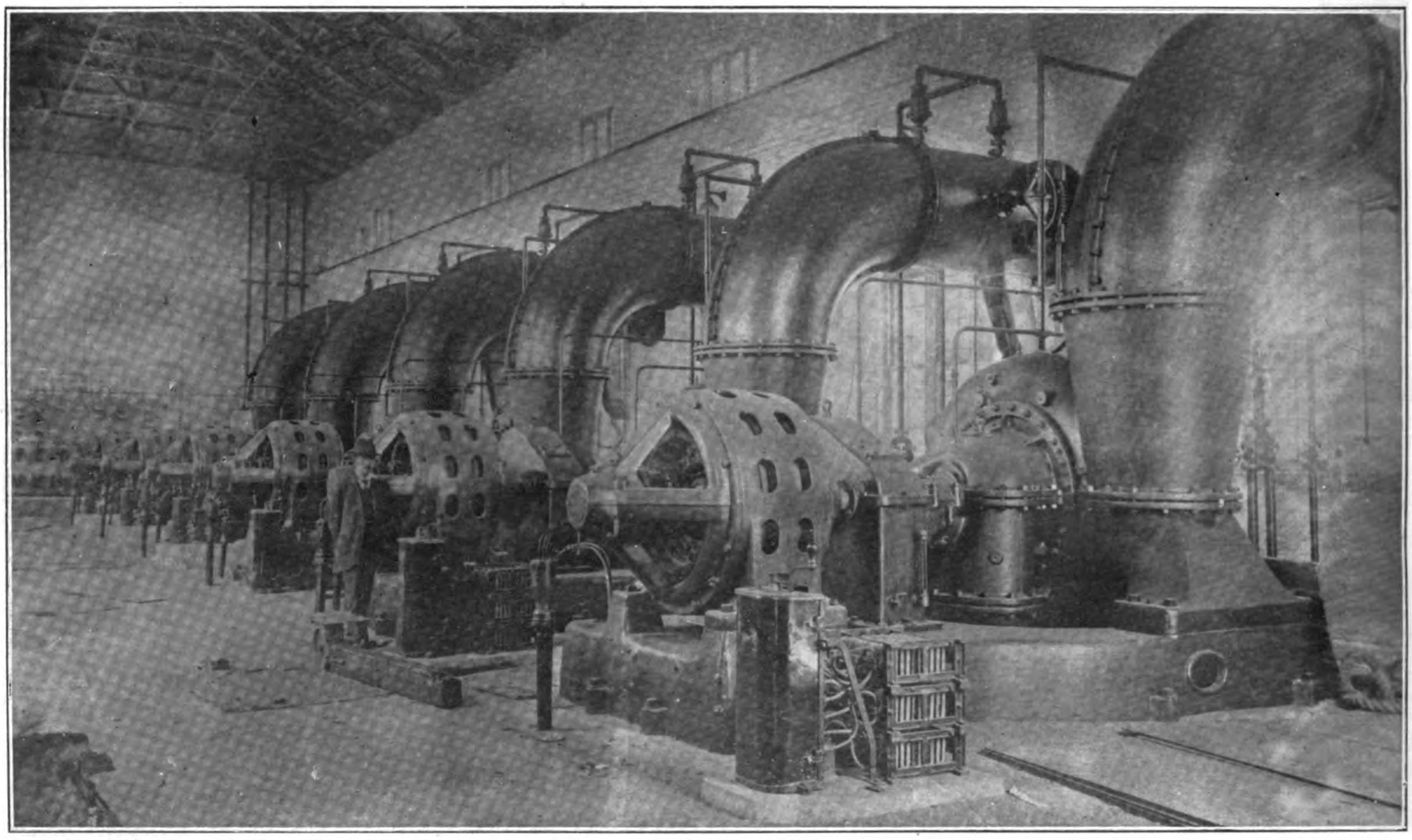
The earthquake damage to the water system was most severe at the Wadabori service reservoir, then in course of construstion. The reinforced concrete side wall, includiug the butresses and footing slabs was completely destroyed in 20 different places, the top of the wall and the connections between the wall and roof receiving the greatest damage. The breakage at these points was so severe that great masses of corcrete were shaken loose and thrown down, exposing the bent and twisted reinforcing bars. Out of 304 reinforced concrete pillars supporting the roof, only 72 come through the quake undamaged.

The expansion and contraction joints in the roof spaced 27 to 56-ft. longitudinally and crosswise, in order to prevent cracking, suffered great damage, while a part of the roofing concrete finished five days before, sank about 6-in. due to the sliding action between the pillars and roofing concrete.

The Reconstruction Budget

(*Continued from page 251.*)

In any consideration of Japan's financial position due to the losses inflicted by the earthquake and fire it should be remembered that the area affected was but a small part of the empire, in the main a center of consumption rather than of production. The estimated property losses represent less than three per cent. of the total wealth of the empire. None of the silk filatures were in the damaged districts, and only about ten per cent. of the country's cotton spindles were destroyed. The capacity of the Japanese people for industry and trade has been only slightly and temporarily affected, and the total losses due to damages and destruction of property will be made good in a comparatively short period by the energy and thrift of the people and the general retrenchment program now being carried out by the Government.



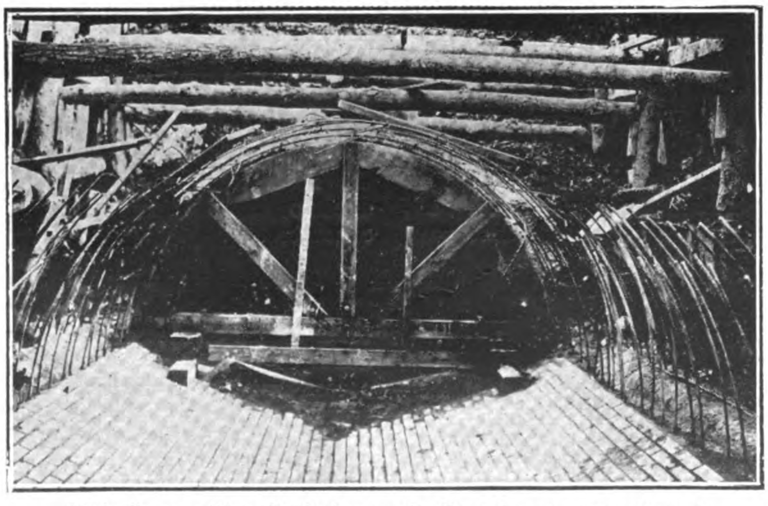
Tamachi Pumping Station

Tokyo's Modern Sewerage and Drainage System

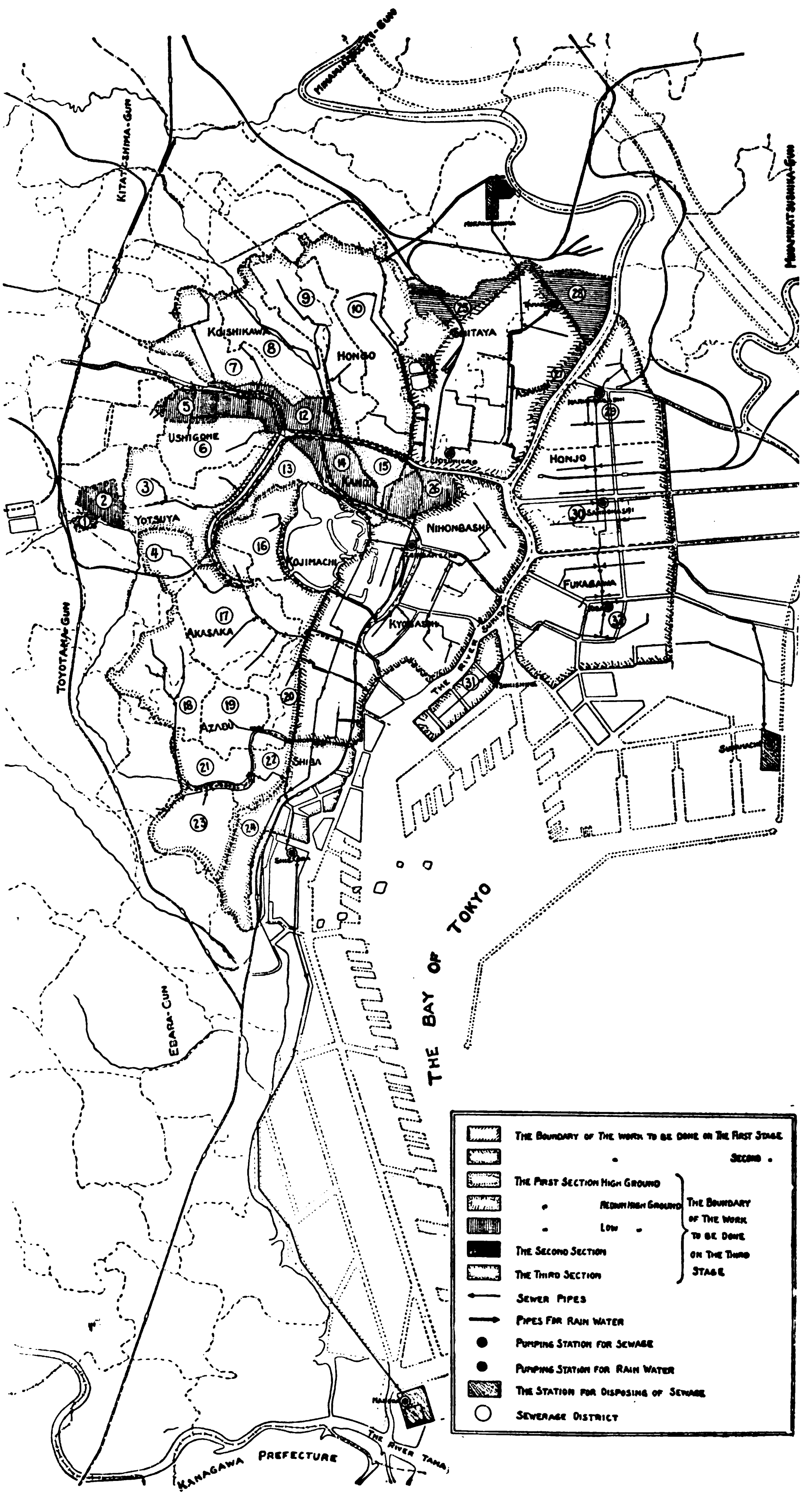
FROM the time of its foundation centuries ago, the surface and waste waters of the city of Tokyo were discharged through open drains into moats, navigable canals and rivers. With the development of the city, these drains were extended and enlarged without system to a point where the public health became endangered. A conflagration which wiped out the Ginza business section in 1871 paved the way for the construction of modern buildings and improved street facilities, and in 1876, the demand for modern sanitation received further accentuation from a violent outbreak of cholera. The Department of Home Affairs at that time authorized the laying of sewage and water mains but work was delayed owing to insufficient funds. Investigations, however, were continued, and with the assistance of an English engineer named Burton, (at that time adviser to the Department of Home Affairs) a sewerage scheme was drawn up but could not be carried into execution until plans for the waterworks system were completed and approved.

The years from 1893 to 1905 were devoted to a thorough survey of the conditions and needs of the city, resulting in complete new plans for a sewage system. In July, 1909, the city Assembly petitioned the Minister of Home Affairs for governmental assistance to the extent of half the estimated cost of the proposed sewerage improvements. A second petition submitted in 1911 elicited the response that as soon as financial conditions were favorable, the Imperial Government would contribute a fixed sum whenever the city started the work on its own initiative. The municipal authorities then appropriated Y. 6,130,000 for sewer construction whereupon the Imperial Government agreed to defray one-third of the estimated costs of construction.

The city of Tokyo, built largely upon reclaimed land at the mouth of the Sumida River is cut by dozens of small streams flowing down from the hills on which are located the residence districts of the city. Many of these streams have been connected or diverted into artificial moats while others act as drainage canals for the frequent heavy rainfalls and the refuse waters of the city.



Main Sewage Line, Built during the First Construction Period



Map of Tokyo Sewerage and Drainage System

A PLAN FOR THE SEWERAGE SYSTEM OF THE CITY OF TOKYO.

The floods of 1910 focused attention on the immediate need of adequate drainage for the city and in the following year plans for a new system were drawn up and approved by the Diet. Work was commenced in 1912, and when the earthquake occurred, several of the most important features of the new system had been completed.

The rapid growth of the city made an adequate drainage system imperatively necessary, for as the suburbs expanded, the streams which served as natural drains were surcharged with sewage before entering the municipal boundaries. Many of these streams, such as the Sen, Otowa, Edo, Waseda and Furu Rivers (each of these names in Japanese ends with "kawa," meaning "river") had to be utilized as the main drainage canals in the new system.

The approved plan provides for the concentration of all the drainage and sewage of Tokyo and surrounding districts into three disposal plants located at Sunamachi, Mikawajima and Shibaura, the last being a temporary plant to be replaced later on by the Rokugo Plant at the mouth of the Rokugo River. Wherever practicable, all surface drainage will be discharged into near-by streams, ponds and moats, while the sewage will be carried to the disposal plants for purification and discharge into the Sumida River and Tokyo Bay.

The new scheme is based on an estimated population of 3,000,000 with a sewage of 6 cub. ft. per capital per day. To this amount (18,000,000 cub. ft.) the highest rainfall, estimated, at 2-in. an hour is provided for, or another 18,000,000 cub. ft. making a total of 36,000,000 cub. ft. a day. In order, however, to discharge this volume rapidly, the plans for the new system have been drawn to carry off 36,000,000 cub. ft., in the space of eight hours, thus leaving an ample margin of safety.

The plans divide Tokyo into three districts:

FIRST DISTRICT: Comprises all of Shiba, Azabu, Akasaka, Yotsuya, Ushigome, Koishikawa, Hongo, Nihonbashi, and Hyobashi Wards; also the greater part of Kanda and a small part of Shitaya.

SECOND DISTRICT: Comprises Asakusa, the greater part of Shitaya and a small part of Kanda Ward.

THIRD DISTRICT: Comprises Honjo and Fukagawa Wards; Since the earthquake, Tsukishima, locatéd in Kyobashi, has been added to this district.

Construction Periods

In the first construction period (1911 to 1923), which work was pushed forward and almost completed in the second district. The cost of construction up to the end of 1924 approximated Y.15,000,000, while repairs necessitated by the earthquake calls for Y.374,000. Most of these repairs are required at the Mikawajima disposal plant.

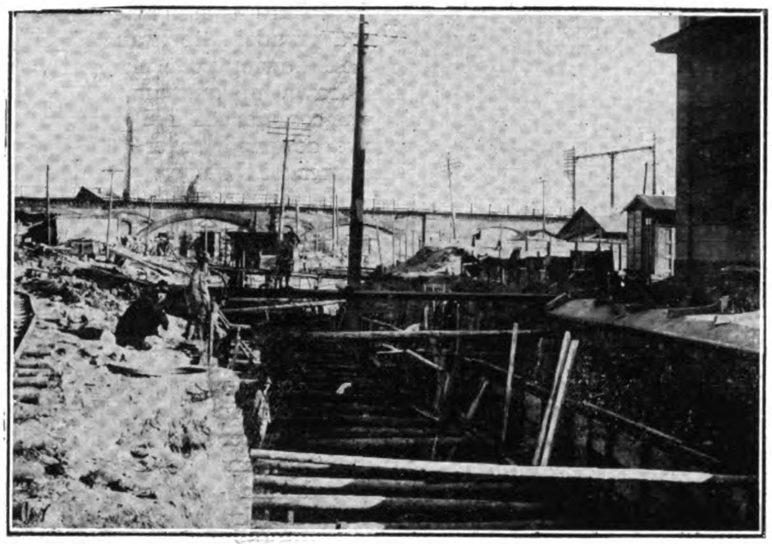
During this period, urgent work at the following places in the first district was completed at a cost of Y.2,500,000.

(1) *Shiba Ward*: From Atago Machi to Gensuke Cho, 3,602-ft.

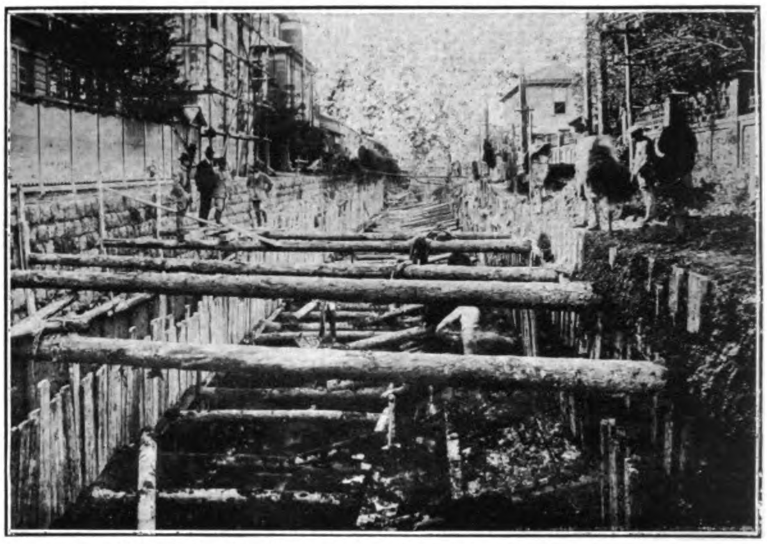
(2) *Shiba Ward*: From Shirokane Imazato Machi to the Furu River, 4,568-ft.

(3) *Akasaka Ward*: From Aoyama Minami Machi to the front of the Red Cross Hospital in Azabu, 5,629-ft.

(4) *Yotsuya Ward*: From Nagazumi Cho to Ushigome Ichigaya Honmura Cho, 5,642-ft.



Widening an Old Drainage "Moat."



Typical Surface Water Drains: The Debashi—Toranomon Drainage Canal

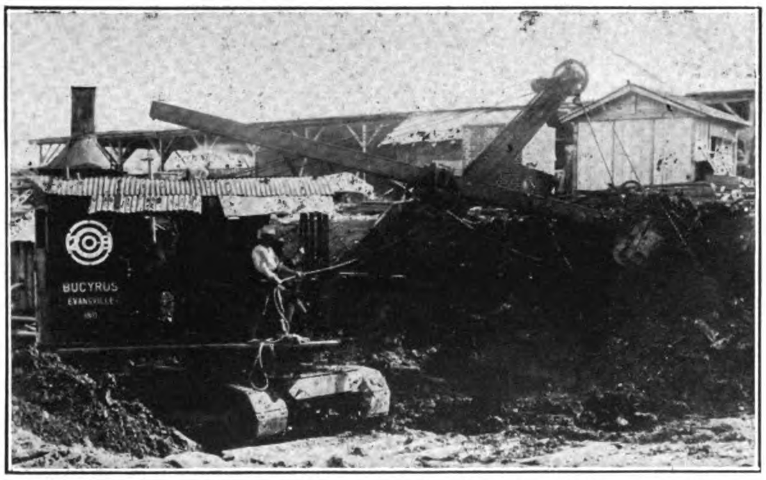
(5) *Yotsuya Ward*: from Tani Machi to the rear entrance of the Aoyama Palace, 1,270-ft.
(6) *Ushigome Ward*: From Waseda Tsurumaki Cho to Koishikawa Edogawa Machi, 2,094-ft.
(7) *Shitaya Ward*: From Yanaka Majima Cho, through Hongo Ward Komagome Sakashita Machi, to Kanda Ward, Manseibashi, 15,162-ft.

The second construction period began in 1920 and at the time of the earthquake, 21.5 per cent. had been completed as follows:

(1) Ote Mon to Shibaura, one portion of the main line of sewage and drainage mains.
(2) Ote Mon to Zenigame Machi pumping station, forming one portion of the high level line.
(3) One portion of the branch lines in Marunouchi district, and in Kyobashi and Nihonbashi Wards.

Total: *Main Line*:
Planned, 45,956-ft.; Completed, 4,232-ft.
Branch Lines: Planned, 607,190-ft.; Completed, 108,330-ft.

The foundations of the pumping station at Zenigame were also completed, and the equipment is now being assembled for installation.



Bucyrus Steam Shovel Excavating for the Foundations of the Zenigame Pumping Station

The second construction period (1921-1928), with an estimated expenditure of Y.20,000,000, will be confined to the first district including: Nihonbashi, the greater part of Kojimachi, especially the Marunouchi District, Kanda and a small part of Shiba.

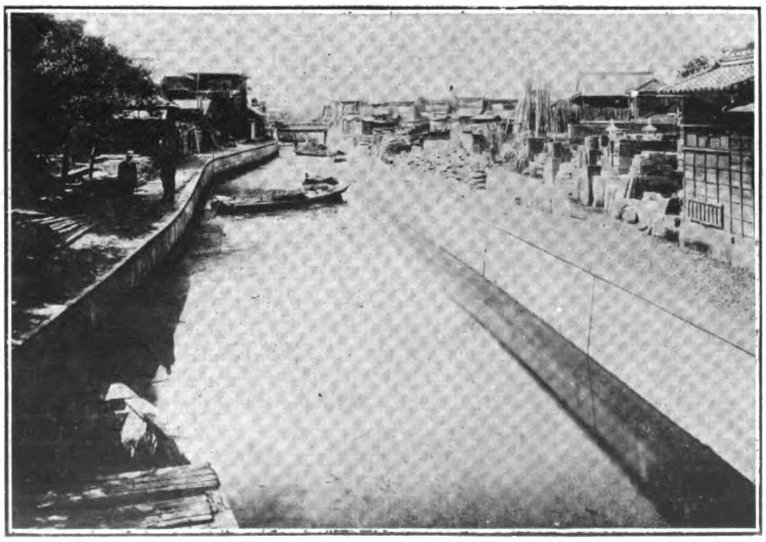
During the first construction period and up to the time of the earthquake, work in the second district was completed as follows:

Asakusa and Shitaya: greater part. Area drained; 2,130,000 *tsubo*.

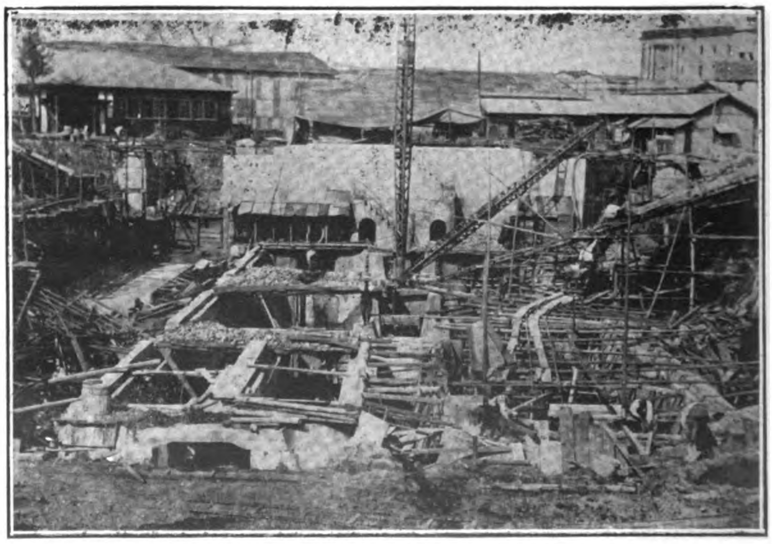
Equipment Planned: 14,880-ft., of main sewage pipe; 8,422-ft., of main drainage and sewage pipes; 15,531-ft., of drainage pipes 407,342-ft., of branch drainage pipes: Manholes, light holes, automatic flushing valves, etc.: Sewage, drainage and sedimentation tanks and two pumping stations.

Kanda Ward, in the vicinity of Izumi Cho, and that part of Asakusa near Senzoku Machi in Tamachi, is low ground and during a heavy rainfall, the waters of the Sumida river back up into the moats and canals and flood these districts, so it is necessary to construct a pumping station at Tamachi to discharge the drainage into the Sumida River.

The third construction period began in 1922 and only a small part of the work in the first district was damaged by the earthquake.



Typical New Style Open Drainage Canal: The Senzoku Bori

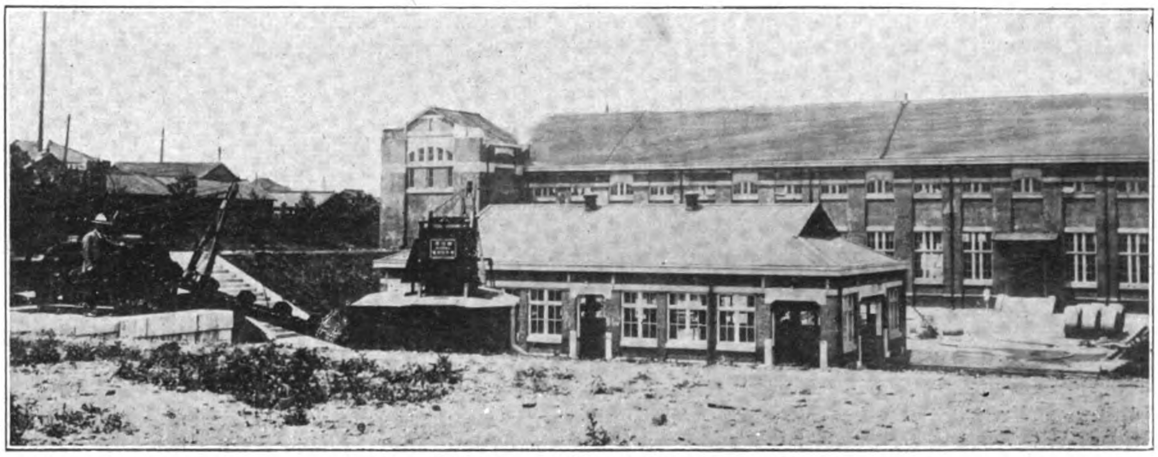


Constructing Foundation for the Zenigame Pumping Station

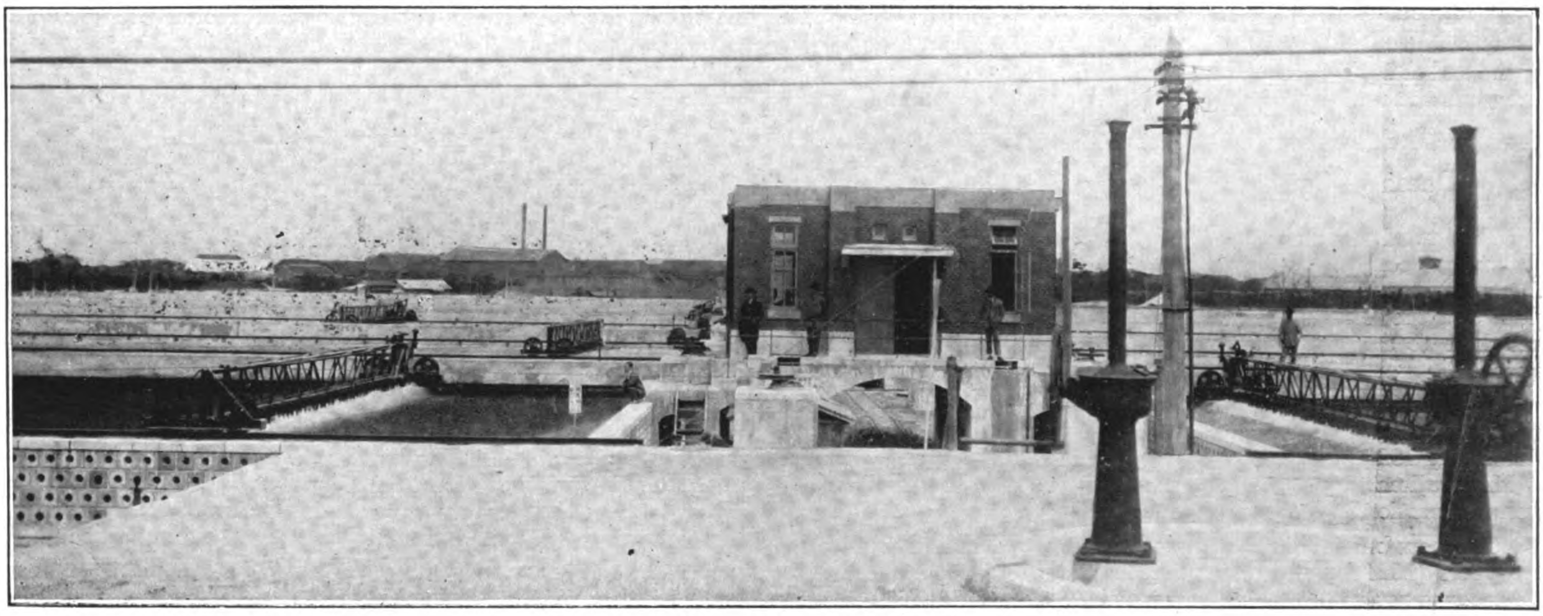
The work completed was: Kanda Ward; That part included in the first district; Kojimachi Ward: Marunouchi district; Main Line: All completed: Branch Lines: Half completed: Area drained: 701,064 *tsubo*.

The length of sewage mains to be built in this period totals: 56,161-ft.,of main lines and 82,863-ft., of branch lines, serving a present population of 109,030, with provision for 134,524.

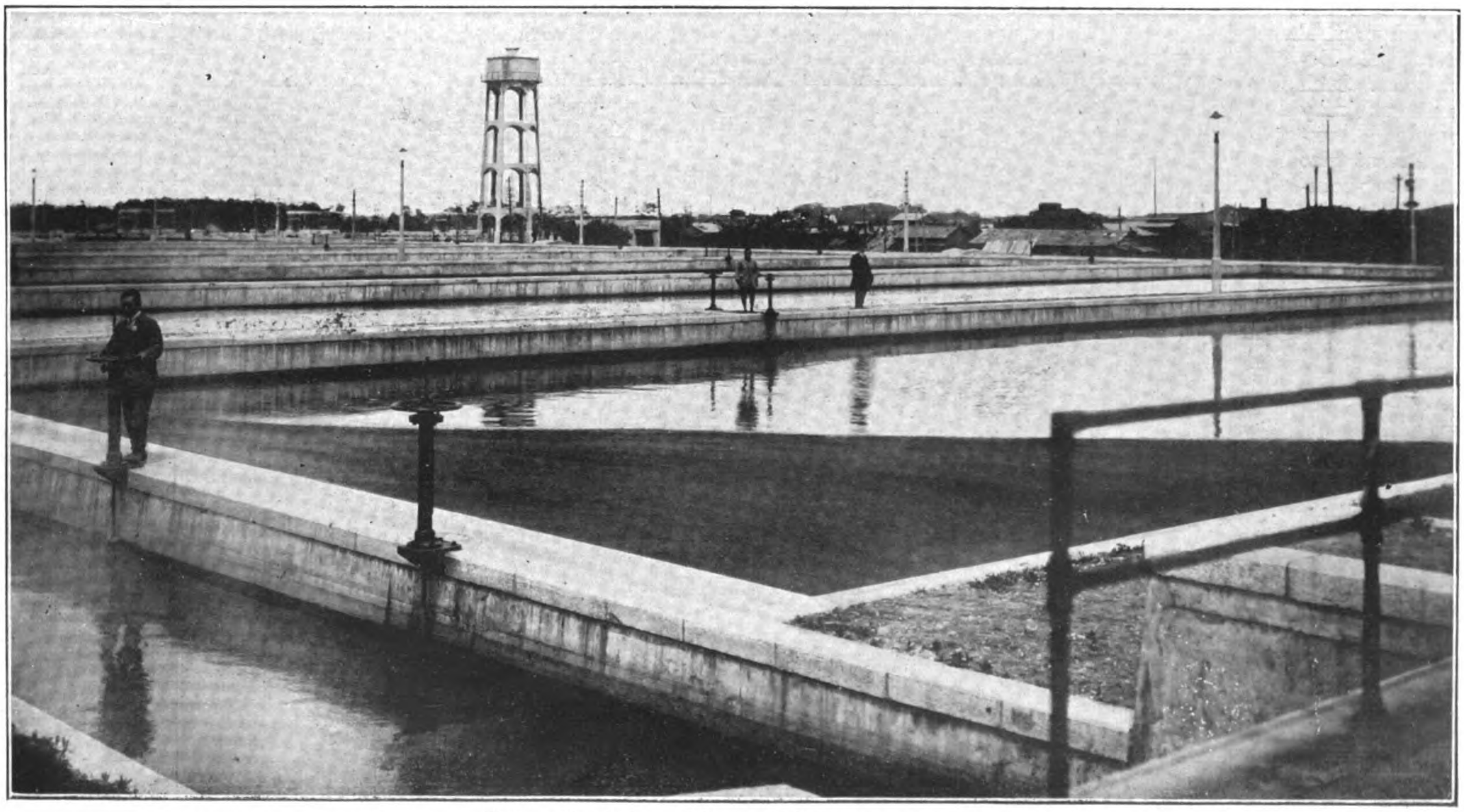
During this period, construction will be completed in the third district, comprising the Fuka-



Mikawajima Disposal Plant: Pumping Station



Mikawajima Disposal Plant: Filtration Beds



Mikawajima Disposal Plant: Sedimentation Tanks

gawa and Honjo Wards. All the main lines and 55 per cent. the branch lines are to be built, draining an area of 3,503,618 *tsubo.* The main sewers will be 35,302-ft. in length, and 181,263-ft. of branches. This will serve a present population of about 477,403, and a future increase to 625,337.

During this period, the Sewage Disposal Plant at Suna Machi will also be constructed, as well as three pumping stations located at Narihira Bashi, Mitsuhashi and Kiba.

The total estimated cost of the Tokyo Drainage and Sewage System is Y.43,500,000, itemized as follows:

Office expenses	Y. 2,361,000
Earthquake damage repairs	374,000
First construction period (for repairs)	220,000
Second construction period	15,110,000
Third construction period:	
First district...	4,499,000
Third district	18,473,000
Miscellaneous construction costs ...	1,250,000
Miscellaneous charges	1,213,000

Of the total original budget, Y.33,850,000 had been expended by the end of 1924, leaving a balance of Y.9,600,000 to be applied to carry out the unfinished work.

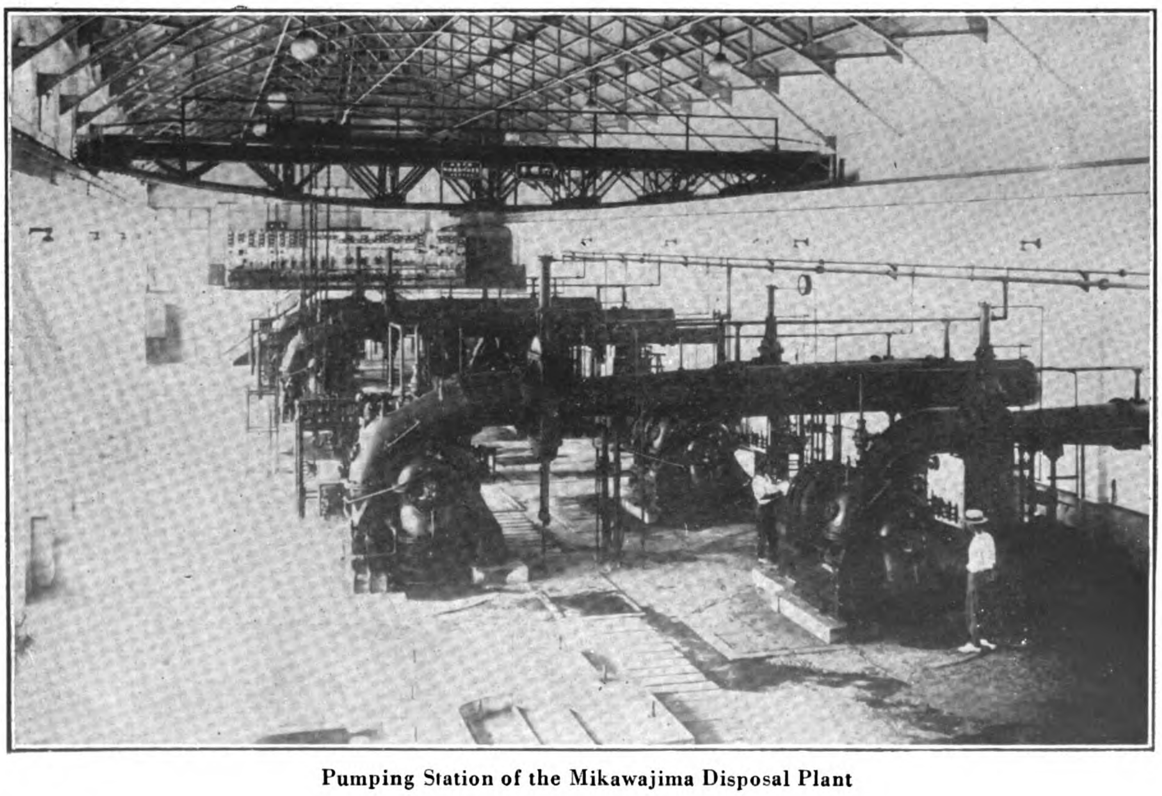
Damage Caused by Earthquake and Fire

The total damage sustained by the sewage and drainage system was comparatively small, being only Y.1,350,000, of which Y.382,500 represents the damage to the Mikawajima disposal plant and the Asakusa Tamachi pumping station. Little damage was done to any work completed during the second construction period.

The damage at Mikawajima and the Tamachi pumping station will be repaired by 1926. Up to the end of the fiscal year, ending March 31, 1925, about 30.8 per cent. of the damage sustained at Mikawajima, and 2.2 per cent. of the repairs to the Tamachi pumping station had been completed.

The new budget for sewer and drainage works is spread over five years (1924-1929), and supervision of the work entrusted to the reconstruction authorities. This budget provides for carrying to completion the second and third period programs (together with such repairs as were necessitated by the earthquake) before the end of 1919. One-half of the funds are to be provided by the Imperial Treasury, the balance to be raised by the issue of Municipal Debentures. Such work as may remain unfinished at that time to complete the original plans of 1911, will be postponed until 1930 and carried along for another seven years at a cost of Y.78,450,000.

Although the National Subsidy will be the principal source of funds, official approval has recently been given to a plan for placing the burden of the costs of all branch drainage and sewer construction on the property owners benefitting therefrom. The sanction of the Imperial Government is still necessary to carry out this radical departure from traditional customs.


Pumping Station of the Mikawajima Disposal Plant

First District

This district, embracing eight city wards is the most important of the three drainage divisions of Tokyo and owing to its great area has been further divided into high level, mid-level, and low level sections.

The surface drainage of the whole district will be discharged into the streams and moats, while the sewage and refuse will be concentrated at Shibaura for pumping to the projected disposal plant at the mouth of the Rokugo River, half way between Tokyo and Yokohama. The Shibaura pumping station will be provided with a collecting tank of sufficient capacity to hold the accumulated discharge for the district for three hours.

The High Level Section.—The district covered by this section includes parts of Kojimachi, Shiba and Yotsuya and all of Azabu and Akasaka, the total drainage area being 4,437,000 *tsubo,* with a length of drains of 702,600-ft. This district is comparatively free from floods and the natural slope permits the waters to flow by gravity to the collecting tank at Shibaura.

Kojimachi.—Part of the surface drainage will be discharged into the inner moat. The moat embankment will be utilized to hold the main sewer which will have an outlet at Sakurada Gate in order to partially discharge the excess storm waters into the moat. The balance, together with the sewage, will be carried on to Toranomon, Yotsuya and Akasaka Wards. The main sewer will commence at Samegahashi, Tanimachi, where all the drainage of the first district will be concentrated. An outlet for storm waters will be located in the rear of the Akasaka Palace and from this point carried to Tameike, thence to Toranomon to join the main line from Kojimachi Ward. Surface waters will be conducted to Dobashi and discharged into the Shimbashi River.

Aoyama Ward.—Storm waters and sewage will be collected along the line of the Furu River, and carried to Sannohashi in Shiba Ward through a new covered moat. Connection will be made at this point with the main sewer from Sannohashi in Shiba Ward.

Shirokane, Shiba Ward.—The major part of the storm waters from this district will be discharged into the Furu River. Sewage will be carried to Sannohashi and discharged into the main line from Aoyama. Passing through Mita Dobo Cho to Shibaura it will connect with the lower level line at Fudanotsuji. From this point the sewage will be carried in double pipes along the newly built road to Shibaura. The largest sewer, between Mita Dobo Cho to Fudanotsuji, will be of the horseshoe type with a width of 9-ft. and a height of 8-ft. 1-in.

Mid-Level District. — This district includes the greater part of Hongo, a part of Koishikawa, Ushigome, Totsuya, Kojimachi, Kanda, Shiba and Shitaya Wards, draining an area of 6,793,000

tsubo calling for 1,458,000-ft. of sewers

All the storm waters from this district will be discharged by gravity into nearby moats and streams, the sewage flowing to the collecting tanks at Shibaura.

Filtering Bed: Mikawajima Disposal Plant

Yotsuya and Ushigome Wards.—The open moat at Aizumi Cho leading through Honmura Cho to Ichigaya Mitsuke, will be covered, and both storm waters and sewage collected. At Ichigaya Mitsuke, the storm waters will be discharged into the outer moat, and the sewage conducted to Iidabashi, connecting there with another main coming from Ushigome Yanagi Machi. From this point, the greater part of the storm waters will be discharged into the Edo River and the sewage conducted to Iidabashi and discharged into the Ichigaya mains.

Kojimachi Ward.—Bancho Main: This main will discharge surface waters into the outer moat, and carry the sewage to Iidabashi where it connects with the Ushigome and Yotsuya mains. From Iidabashi, it will flow to Kudan Shita, where, chainging direction, it will pass the Department of Finance and connect with the main from Kanda Ward.

Koishikawa Ward.—The Zoshigaya main will meet the Otsuka main at Kokokuji Mae, carry the flow to Edogawa Bashi, and discharge the surface water into the Edo River. Changing direction, it will then go on to Suidobata Machi, and passing to the west of Suidocho, will serve the Ushigome Tenji Shrine and the Artillery Arsenal. Here a tunnel will be dug through the grounds to Tomisaka, connecting with the Sen River.

Sen River Main.—This is the main collection line for surface waters and sewage from the suburban and country districts. A new bed is to be constructed from Itabashi station to the Shakuji River and on to where the latter joins the Sumida River. This line will serve the suburbs to the south of the railway, and follow the new projected roads to Tomisaka connecting here with the Suido Bata main. Sewage will be carried on to Tomisaka Shita and connect with the Haramachi Line. Storm waters will be discharged through the Arsenal moat into the Kanda River.

Haramachi Main.—This main will gather all storm waters and sewage, connecting below Hakusan, with the line from Akebono Cho. A part of the storm waters will be discharged into the existing moat emptying into the Sen River. Excess storm waters will also be discharged through this covered moat into the Kanda River, and the surplus carried along to Suidobashi, across the Kanda River to Sarugaku Cho, and Nishiki Cho Sanchome and then discharged into the outer moat, the sewage flowing into the Hongo line.

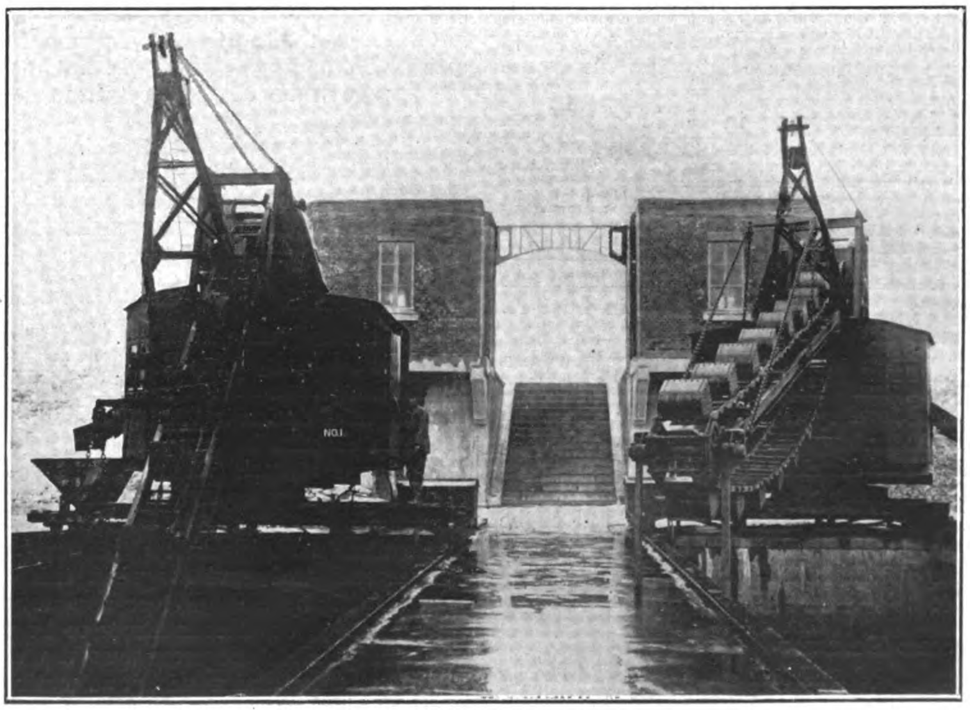
Hongo Line. — A new canal will be constructed from a point below Dozaka to the Sumida River collecting the storm waters from the suburban districts. This will necessitate rebuilding the existing canals. A concrete covered sewer will collect all sewage and storm waters in this district and discharge part of the storm waters into the Shinobazu Pond below Uyeno Park. Sewage and storm waters from the higher parts of Hongo will be collected and discharged at Ikenohata Nakamachi.

The area of Shinobazu Pond is 43,000 *tsubo* and its water level can be raised one foot without inundating the surrounding streets. Two outlets are to be constructed so that rain waters may be drained off to the normal level. At Nakamachi, the main sewer will be divided into two lines. The first will pass through Nakamachi to Manseibashi where surface waters will be discharged into the Kanda River and the second will carry the sewage to Kiridoshi Sakashita, thence to Shoheihashi, crossing under the Kanda River to Nishikicho Sanchome, then across the outer moat to connect with the Suidobata line. At Kanda Bashi it will join the Ushigome main, and pass in front of the Department of Finance and connect with the low level system. This line will follow along the main road through the palace outer grounds, then to the south and west of Hibiya Park, cross Shinsaiwai Bashi to Onari Mon, through Shiba Park to Shibazono Bashi cross the Furu River by Fudanotsuji discharging at the Shibaura collecting tanks.

Shiba Ward.—Two branch lines will serve this district. The first will start at Shiba Rogetsu Cho, passing through Shin Senza Machi, and crossing the Furu River will connect at Shibazono Bashi with the mid-level system. Automatic valves will be employed to control the flow when the rainfall is heavy permitting its discharge into the bay at low tide and closing automatically at high tide.

The largest pipe in this district on the lower stream of the Sen River will have a width of 20-ft. and a depth of 9-ft. The second line from Shibazono Bashi to Shibaura will be box shaped, 11-ft. wide and 8-ft. 8-in. deep.

Sewage will be collected at the Shibaura pumping station, and after settling, pumped to the Rokugo disposal plant. The main pipe line at its greatest depth will be only 6-ft. 4.6-in. under the standard Reiganjima level.



Mikawajima Disposal Plant

LOW LEVEL LINE.—This district includes the whole of Kyobashi (excluding Tsuki shima) a small part of Kanda and Kojimachi and the Edo River. The drainage area is 3,256,000 *tsubo*, calling for 801,000-ft. of sewers. This district is very low and flat and provision has been made for flushing the pipes from the water mains.

At low tide the storm waters can be easily disposed of, but with high tide or during heavy rains, the waters must be pumped off. The sewer pipes will be

equipped with automatic valves to open and shut at low and high tides. All the sewage from this district will be collected at the Zengame pumping station where it will be raised and discharged into the Midlevel main.

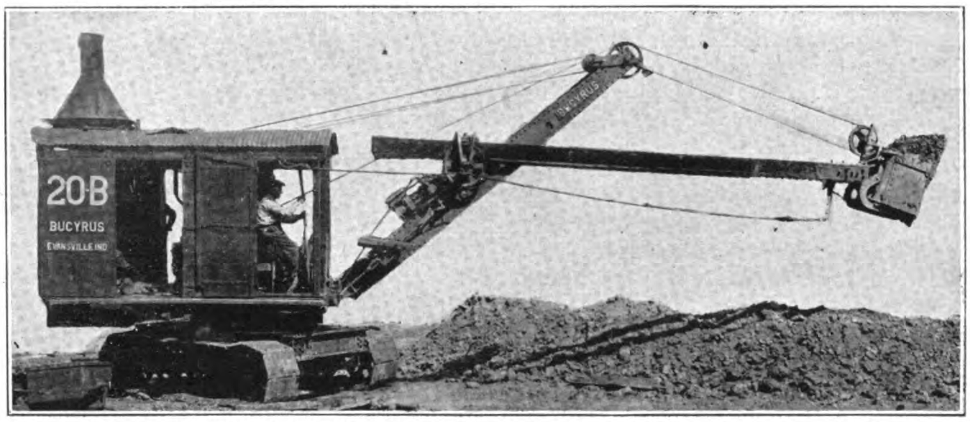
Ushigome and Koishikawa.—A main will be constructed along the Edo River. Storm waters will be discharged direct into the river, and sewage conducted to Funakawara Bashi. Crossing the Edo River, it will connect with the Iidagashi line at Koishikawa Bashi and running along the outer moat will come out at Kanda Bashi and proceeding to Ryukan Bashi it will connect with the Kanda and Imagawa Bashi mains.

Motoshiro Cho in Kanda Ward is entirely surrounded by canals into which all the surface water and sewage has been discharged. A sewage drain will be laid from Iwamoto Cho to Kubo Bashi, thence to Jinbei Bashi and Ryukan Bashi where it will connect with the Kanda main. From there it will go to Tokiwa Bashi, and connect with a branch line coming from Nihonbashi, pass through Ise Machi and Muromachi and discharge into the Zenigame pumping station.

The main line from the Ginza in Kyobashi Ward will connect with one from Sukiya Bashi and Kiinokini Bashi at Minami Konya Cho. Surface waters will be discharged into the outer moat and rivers in this district. Crossing over the Eikuni Bashi this line will go to Gofuku Bashi where it will connect with the one from Kaiun Bashi.

Tsukiji.—Storm waters will be discharged into the canals and rivers and the sewage carried through branch lines to Shintomi Cho, then across the Kyobashi River, through Hatchobori Machi, to Matsuya Cho, connecting there with the Reiganjima line.

The Reiganjima line will start at Reiganjima Hama Cho, and connect with the Tsukiji line. The combined lines will go to Sakamoto Cho meeting another coming from Ryogoku Cho and Hama Cho. Surface waters will be discharged into the Sumida and Hamacho Rivers. This line will then cross the Hamacho and cross the Nihonbashi Rivers and connect with the Tsukiji and Reiganjima lines. The three combined lines will cross the Kaida River at Honzaimoku Cho, run along the Kaeda River and come out at Ikkoku Bashi. Here it will connect with the Ginza line and discharge into the Zenigame pumping station.



Bucyrus 20-A Ravolving Shovel—Equipped for Sewer Service 18-ft. Boom 24-ft. Handle ½ yd. Sewer Dipper

Two branch lines will be constructed in Kojimachi Ward. The first will start at Uchiwaicho, passing through Uchiyamashita Cho, Yuraku Cho, Yaesu Cho and Eiraku Cho. The other starting at Ote Machi passed through Zenigame Bashi, where it will join the first and discharge at the pumping station.

There will be no large sewers in this district. The maximum is of the horseshoe type 5-ft. 5-in. wide and 4-ft. 1-in. deep. At the deepest place near Gofuku Bashi, the bottom will be 8-ft. 1.5-in. below the Reiganjima level.

The Zenigame pumping station will handle sewage only with a very small quantity of storm waters. The sewage from this station will be discharged into the mid-level system at Ote Machi through an iron pipe 5-ft. 5-in. in diameter.

All the sewage from the first district will be collected at the Shibaura pumping station and freed of sediment. From here it will be pumped to Haneda, and then south through land to be reclaimed from Tokyo Bay to the mouth of the Rokugo River. This main of the horseshoe type will be 12-ft. wide and 9-ft. high with a gradient of 1 in 3,000.

Second District

The second district includes the entire Asakusa Ward, and parts of Shitaya, Kanda and Hongo. The drainage area covers 2,495,000 *tsubo*, with 588,000-ft. of mains and branches.

With the exception of Uyeno and the high lands of Hongo, this district is low and damp. In the lowest part at Senzoku Machi, on the banks of the Shinbori River, the drainage is exceptionally difficult. Ordinary rainfall raises the level of the Sumida River higher than the moats and canals carrying off the drainage, causing unsanitary and disagreeable flooding of the districts. This is also true of Shitaya Ward, whose main drainage canal, the Aizome River, frequently overflows with the surface waters from Hongo and Uyeno as a result of any considerable rainfall. To relieve this, a special sewer with a diameter of 10-ft. will be built from Shinobazu Pond to Manseibashi discharging into the Kanda River. All the surface drainage and sewage of this district will be collected in the same mains, the surface waters discharging into nearby streams at convenient points.

The population of this district is estimated at 600,000, with sewage requirements of 12 cu. ft. per capita a day. The sewage will be conducted through a main from the western end of Nakaokachi Machi and Matsunaga Cho. The Izumi pumping station will force it through to Shitaya, there discharging it into the Goryu Branch line. The main sewage line from Shitaya Okuchi Machi, passing through Nishimachi Takecho, will discharge direct into the Suga River. A covered moat starting at Fukutomi Cho will be constructed from Samisen Bori and passing through Torigoe Cho, Misujimachi Iriyachi and Ryusenji Machi will receive the accumulations of the branch lines and discharge at the Mikawajima disposal plant. All these branches are to be covered moats.

Surface waters will be discharged into the Sumida and Kanda Rivers and the Sanya Moat. A main pipe line will be constructed from north to south passing near the Honganji Temple. Here the sewage will be divided into two parts, the surplus rain waters from the south discharging through the Shin Bori into the Sumida River, at Kuramae Katamachi. An automatic valve will be installed at the outlet to keep out the tide waters.

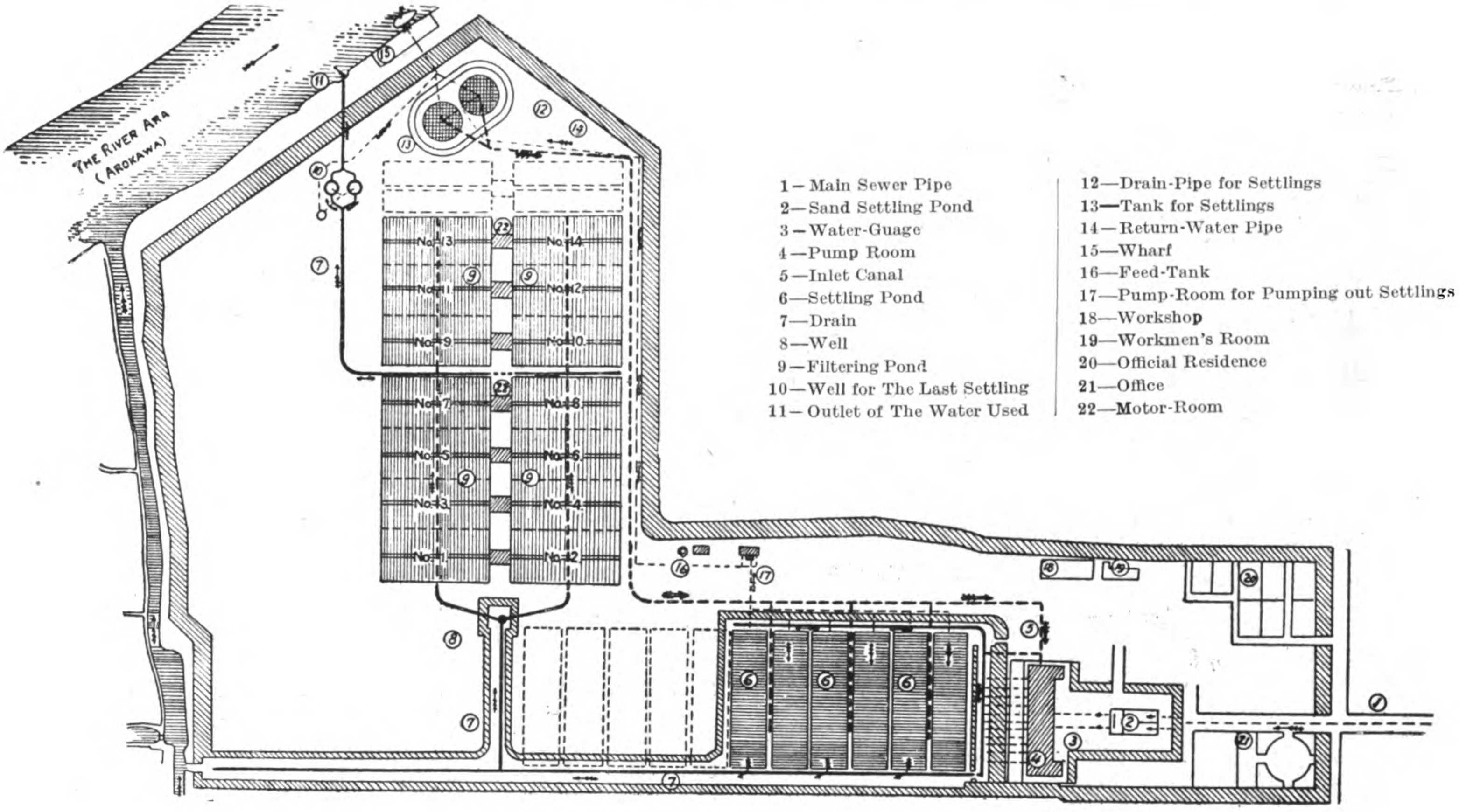
Drainage from the north will be carried through the existing moat to Kogetsu Cho and from here will pass through Tamachi where a new open moat 24-ft. wide will be built to carry the drainage to Sanya Bori. This stream is to be widened to 30-ft. from this point to Yoshino Bashi. An automatic water gate and pumping station will be built near Tamachi to handle the sewage while the surface drainage will be diverted into the open moats.

The largest sewer line, 9-ft. in diameter, will start at Kogetsu Cho, passing through Ryusenji Machi and Minoa and discharge into the Mikawajima disposal plant. The gradient is 1-2,000, and the bottom of the pipe line at its lowest point, 11-ft. below the Reiganjima standard.

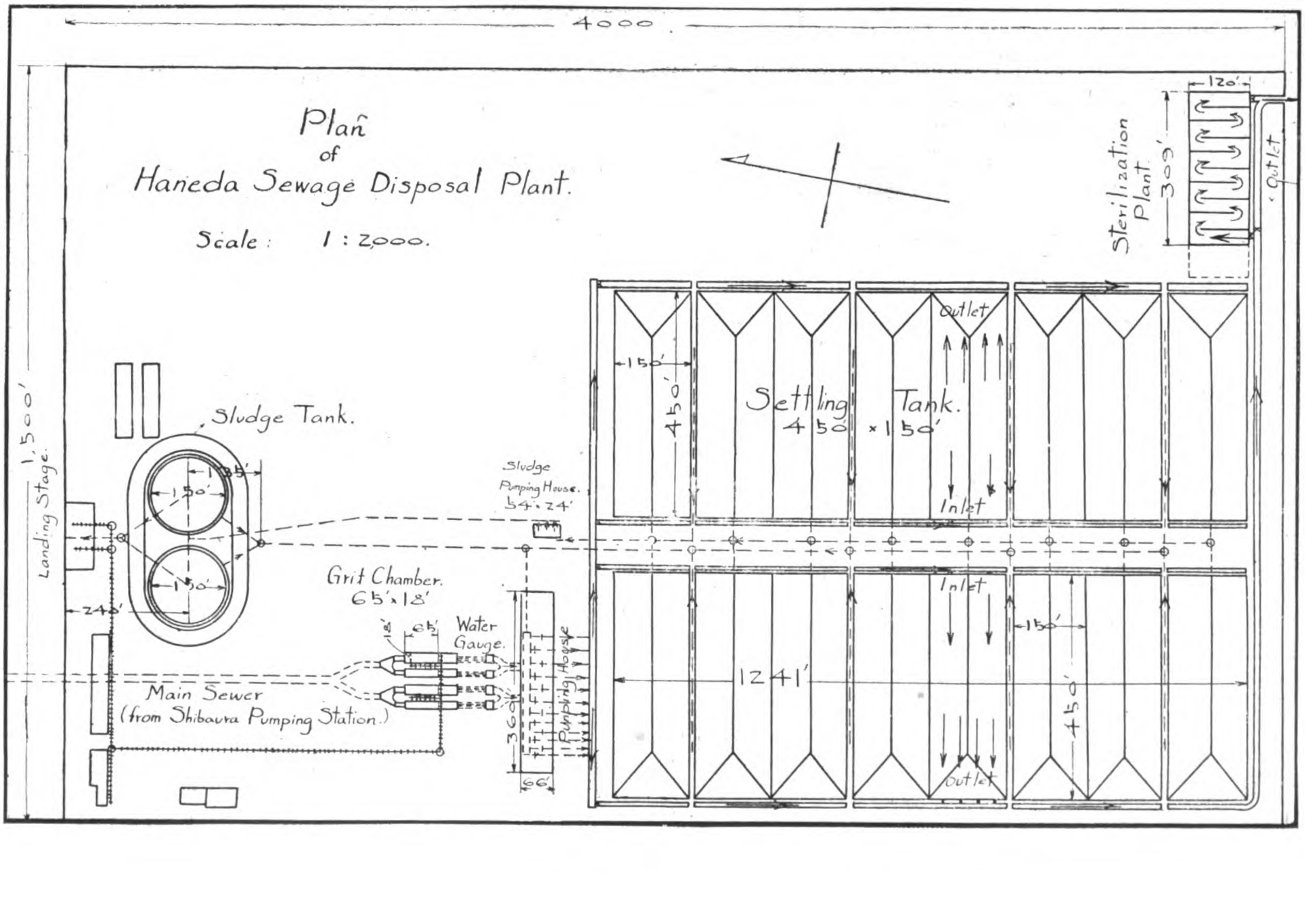
Third District

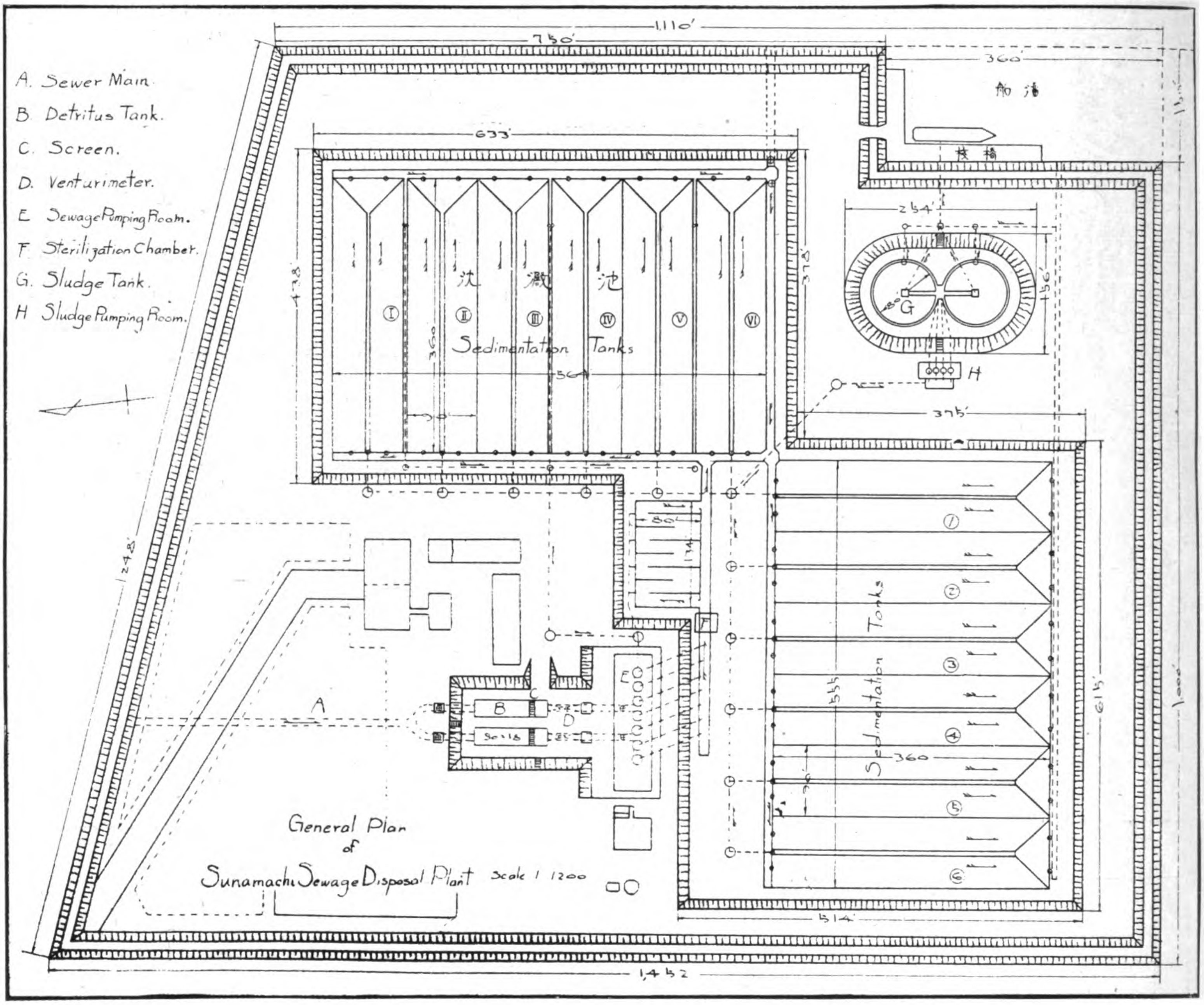
In the original plan, this district embraced all of Honjo and Fukagawa Wards. The Reconstruction Bureau has since included Tsukishima, increasing the drainage area to 3,787,000 *tsubo*, and the length of drains to 721,000-ft.

The district is exceptionally low and damp and with the exception of a small section it is impossible under ordinary conditions to properly expel the drainage and sewage. The high tide mark is about 7-ft. 5-in. above the Reiganjima standard level. These districts being below this level, the tide frequently floods the streets. To provide against this contingency, embankments raised 10-ft. above the Reiganjima standard are to be built with a water gate at the Koeda River to keep back the tide water and make it possible to pump out the accumulated storm waters. Supplementary drains with automatic water gates will be constructed throughout the district in order to permit the discharge of drainage at low tide. All gates will be closed at high tide and



General Plan of Mikawashima Disposal Plant





the drainage collected at the pumping stations until the next low tide. The pumping stations will handle both drainage and sewage discharging into the surrounding streams. The greater part of the sewage and a small part of the storm waters will be pumped to the disposal plant located in the bay near Nakagawa Hosuiro.

The third district has been subdivided into four sections :

(1) From Honjo, Yanagijima Machi, Tenjin Bashi, passing through Hoonji Bashi to Yokoami Cho 2 chome, to the north of the road.

(2) From the boundaries of the first section and north of the Onari River.

(3) South of Onagi River, including all Fukagawa Ward.

(4) Tsukishima.

First Section.—*Narihira Bashi Pumping Station District.*—Includes the district bounded by the Kita Jikken and Oyoko Rivers : (1) Mukojima ; (2) Yanagijima and Oshiage district ; (3) Naganogo district.

A pumping station will be built at Narihira Bashi, to permit the accumulation of drainage to be expelled at all stages of the tide.

The main sewage and drainage line of this section will be :

(1) From Mukojima, Nakanogo Machi, Shichihon Matcu Bashi, along the North Bank of the Hikifune River ; crossing the Kita Jikken River to reach the pumping station.

(2) Surface drainage from the northern part will be carried along the line of the tramway, passing Oshiage Bashi to reach the pumping station.

(3) The main line of surface drainage from the southern parts of 1 and 2, will be concentrated at Matsukura Machi 2 chome, passing to the north will reach Hachiken Cho 2 chome, joining the drainage from the northern part of the second section.

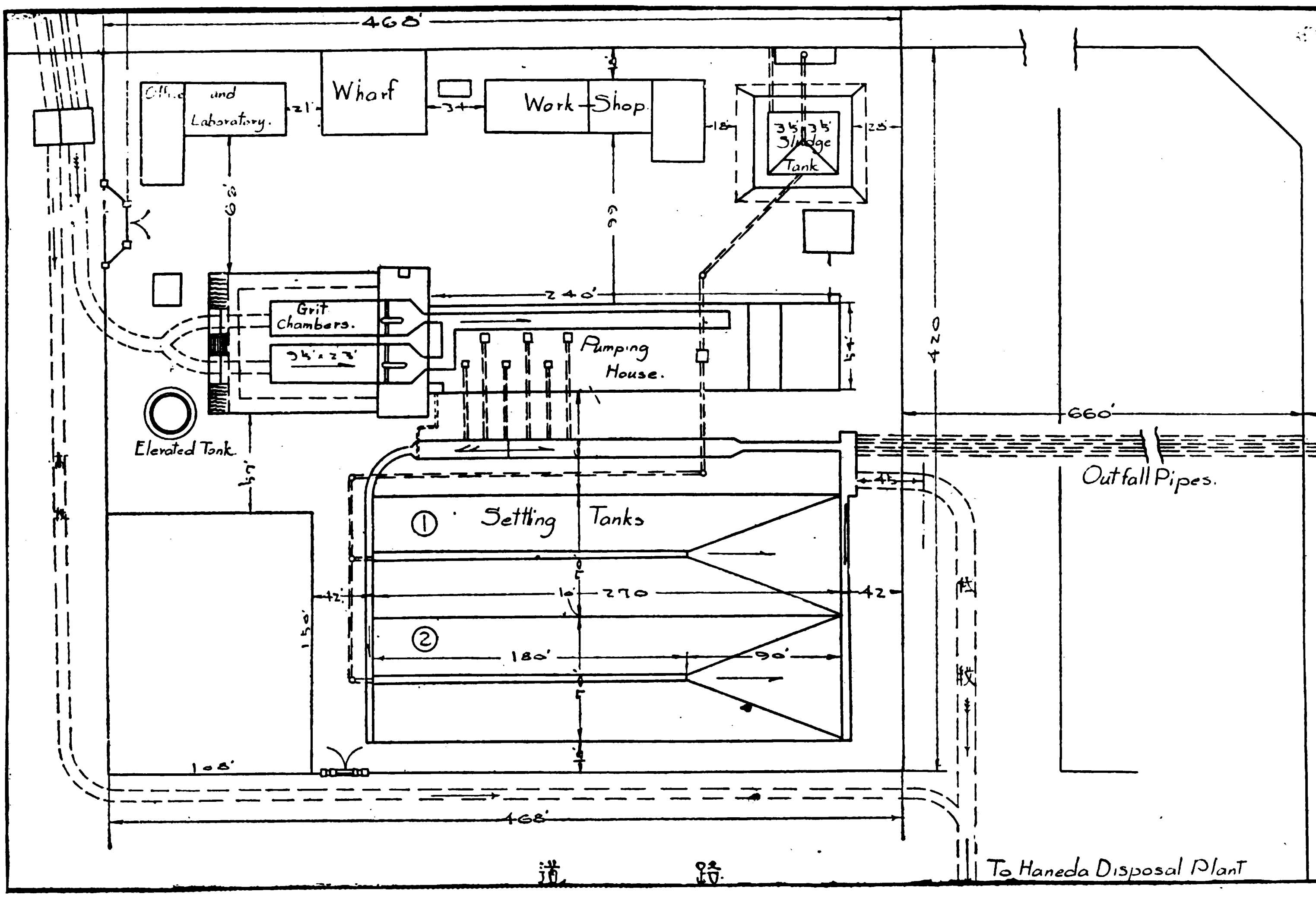
The largest drain will be of the horseshoe type, 14-ft. wide, 8-ft., 4-in. high. The bottom of the pipe will be 8-ft. 7-in. below the Reiganjima level. Surface waters from this district will be discharged into the Kita Jikken River while the sewage will be raised by special pumps and carried to the Sannohashi pumping station. The maximum volume of surface water is estimated at 800 cu. ft. per second, and the maximum volume of sewage at 33 cu. ft. per second.

Second Section.—*Sannohashi Pumping Station District.*—This section is divided by the Tae and Oyoko Rivers into four subsections : (1) Kinshi Cho ; (2) Midori Cho ; (3) Sarue Ura Machi ; (4) Kikugawa Machi and Morishita Cho.

A pumping station is to be erected at Tokuemon Cho near Sannohashi.

The main sewage and drainage lines of this section are :

(1) Start at Yoshida Machi, receive sewage coming from Narihira Bashi pumping station, then turning to the south



Plan of the Shibaura Pumping Station

it will join the main from the first and second sub-sections at Kasamatsu Cho and Hama Cho. Crossing the Tate River will discharge into the pumping station.

(2) From Fukagawa (Honnura Cho) will meet the line from the north half of the third sub-section, and crossing the Oyoko River will discharge into the pumping station.

(3) From Fukagawa (Rokkenbori Kitanohashi) collecting from the southern part of the fourth sub-section, will pass the Tokuemon station and join the line from the southern part of the third sub-section, and connecting with another line from the northern part of the fourth sub-section, will discharge into the pumping station.

The largest drain will be horseshoe shape, 18-ft. wide, 10-ft. 8-in. high. The bottom of the pipe at its greatest depth will be 10-ft. 6-in. under the Reiganjima standard level. The maximum volume of surface water is estimated at 1,100 cu. ft. per second; of sewage, 75 cu. ft. per second.

The main sewer from this section will pass through Kikugawa Cho, Tomikawa Cho, and passing to the south cross the Onagi River to Higashi Daiku Machi, and join the main line from the third section.

THIRD SECTION.—*Kiba Pumping Station District.*—This section is divided into five sub-sections:

1. East of the Oyoko River, Nijikken River, both North and South, and the vicinity of Senda Machi.
2. Ogibashi Machi, Reigan Machi vicinity, East of Oyoko River, and North of Sendaibori River.
3. Vicinity of Hirai Machi, East of Oyoko River and South of Nijikken River.
4. Vicinity of Kibe Cho, West of Oyoko River, South of Sendaibori River, and East of Naka River.
5. Kuroe Cho Furuishiba Machi, West of Naka River, and South of Sendaibori River.

The pumping station will be located at Ogi Machi, near Suehiro Bashi.

The main sewage and drainage lines are:

1. Starting at Higashi Daiku Machi, Irifune Bashi, will join the line which comes from Sannohashi and proceeding to the South, connecting on the way with several lines from other sections, will cross Sendaibori to the pumping station.
2. Starting at Etchujima Machi, joins the sewage line from Tsukishima, passing through Shioami Bashi to Kiba Machi (2 banchi, seashore), where the sewage from the third section is received. It then joins the main line coming from the East and turning to the North discharges into the line from the fourth section and flows to the pumping station.

The largest drain is 18-ft. wide, 10-ft. 8-in. deep, with the bottom of pipe at its lowest point 10-ft. 4-in. under Reiganjima standard level. The pumping station covering an area of 3,900 *tsubo* will be the same as the others. A power generating station will, however, be added to the other equipment. The maximum drainage discharge is estimated at 900 cu. ft., per second and maximum sewage discharge at 150 cu. ft. per second. The pumping station in this third section will collect all the sewage and discharge into the Sunamachi disposal plant.

FOURTH SECTION.—*Tsukishima.*—Tsukishima is somewhat higher than other parts of the third district, and its drainage presents no special problem. The main sewer starting at Shin Tsukishima Bashi and laid under the Nijikken Road will discharge into a small pumping station at Hatsumi Bashi, which will force it through an iron pipe crossing the Aioi bridge to connect with the main line from the Kiba pumping station.

The main sewage line from Kiba to Sunamachi is to be 9-ft. wide, 6-ft. 3-in. high, horsehoe type. It will follow along the Nijikken River and south shore of Sunamachi canal, thence turn

eastward and at the north side of Hachiman shrine will turn to the South, parallel the Ara River embankment, and discharge into the disposal plant. The bottom of the pipe at its lowestd epth will be 5-ft. 9-in. below the Reiganjima standard level. The Sunamachi disposal plant is designed to handle all the sewage from the third district. It will be built on reclaimed land out in the bay at Arakawa Hosuino.

The following table shows the expenditure on sewers and drains from the time of the earthquake up to the end of August, 1924 :—

Year	Estimated Costs of Construction	Payments to end of August, 1924	Percentage of total completed
1923-24 ...	Y.1,500,000	Y.882,252.89	58.8%
1924-25 ...	9,400,000, plus surplus from previous year Y.617,747.11	Y.1,906,036.09	21.1%
Total ...	9,900,000	Y.2,788,288.98	28.1%

Disposal and Pumping Plants

Mikawajima Disposal Plant.—This plant, serving the second sewage district was completed in 1922. The disposal process is carried out by sedimentation and bacterial treatment through trickling filters. The maximum capacity of the present plant is 165 cubic feet per second or 14,256,000 cu. ft. per day for rainy weather, while the normal dry weather load is 2,760,000 cu. ft. a day.

The equipment consists of two grit chambers each 65-ft. long and 18-ft. wide and 17-ft. deep, filled with mechanically scraped racks. There are six horizontal flow sedimentation tanks, each 280-ft. long, 70-ft. wide with 68 of effective depth, sixteen trickling filter units equipped with Hartley Sons & Co. (Stoke-on-Trent) travelling distributers are installed, each unit being 220-ft. long, 100-ft. wide and 6-ft. deep filled with broken stone. The filtering area covers nearly seven acres with a total volume of filtering medium of 1,850,000 cu. ft. The pumping house is equipped with six motor driven centrifugal pumps (16-in.-22-in. and 30-in. diameter). There are also two final settling (25-ft. diameter, 24-ft. deep) tanks and two sludge storage tanks of 72-ft. diameter with an efficient depth of 8-ft.

Sunamachi Disposal Plant.—This plant, handling the refuse of the third district will be erected on reclaimed land in Tokyo Bay some distance off the foreshore and have a maximum rainy weather capacity of 12,960,000 cubic feet per day or 150 cu. ft. per second (4,200,000 cu. ft. per day) in normal or dry weather.

The pumping house will be equipped with seven motor driven centrifugal pumps, 16-in. to 32-in. diameter, with a total capacity of 195 cubic feet per second. There will be two grit chambers each 90-ft. long, 18-ft. wide and 8.5-ft. of effective depth, fitted with mechanically scraped racks. The purification battery consists of twelve horizontal flow sedimentation tanks each 360-ft. long 90-ft. wide and 8-ft. effective depth, six of which are sufficient to handle the normal discharge from the district, the whole battery being operated only during rainy weather.

The disinfection process will be carried out in three sedimentation tanks, grit chambers and one sludge tank. This part of the plant will be built first. There will also be two circular sludge storage tanks of 80-ft. diameter and 14-ft. depth each.

Haneda Disposal Plant.—The disposal process at this plant will be plain sedimentation and disinfecting, the installation to consist of four grit chambers 100-ft. long, 18-ft. wide and 16-ft. deep, fitted with cage screens ; 16 horizontal flow sedimentation tanks, each 450-ft. long, 150-ft. wide and 7½-ft. effective depth, of which only half will be in use during dry weather. There will also be two circular sludge storage tanks 150 ft. diameter each, with a total height of 27½-ft. and 12-ft. effective depth and disinfecting equipment. The capacity of the plant will be 12,800,000 cu. ft. per day in dry weather and 405 cu. ft. per second (34,992,000 cu. ft. per day) in wet weather. The pump house installation will consist of ten motor driven centrifugal pumps, 16-in. to 32-in. diameter with a total capacity of 420 cu. ft. per second.

Pumping Stations

Tamachi Pumping Station (Constructed).—This station is equipped with six motor driven centrifugal pumps of 45 1-in. diameter having a total capacity of 600 cubic feet per second. The intake tank is of simple reinforced concrete construction filled with racks.

Zenigame Pumping Station (Under Construction).—The collecting basin or intake of reinforced concrete construction is 40-ft. long, 20-ft. wide and 25-ft. deep. There are two grit chambers each 130-ft. long, 15-ft. wide and 12-ft. deep, equipped with wing screens.

The pumps house equipment will consist of five motor driven centrifugal pumps, of which two are of 32-in., two of 24-in. and one of 16-in. diameter, with a total lift of 25-ft. Their total capacity is about 114 cubic feet per second. A further extension to this plant is contemplated in order to raise its capacity to 158 cubic feet per second.

Shibaura Pumping Station (Projected).—There will be two grit chambers each 95-ft. long, 23-ft. wide and 17½-ft. deep, fitted with mechnically scraped racks. The pump house will be equipped with six motor driven centrifugal pumps of which three will be of 30-in., two of 16-in. and one of 24-in. diameter. The total lift is 22-ft. and their combined capacity about 150 cu. ft. per second. A further extension is provided for that will increase the number of pumps to twelve with a total capacity of 330 cu. ft. per second. Pending the construction of the Haneda disposal plant, the Shibaura pumping station will be equipped with a temporary disposal equipment of two sedimentation tanks each 270-ft. long, 70-ft. wide and 7-ft. deep ; one sludge tank 35-ft. square and 10-ft. deep and a disinfecting process. When the Haneda disposal plant is completed, the sewage emptying into the Shibaura collecting tanks will be pumped up and carried away by gravity to Haneda through a reinforced concrete conduit of horseshoe shape (12-ft. by 9.6-ft.). The length of this conduit will be 35,000-ft. with a gradient of 1-3,000.

Honjo and Fukugawa Pumping Stations (Projected).—Three pumping stations are planned for this district to be located at Narahirabashi, Sannohashi and Kiba.

The Narahirabashi plant will be equipped with four grit chambers with mechanically scraped racks, each 100-ft. long, 15-ft. wide and 22-ft. deep. The initial pumping equipment will consist of one 48-in. diameter centrifugal pump with a lift of 10-ft. and 400 cu. ft. capacity per second for storm waters and one 20-in. and two 12-in. diameter pumps with a total of 27 cu. ft. per second capacity and lift of 18-ft. for sewage, giving a total of 427 cu. ft. per second. Provision is made for doubling the capacity of this station to 843 cu. ft. per second by the addition one 48-in. storm water pump and one 20-in. pump for sewage.

The Sannahasi pumping station will be equipped with four mechanically scraped grit chambers each 100-ft. long, 20-ft. wide and 24½-ft. deep. The initial pumping installation for storm waters will consist of four 52½-in. centrifugal pumps with a lift of 10-ft. and 640 cu. ft. capacity per second. For sewage there will be two 24-in. diameter pumps with a capacity of 50 cu. ft. per second with a lift of 18-ft. and two 18-in. pumps of 24 cu. ft. capacity, a total capacity of 714 cu. ft. per second. Provision is also made to expand this capacity to 1,219 cu. ft. per second by the addition of three 52½-in. storm water pumps and one 24-in. sewage pump.

The Kiba pumping station will have four mechanically scraped grit chambers each 100-ft. long, 16-ft. wide and 27-ft. deep, with an initial pumping equipment of four 51-in. diameter storm water pumps with a total capacity of 600 cu. ft. per second and lift of 10-ft. Sewage will be handled by one 32-in. (50 cu. ft. per second) two 24-in. (50 cu. ft. per second) and one 16-in. (10 cu. ft. p.s.) giving a total capacity of 710 cu. ft. per second. Provision is also made to increase the capacity of this station to 1,085 cu. ft. per second by the addition of two 51-in. storm water pumps giving a total storm water capacity of 900 cu. ft. per second and one 32-in. and one 24-in. pump for sewage. A power plant of 3,600 k.w. capacity will also be added to the Kiba pumping station.

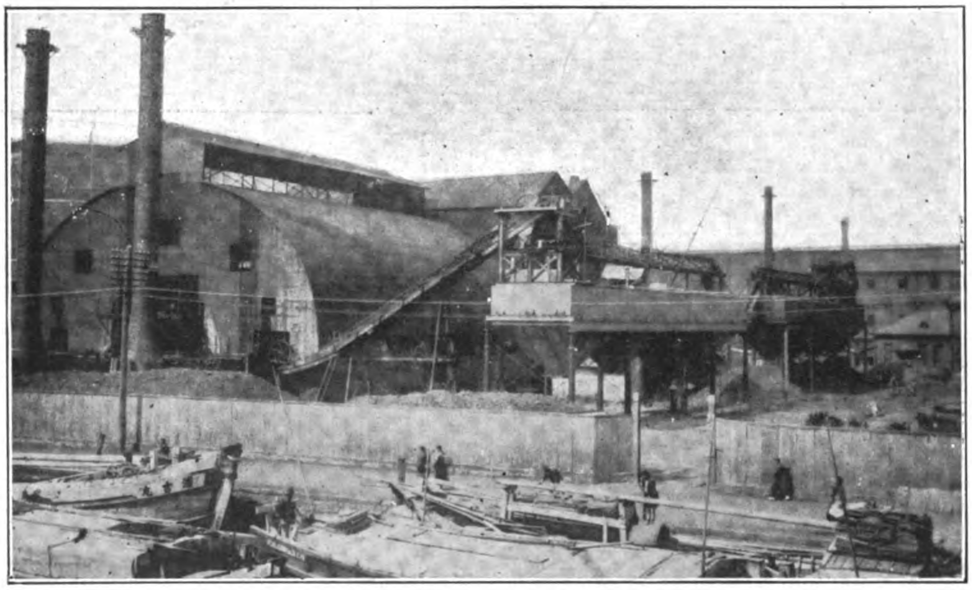
The sediment from all disposal plants and pumping stations after a brief storage in the sludge tanks is to be loaded into specially constructed sludge barges and discharged into the sea at a suitable distance from Tokyo.

Gas Supply of Tokyo

The Tokyo Gas Company

THE gas supply of Tokyo is a monopoly of the Tokyo Gas Company. The first gas works in the capital was operated by the Tokyo Prefectural Gas Department which was handed over to a private company headed by Baron Eiichi Shibusawa in 1885. The original small plant at Shiba, devoted exclusively to the manufacture of gas, has been developed with the growth of the city until at the time of the earthquake the company was operating five manufacturing stations, two by-product plants and one gas meter manufacturing and repair plant. In 1892, the Senju Works were erected, followed four years later by the Fukagawa Works. In 1901 a coal tar distillery and in 1905 a factory for making gas meters and appliances was added. The Omori Works was erected in 1910 and the same year the company purchased the coke plant of the Furukawa Mining Company and in 1912 acquired the works of the Chiyoda Gas Company, which was amalgamated to Tokyo Gas Co. Pipe lines were extended to all parts of the city and improvements made in manufacturing so that at the time of the disaster, the company was supplying 250,989 customers at a price equivalent to $1.08 gold per thousand cubic feet.

Before the earthquake, the aggregate daily output of these plants was about 25,000,000 cubic feet. Various types of retorts were in use, including two installations of vertical retorts, one of 2,000,000 cub. ft. per day at the Shiba Works and one of 1,500,000 cub. ft. per day at the Fukagawa Works. Horizontal retorts were in use in only one of the five gas works at Senju, where the capacity of the installation was 3,500,000 cub. ft. per day. At the Senju Works there were also inclined retorts having a capacity of about 2,000,000 cub. ft. per day. The carbonizing plant at the Fukugawa Works included an installation of inclined retorts capable of producing something like 4,500,000 cub. ft. per day. There are also two water gas plants, each of a capacity of 3,000,000 cub. ft. per day—one at the Fukagawa Works and the other at the Senju Works. At the Omori Works there was a battery of Koppers Coke Ovens having a daily capacity of 3,000,000 cub. ft. per day and at the Sunamachi Works a similar battery with a capacity of about 1,000,000 cub. ft. The by-products plant produced about 2,000 tons of tar per month.



Fukagawa Plant of the Tokyo Gas Company

The damage done to the plants by the earthquake was extensive, but the total loss did not exceed Y.5,600,000 which has since been offset by the enhanced rise in value of the other properties. The greatest blow to the company consisted in the loss of over 110,000 customers whose houses were destroyed. The coke ovens at the Omori Works were almost completely destroyed, but they are now undergoing repairs and reconstruction. The vertical retorts at the Shiba Works and the coal washing plant at Sunamachi and some of the machine houses, store houses and offices were so seriously damaged by fire as to be rendered useless. The company's head office and many of its branch offices were totally destroyed by fire. Fortunately, the damage done to the Fukagawa and the Senju Works was comparatively slight and within a fortnight all necessary repairs were effected. One of the by-products works was involved in the general conflagration which resulted in the complete loss of all the coal tar, pitch and oil stocks. These works were however completely rebuilt in three months and able to resume their normal output.

Immediately after the earthquake all manufacturing operations and distribution of gas was suspended and all gas holders emptied, but in spite of every precaution that could be taken, a few of the mains exploded in various parts of the city. Nearly all the joints carried over the river bridges were broken, though for the most part, the joints of the underground pipes were not so severely damaged.

Some idea of the extent of the damage done to the distribution side of the undertaking may be gathered from the fact that of the 250,989 gas meters in use at Tokyo at the time of the earthquake, 112,588 were destroyed. The total damage, as mentioned above, approximates Y.5,600,000, but it will be necessary to spend three times that amount in order to bring the works of the company into full working order and make them adequate to meet the needs of the future.

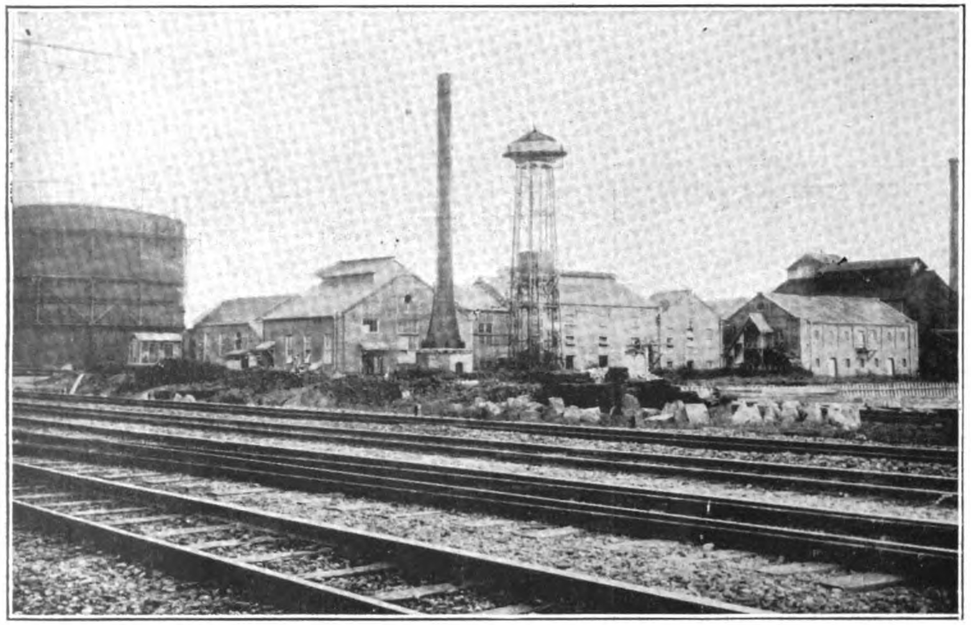
The gas supply to Tokyo was resumed within three weeks after the disaster and by the end of October the company was supplying 12,000,000 cub. ft. per day—about half the normal output. By the end of 1923, the whole of the distribution system in the unburnt districts was completely repaired and in good working order while the mains and pipes in the burned districts were largely relaid during the first half of 1924.

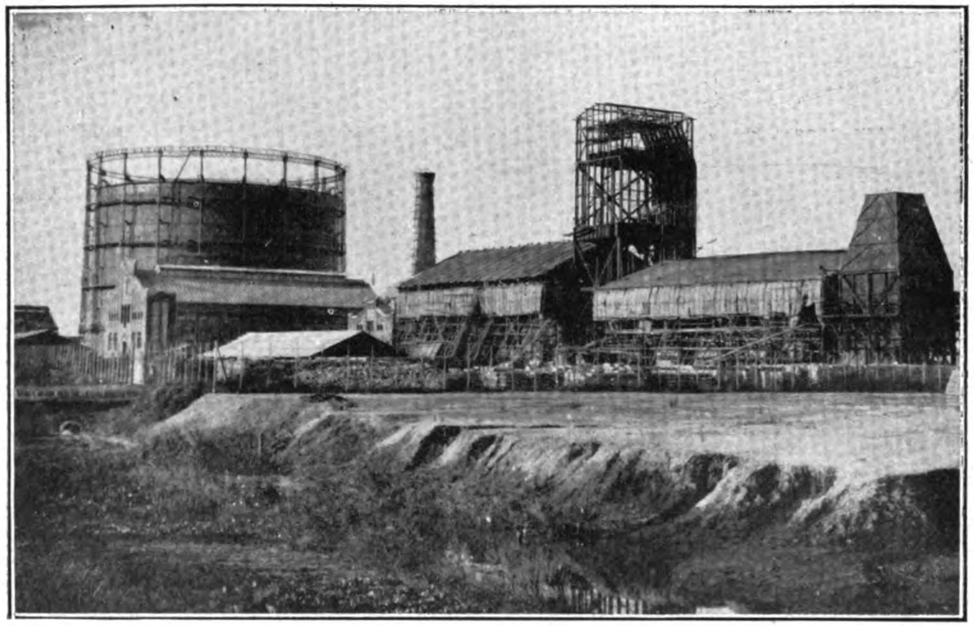
At the present time, the company is purchasing gas in bulk from the Kanagawa Coke Company, which operates a plant a few miles from Tokyo, enabling it to maintain a supply which varies from 16,000,000 cub. ft. per day in summer to 24,000,000 cub. ft. per day in winter. Considerable new equipment has been installed, including vertical retorts of the Glover-West type (manufactured in Japan) at the Shiba Works of 3,000,000 cub. ft. capacity per day and horizontal retorts of 1,000,000 cub. ft., and a water gas plant of 3,000,000 cub. ft. capacity at the Omori Works.

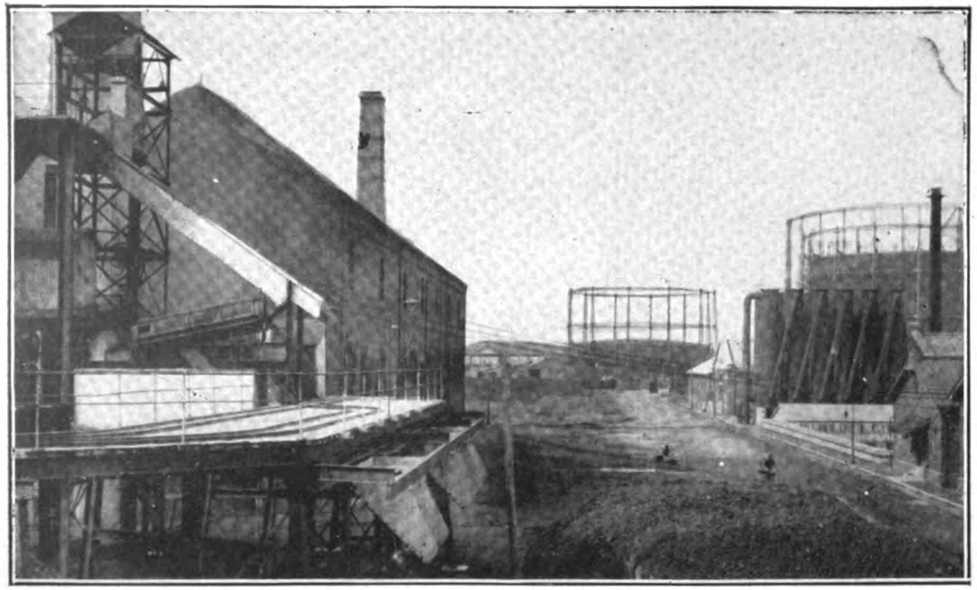
The Tokyo Gas Company has every reason to look forward to a most prosperous future as the demand for gas is constantly increasing and the use of gas appliances becoming more and more popular. A large and increasing demand is being felt for gas heaters and although the employment of gas engines as prime movers has been displaced by the electric motor this is being offset by an increasing demand for gas in industrial plants. The largest purchaser of gas for manufacturing purposes is the Asahi Glass Company, whose great plant near Tsurumi consumes from 200,000 to 300,000 cub. ft. daily.

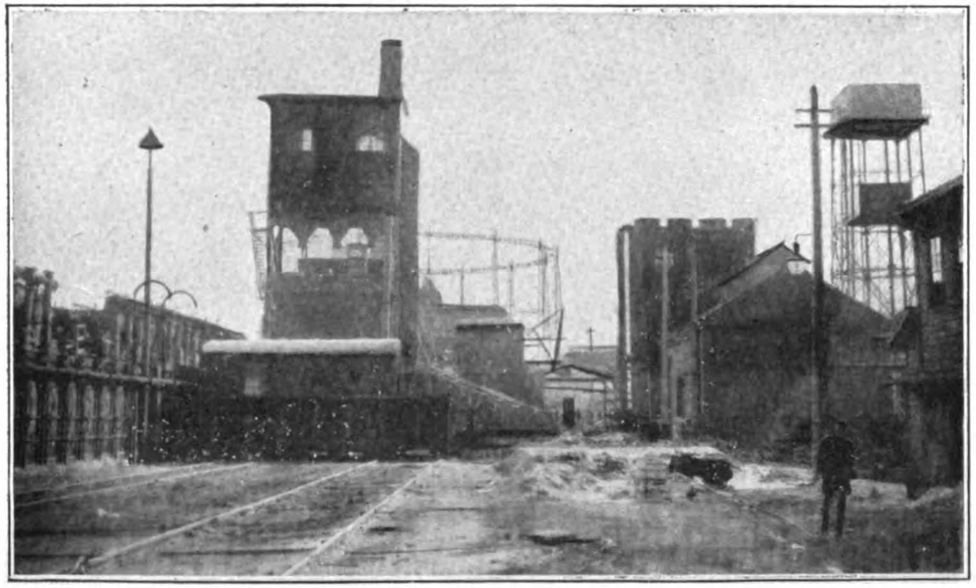
The extensions to the Omori plant include the installation of coke ovens of 4,000,000 cub. ft. capacity to be completed by the end of the present year. This is to be followed next year by another similar plant of equal capacity. On the completion of the Omori plant, the Senju Works are to be enlarged, followed by the erection

PRINCIPAL PLANTS OF THE TOKYO GAS COMPANY


Shiba No. 2 Plant


Omori Plant


Senju Plant


Sunamura Plant

of another new works for which the company is at present selecting suitable ground in the environs of Tokyo. A 3,000,000 cub. ft. holder tank with all accessories and equipment is now under erection at Meguro and will be completed by the end of next year. The plans of the company contemplate a supply of 60,000,000 cub. ft. within seven years, calling for additional equipment to manufacture 32,000,000 cub. ft. In order to carry out this great expansion program, the capital of the company will be increased from Y.45,000,000 to Y.90,000,000.

The present capital of the company is Y.45,000,000 divided into 900,000 shares, all paid up, with outstanding debentures of Y.8,000,000 at 8 per cent. The latest dividends were nine per cent. per annum.

Equipment of Plants

SENJU GAS WORKS: Horizontal and inclined type retorts and water gas plant with a capacity of 9,000,000 c.ft. daily.

FUKAGAWA GAS WORKS: Vertical and inclined retorts with water gas plant 9,000,000 cub. ft. of gas per day.

SHIBA GAS WORKS: Vertical type retorts, 3,000,000 c.ft. gas daily.

OMORI GAS WORKS: Before the earthquake this plant was equipped with Koppers Type Coke Ovens. It was almost entirely destroyed and is now being reconstructed by new design. Present capacity is 3,500,000 cub. ft. daily by horizontal retort and water gas plant.

SUNAMACHI GAS WORKS: Koppers Type Coke Ovens, 1,000,000 c.ft. capacity daily. The plant is producing hard coke.

OSHIMA SEISEIJO: By-products works distilling tar from gas works with a sulphate of ammonia plant and chemical plant.

SARUE BRANCH FACTORY: Distilling 60 to 70 tons of tar per day.

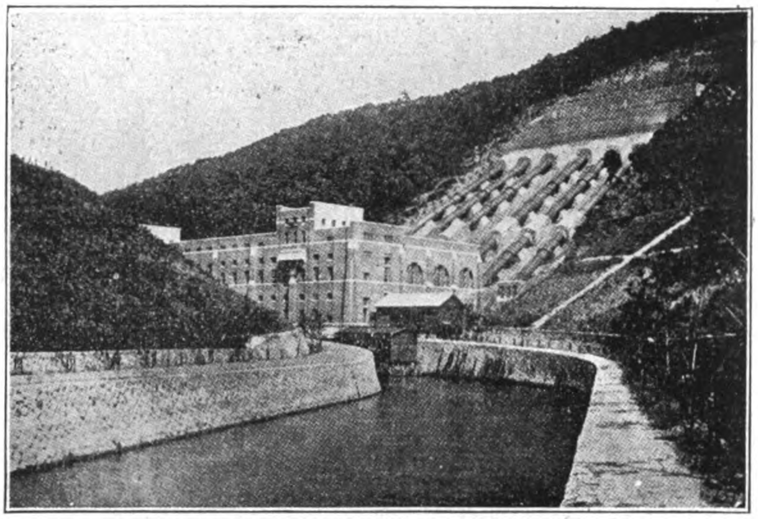
OTHER FACTORIES: Gas meter, repair and appliance works. Stock storehouses, inspection and repair shops.

GAS HOLDERS: The Senju Works has three holders, with the following capacities, 3,500,000 cub. ft. 1,000,000 cub. ft. and 500,000 cub. ft. The Fukagawa Works has two, one of 1,000,000 and the other of 600,000 cub. ft. capacity. The Shiba Works has two holders one of 3,000,000 cub. ft. and the other of 1,000,000 cub. ft. The Omori Works has one holder of 3,000,000 cub. ft. and the Sunamachi Works one holder of 600,000 cub. ft. capacity. In addition, there are three gas holder stations one at Yodobashi of 3,000,000 cub. ft., one at Takinogawa of 3,000,000 cub. ft. and one at Kawasaki of 50,000 cub. ft.

GAS MAINS: At the present time there are over 75 miles of high pressure mains, with 980 miles of low pressure lines of above three inches diameter and 685 miles of 2½-in. or less. Over 285,000 house connections are laid, but at present only 216,000 houses are being supplied.

A few particulars as to the type of plant in use and the output and prices charged for gas in Japan will be of interest as showing the favorable position of the Tokyo Gas Company as compared with other Japanese gas undertakings. The maximum output from the five works of the Tokyo company at the present time is about 25, 000,000 cub. ft. per day, and the price is Yen 2.60 (par value equivalent) per thousand c.ft. in Tokyo, and from Yen 3.50 in the outlying districts.

The Osaka Gas Company has a works with a carbonizing capacity of 8,000,000 cub. ft. per day. Here horizontal retorts are used, and in addition to these there is a water gas plant and a battery of chamber ovens. The price of gas is Yen 3 per thousand feet. Horizontal retorts are used exclusively for carbonizing at the Kyoto Gas Works, where it is possible to meet a demand for 3,000,000 cub. ft. of gas per day. Here the price of gas is Yen 3 per thousand feet. At Kobe, there are two gas works, which together are capable of producing over 5,000,000 cub. ft. per day. The carbonizing plant consists of horizontal retorts and a tully plant. The price of gas is Yen 3.75 per thousand. The Tokyo Gas Company owns four gas works giving an aggregate output of nearly 4,000,000 cub. ft. per day. Both vertical and horizontal retorts are in use and there are also some coke ovens. This company supplies a fairly wide area and the prices charged vary from Yen 2.75 to Yen 4.50 per thousand feet. The Hiroshima Gas and Electric Company operates four works with horizontal retorts and coke ovens. The daily capacity of these four works is about 1,500,000 cub. ft. The price of gas varies between Yen 2.75 and Yen 4.50. Horizontal retorts are used by the Saibugodo Gas Company, the Northern Kyushu Gas Company and the Hokkai Gas Company. The prices charged by these three companies are Yen 2.75 to Yen 3.50 per thousand.



No. 1 Power House of the Ujigawa Electric Company

Vast Field for American Capital

Ujigawa Issue Suggests Broader Market for Mortgage Bonds of Foreign Power Companies.

COMMENTING on the offering of $14,000,000 mortgage bonds for the Ujigawa Electric Power Company, one of the largest hydro-electric power companies in Japan, *The Sun* (N.Y.) calls attention to a vast field for the profitable employment of American capital.

New York bankers, says *The Sun*, have merely scratched the surface of the world's capital requirements for developing the power and light industry. Bonds secured by the property and earning power of power companies serving large and growing territories abroad are likely to find a broader market here than industrial issues, for American investors have learned to appreciate the strength that stability of earning power imparts to securities.

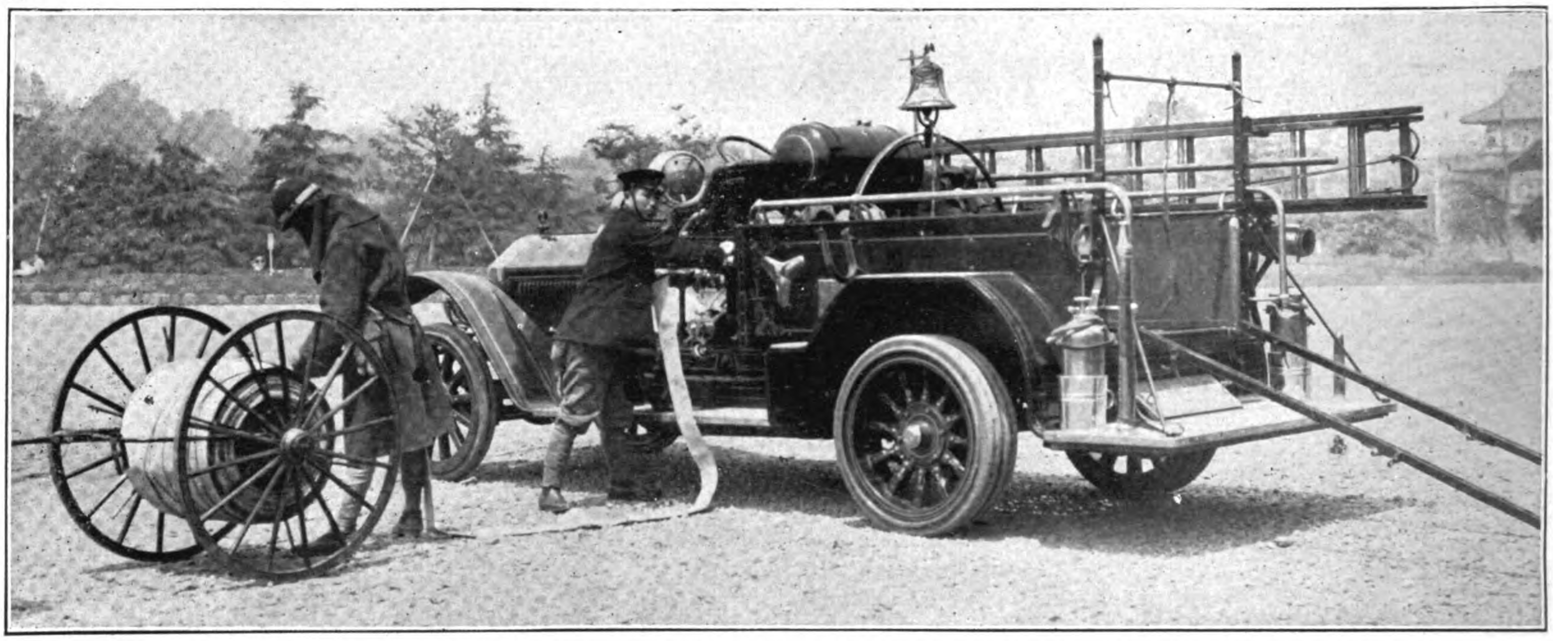
The Ujigawa Electric issue, offered in New York last April at a price to yield 7.90 per cent. to maturity in 1945, represents the third important piece of power financing done for Japanese companies in the American market. The attitude of the Japanese Government on external borrowings by Japanese corporations can be interpreted favorably for this and any other loan with Japanese property and earnings as security.

Because yen exchange is quoted at a discount of about 17 per cent. in terms of dollars, Japan is anxious to avoid the creation of debts abroad that will call for a constant exportation of capital to pay interest. Such interest payments would count in Japan's foreign trade balance sheet the same as importation of goods. They would require the purchase of dollar exchange.

Japan makes an exception, however, of loans for productive purposes. Sanction is given where it is manifest that the wealth to be created at home through a loan counterbalances the ill effect of capital exportation for interest. It can be assumed, therefore, that when a loan is approved the borrowers and the Government see their way clear to make the money earn its cost by a good margin. The Japanese power loans therefore start out without any question as to economic merit.

There is still another feature of Japanese corporation loans that gives them an unusual standing. All mortgages are "closed," not by agreement between borrower and lender, but because the laws do not permit any other kind of mortgage. All loans are secured by specific property, either all or just part of a company's plants. The mortgage cannot be increased in amount. In the case of the Ujigawa loan the earnings for 1924 were 3.2 times interest charges on the mortgage bonds.

A long-established American power company having the capital structure and earning power of the Ujigawa could borrow money at home on a first mortgage, on a 5½ per cent. basis or better. Japan is a long way off and it is difficult for an American investor to visualize the borrowing company's property and field. Furthermore, our investors are not yet educated up to the general idea of foreign investments. With all its wealth and surplus capital, America presents a relatively small market for foreign corporation bonds. This condition and state of mind account for a large part of yield disparity as between domestic and foreign corporation bonds.



One of the American-La France 75 H.P. Motor Fire Engines on duty at the Headquarters Station of the Tokyo Fire Department

Modernizing Tokyo's Antiquated Fire-Fighting Methods

FIRE has always been one of the greatest menaces to life and property in the city of Tokyo, the paper and wood construction of buildings, open braziers for heating, and congested districts all contributing to a fire hazard greater than in most large cities of the world.

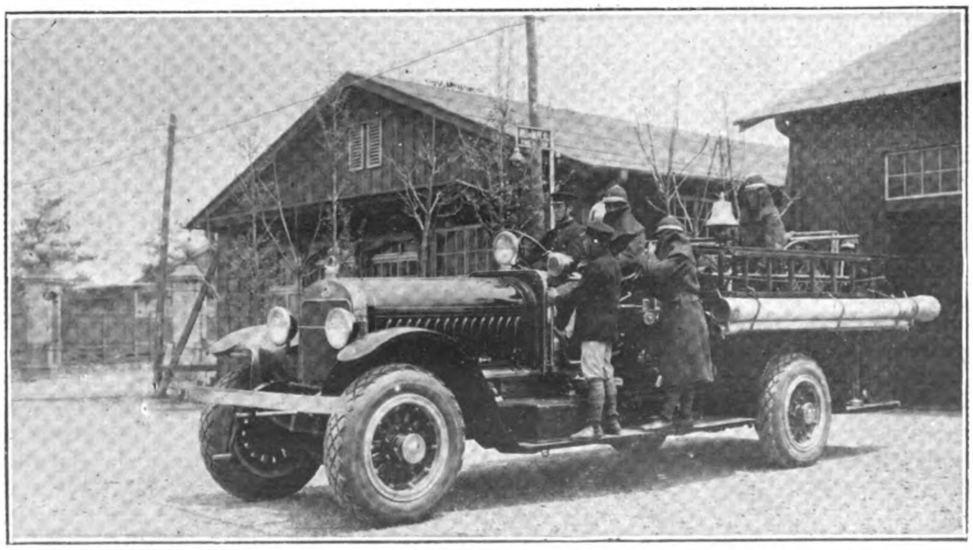
The history of the city shows that it is visited by a conflagration which reduces the greater part of the buildings to ashes at least once in every thirty years. The statistics for the last three years bring out the fact that there is an average of 984 fires a year, with an annual loss of Y.12,000,000 in property, which is Y.12,000 for each fire, the average loss being low on account of a large number of small fires which involve small dwellings and shops only. This is proof of the efficiency of the present fire-fighting equipment.

The first fire brigade was formed in Tokyo 275 years ago for the protection of buildings within the compound of the Yedo castle. This organization being still in existence to-day, is the oldest fire department in the world. A fire department for the protection of the city in general was organized in 1715 by the famous magistrate Ooka Echizen no Kami, which is followed to the present day in the auxiliary units of the city's fire brigades.

The organization of these old fire brigades was highly developed and their equipment as efficient as in any other part of the world at the same period. They corresponded in many ways to the volunteer fire brigades of the late seventies in the United States, but were supplemented by a professional organization of regularly paid men supported by the local communities and the city government. The same keen rivalry developed between the brigades of the various city wards as in America, where this rivalry almost overshadowed the real purpose of fire protection.

The city was divided into fire districts, each maintaining a station for the storage of equipment and a watch tower. The streets were patrolled by privately paid fire watchmen, while a lookout was constantly on duty at the top of the towers. The alarm was given by striking a bell in one of the towers, the number of strokes indicating the proximity of the fire in order that the citizens might be warned of both dangerously near fires and others which might spread to their district.

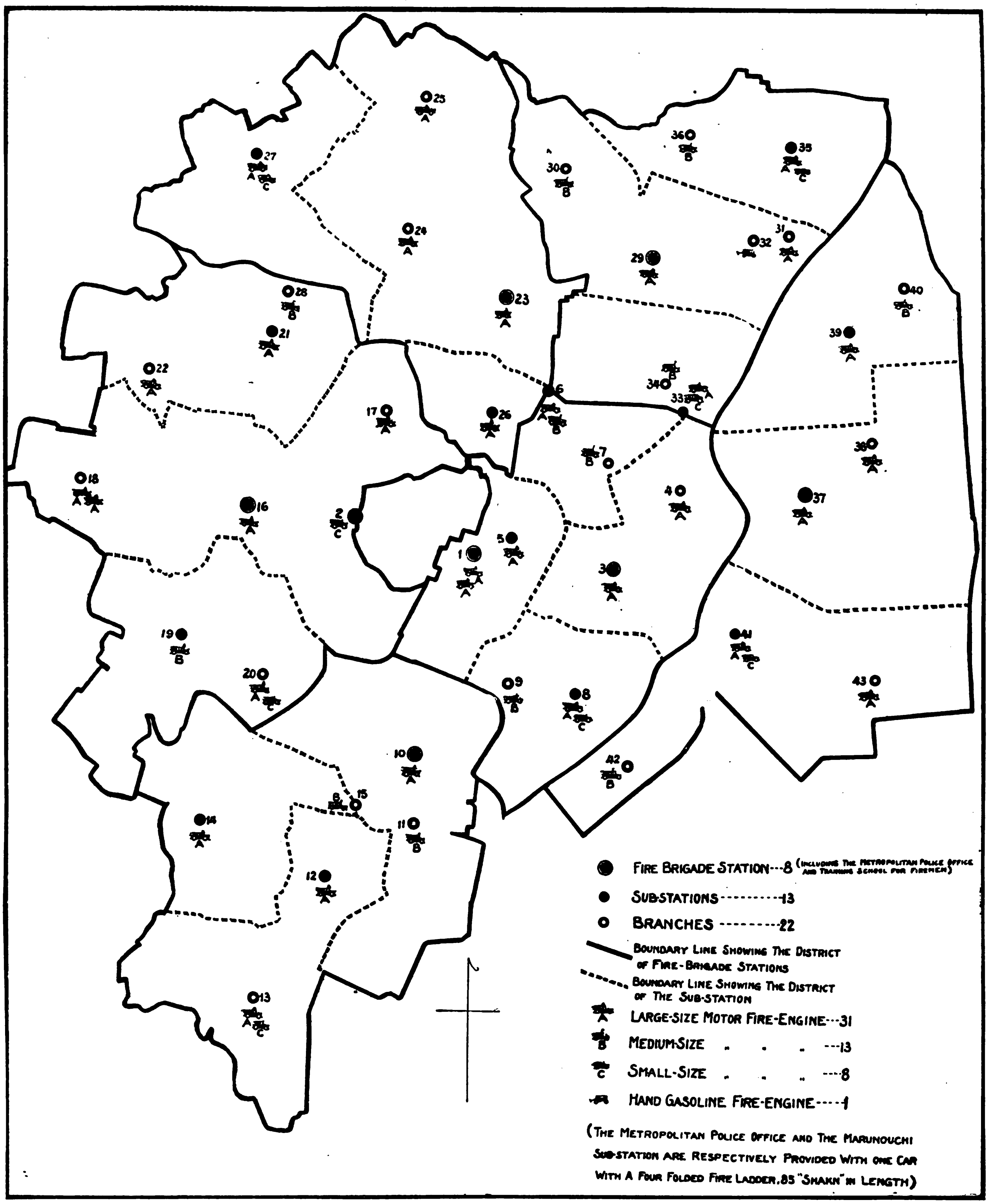
The volunteer brigades immediately assembled at their respective stations with their elaborate costumes, which were absolutely essential, and their individual equipment. Buckets were rushed to the scene of the fire and lines formed to the nearest moat as the only means of directly combating the flames. Small hand plunger pumps, one might almost call them squirt guns, were also used, but their effectiveness can be imagined. These old brigades were also trained in the tearing down of houses as a means of stopping the spread of the flames.



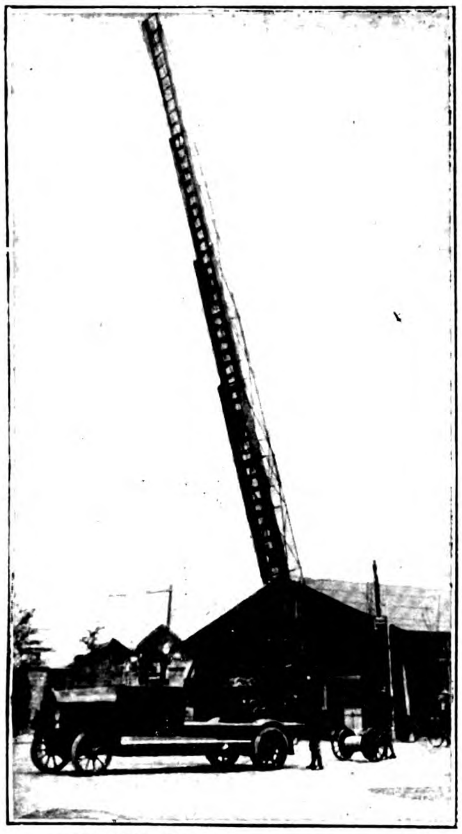
Stutz 140 H.P. Motor Fire Engine on duty at the Headquarters Station of the Tokyo Fire Department

The fighting of fire in the old days was also surrounded by an elaborate etiquette. Each brigade carried sacred and demon dispelling emblems which were planted on the roofs adjacent to the fire to prevent its spread. The standard of the company was placed as close to the fire as possible, and it was considered a great disgrace to have to move it back. This standard also served

Map Showing the Arrangement of Regular Fire Brigades in the City of Tokio



(1) *The Metropolitan Police Office* Headquarters of
(2) *The Training School for Fire-men* Fire-Brigade
(3) *The First Fire Brigade Station*
(4) Hisamatsucho Branch of the above Station
(5) Marunouchi Sub-station
(6) Manseibashi Sub-station
(7) Odenma-Shiocho Branch of the above Sub-station
(8) Tsukiji Sub-station
(9) Sanjikkenbori Branch of the above Sub-station.
(10) *The Second Fire-Brigade Station*
(11) Shogenbashi Branch of the above Station
(12) Mita Sub-station
(13) Nihonenoki Branch of the above Sub-station.
(14) Azabu Sub-station
(15) Iigura Branch of the above Sub-station
(16) *The Third Fire-Brigade Station*
(17) Kudanzaka Branch of the above Station
(18) Shinjuku Branch of the above Station
(19) Aoyama Sub-station.
(20) Shinmachi Branch of the above Sub-station
(21) Nishigome Sub-station
(22) Wakamatsucho Branch of the above Sub-station
(23) *The Fourth Fire Brigade Station*
(24) Sojimachi Branch of the above Station
(25) Komagome Branch of the above Station
(26) Surugadai Sub-station
(27) Otsuka Sub-station
(28) Suidocho Branch of the above Sub-station
(29) *The Fifth Fire Brigade Station*
(30) Yanaka Branch of the above Station
(31) Umamichi Branch of the above Station
(32) Asakusa-Koen Branch of the above Station
(33) Asakusabashi Sub-station
(34) Mukoyanagiwara Branch of the above Sub-station
(35) Nihonzutsumi Sub-station
(36) Shitaya-Kanasugi Branch of the above Sub-station
(37) *The Sixth Fire Brigade Station*
(38) Hanamachi Branch of the above Station
(39) Honjo Sub-station
(40) Oshiage Branch of the above Substation
(41) Eitaibashi Sub-station
(42) Tsukijima Branch of the above Sub-station
(43) Susaki Branch of the above Sub-station.



A 50 H.P. Benz Hook and Ladder Motor Truck at the Headquarters Station of the Tokyo Fire Department

to indicate the first arrivals at the fire, and the companies in attendance, in order that each might be rewarded in case of a successful attack.

Groups of men were designated whose duty it was to go through the district immediately surrounding The fire, and knock on each door, saying, "The fire is near, give us the children." The children were then marched out of the danger zone in an orderly manner and taken care of, each child having an identification tag around his neck. The children out of the way, the saving of property followed, in which special divisions of the fire department assisted.

The old volunteer organization is still in existence to-day, the fireman wearing the same elaborate costume, carrying the same bamboo ladders, the same implements, with hand drawn pump carts as the only modern innovation. They still hold a great festival at New Year time, in which feats of acrobatics, supposed to be useful in swarming over buildings and saving the inmates, are a major feature.

As was natural in a locality in which fire was so great a danger, the fire-bug or incendiary was punished with great severity, usually death by torture and the disgrace of his entire family. Inasmuch as most fires before the introduction of electricity were due to individual carlessness, the Japanese law held the family in whose home a fire started as directly responsible, for which due penalties were exacted. It is interesting to note that the Code Napolean also recognizes this responsibility in Europe, and that the opinion is still held in Japan at the present time.

Old Style Observation Tower at Tokyo Fire Department Headquarters

The next period of development of the Tokyo fire control system came with the introduction of hand-operated hose carts and chemical extinguishers, which the Japanese adopted as soon as they learned of their existence. Since that time Tokyo has kept abreast of the latest equipment designed for fire protection. Horse-drawn steam pumps were used in the latter part of the Meiji Era (1892-1911), together with a more extensive waterworks system. The complete motorization of the department has since gone on rapidly, and Tokyo now has one of the model fire departments of the world.

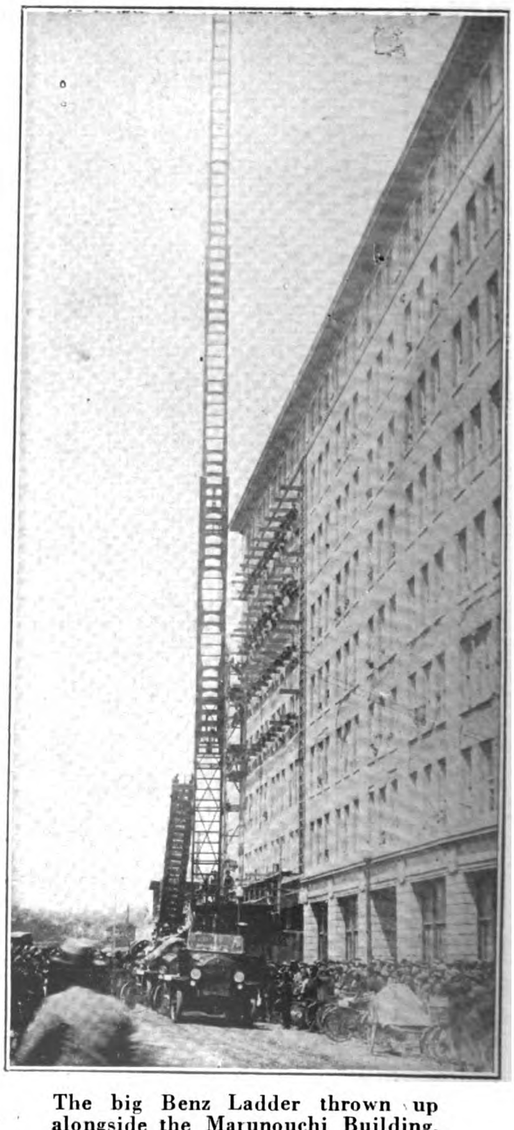
For the purpose of fire protection the city of Tokyo is divided into nineteen districts, with one fire brigade and one or more subsidiary posts attached to each district. In addition there are two brigade stations controlled by the Metropolitan Police Board with superintendence over a great number of smaller stations and volunteer posts. The total number of all main stations is forty-three; two police controlled stations, nineteen division stations and twenty-two detached posts. The total number of men regularly attached to these stations is 831, or an average of from 10 to 24 men at each place on duty alternately every other day.

Assisting the regular fire department there are the reserve brigades of voluntary firemen, each with one post and two hand-drawn hose carts each. The total number of men in this reserve is 1,520, 38 persons forming one company. The reserve assists the regular organization during the period of greatest fire danger, namely from November 11 to May 10 from 8 p.m. until 6 a.m.

In the suburban districts immediately surrounding Tokyo there are 188 companies and 52,000 men. They have a total of one hundred motor-driven pumps and 938 hand-pumps. These companies are supported by their respective villages and are under the direct control of the local police station. The rural brigades are almost entirely volunteer fire departments, but are well drilled and in a position to give material help to the city department.

The mechanical fire-fighting equipment of the city of Tokyo includes fifty-three motorcar engines, fifteen motor hose cars, three hook and ladder motorcars, one gasoline-driven pump and four other motorcars for officials and the division chiefs. It is planned to have at least two motorcar engines at each station in the future instead of at only ten stations as at present. There is also a geat deal of chemical apparatus and fire-fighting equipment of other kinds scattered throughout the various main stations of the city.

Comparing Tokyo with other large cities of the world shows that she is far behind in the amount of mechanical appartatus provided and in the number of men in the standing force. In New York there are eighty-five stations with 182 motorcar



The big Benz Ladder thrown up alongside the Marunouchi Building, Tokyo's tallest office building.

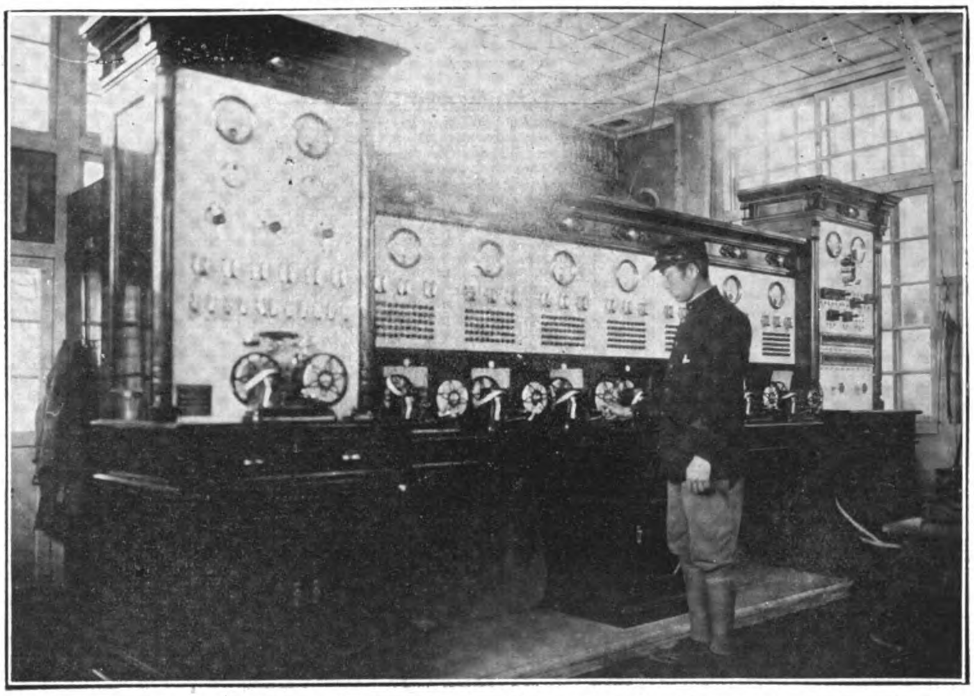
engines and 5,908 men; in London sixty-seven stations with 169 motorcar engines and 2,066 men; while Berlin has seventy-two stations, ninety-four motorcars and 1,101 men. It must also be taken into account that these cities contain a great number of fireproof buildings in comparision with the inflammable nature of most of the structures in Tokyo.

There is a total of 6,030 fire hydrants in the city, which is one hydrant for every seventy houses, and about ten to each mile of street. These are supplemented by 1,768 private hydrants suitable for fire fighting hose attachment. The pressure on the mains before the earthquake was forty pounds in the uptown districts and thirty pounds downtown, since which time the pressure has decreased slightly. Other sources of water supply for use in combating fires are twenty-nine reservoirs and 836 points beside the rivers and moats specially constructed for emergency pumping. On account of the tidal rise and fall of some of the rivers, these sources cannot always be relied upon, so that there are a number of private ponds in the compounds of the big mansions which are subject to the use of the fire department.

To improve the existing water facilities for fire protection the city authorities are now working on a high pressure system, the general idea of which is to supply water to Koishikawa, Hongo, Shitaya and Akasaka from the river Arakawa; Kojimachi, Kanda, and Nihonbashi from the river Edogawa of Sekiguchi and to Yotsuya, Ushigome, Akasaka, Azabu, Shiba and Kyobashi from the old watercourse of the Yodobashi, also to Honjo, Fukagawa and Tsukishima from the river Nakagawa. This plan includes the making of open spaces for pumping from the river Sumida and other smaller streams, by providing swimming pools in the parks and pools or foundations in the compounds of shrines and temples and other places of easy access for apparatus. Fire fighting craft will also be built for use on the river for fighting fires in vessels and near the river banks.

The Chief of the Tokyo Fire Department recently pointed out in a public address the greater needs of the city in improving its fire-fighting efficiency. He said that the parks and other open spaces of the city are only 19 per cent. of the total area, so that congestion of the streets at the time of a fire is often great enough to impede the progress of the equipment in reaching the scene in good time. Of the total length of roads in the city, 155.5 miles are over thirty-six feet in width, while the length of streets under thirty-six feet is 539.4 miles. These narrow roads often prevent the modern motorcar apparatus from approaching close enough to a fire to be effective. The importance of this fact is brought home by the statistics on the property loss at different fires, which is Y.6,300 per fire in the city and Y.25,000 in the suburbs where the roads are narrow and the equipment inferior to that in the central districts.

Before the earthquake there were 187 electric fire alarms, mostly in Nihonbashi, Kanda, Asakusa and Kojimachi, 70,000 telephones and 29 watch towers. This number has since been reduced, but is rapidly being brought up to the standard. In addition there is a plan to install automatic fire alarms every 240 yards, which would mean a total of 5,150 such instruments, with receiving apparatus at each of the seventy-five main stations. The fire brigades are well trained in



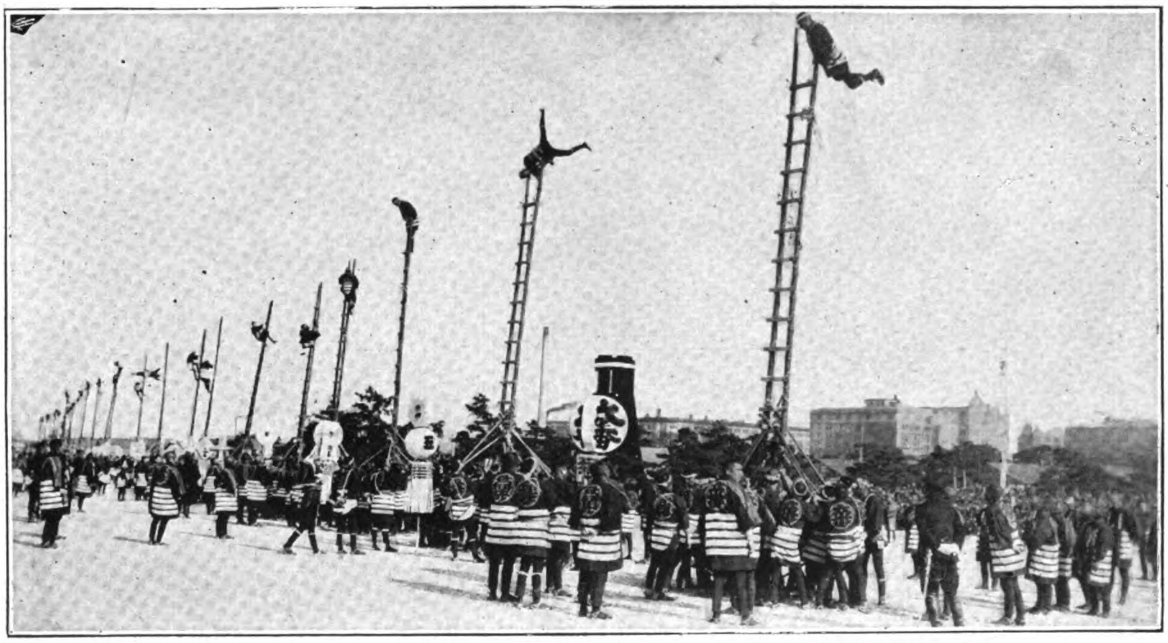
New Fire Alarm System Installed in Various Government Buildings with Control Station at Headquarters. This Installation, made by the Tokyo Fire Alarm Company, is the first step towards equipping the City with a modern fire alarm system

Tokyo's Fire Fighters at Work

reaching a fire quickly, the usual time being twenty seconds in getting away, and five minutes to reach the scene of the fire and lay hose lines. This good record is of no value, however, unless the alarm is turned in quickly, as was pointed out by the Fire Chief recently, and the installing of new equipment for giving the department notice of a fire will go forward as rapidly as possible.

The greater part of the city consists of only temporary structures built shortly after the earthquake and a number of barrack dwellings in all the congested residential districts, so that the risk of fire is much greater than at any other time. The streets are torn up in many places for repair and reconstruction work, still further hindering the work of the fire apparatus. These defects will be gradually overcome in the new zoning system which is to be rigidly followed in all permanent buildings, the widening of the streets in the general reconstruction plan, the building of parks, a greater number of fireproof structures and the improvements which are planned in the fire-fighting organization itself. The present system is worked out for the needs of the city at the present time and calls for the assemblage of at least ten motor fire engines at every barrack fire. The plans for the concentrating of apparatus are carefully worked out in accordance with the size of the fire, the force of the wind and the buildings involved, as to whether the second and third reinforcements are brought up.

Tokyo Volunteer Fire Brigade, showing Emblem of the East Company



Tokyo has its Volunteer Fire Brigades, which meet in annual contests of skill. The above shows them doing some of their stunts. The ladders are held up by hooks

The regular brigades are taught all the methods of fighting the complex fires of the present day by water and chemicals, smudging and by the destruction of buildings in the path of the flames. Daily drills are held in quick hose attachment, the use of the mechanical equipment, in the fighting of special fires such as in the taller buildings, theaters, hospitals and the like, as well as trial runs.

Educational fire prevention campaigns are being carried on by the police and educational authorities, which aim at the root of the evil and will materially reduce the number of fires caused by carelessness. The new building regulations are more strict in fire protection measures, with more attention paid to the methods of electric wiring, which have been the cause of a great number of fires in Tokyo. The improvement in all existing fire protection methods is therefore going on in a most thorough manner and should materially reduce the large losses by fire which have been the burning shame of the city for so many years. The time will soon come when "the flowers of Tokyo" will bloom in much less fertile soil and the clang of the alarm is heard at longer intervals.

The budget of 1924 set aside Y.947,694 for fire protection purposes under the control of the Metropolitan Police Board, and Y.344,412 to be expended in the outlying districts for the same use. The total loss by fire in the city of Tokyo during the same year amounted to Y.1,022,648, or a trifle more than the amount expended for protection. In the country districts immediately adjacent to the city the loss was Y.3,169,450, or ten times the amount set aside for fire fighting equipment. While these figures indicate that the losses are much less where more apparatus is provided, it must be taken into account that road conditions and water supplying the outlying districts contributed to the larger losses.

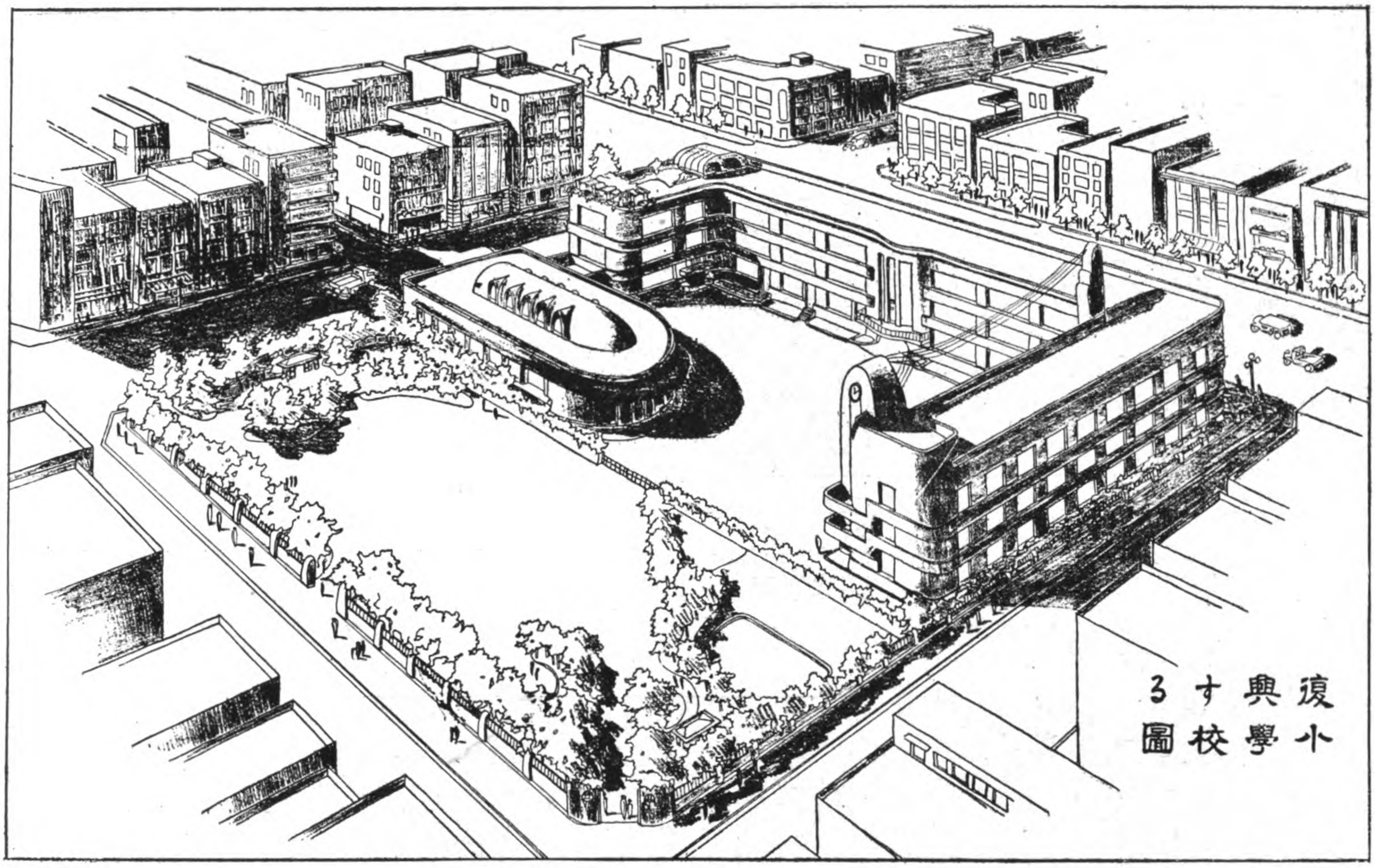
The total number of fires which broke out in the city and surrounding territory during 1924 was 946. It is interesting to note that of this total the largest number were caused by fires of unknown origin accounting for 196, followed by electricity with 93, 77 incendiary fires, 70 from defective chimneys, 67 due to carelessness with tobacco, 41 due to illuminating and heating gas, 40 from overturned hibachi (the charcoal brazier used for heating and cooking by the Japanese), with ash dumps and drying rooms next on the list. The balance of the figures originated in diverse sources such as candles, children playing with fire, oil lamps and the like. If the origin of the unknown fires were determined they would undoubtedly swell the total of incendiary fires and those due to electricity and careless disposal of lighted cigarettes.

A list of the more important pieces of motor fire-fighting equipment of the city is as follows:—

FIRE ENGINES

Chassis	Type of Pump	H.P.	Pressure in lbs.
Stutz	Northern Co.	140	250
American La France	American— La France	120	,,
,, ,,	,,	105	,,
Allen-Fox	Allen-Fox	85	300
Magras	Magras	75	120
American— La France	American— La France	75	120
Leland	Leland	48	120
Seagrave	Seagrave	77	120
Reo	Northern Co.	45	120
Hudson	Northern Co.	35	200
Dodge Bros.	Ishikawa	35	120
,, ,,	Teikoku	35	120
Benz	Benz	40	200
Benz	Benz	30	200

HOSE CARTS (3): Columbia, Dodge Brothers, Maxwell,
HOOK AND LADDERS CARS (2): Federal, Benz



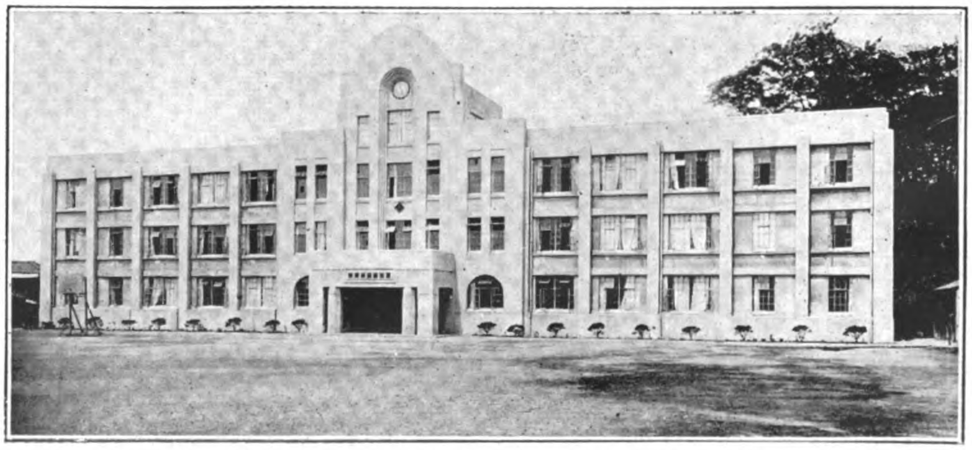
117 New Primary Schools are to be Erected in Tokyo in the Next Three Years. They are all to be Three-storied Reinforced Concrete Structures, Equipped with Gymnasiums and situated as far as possible alongside small parks. The above is typical of the General Style, on Square Lots

Schools for the People

117 Handsome New Primary Schools of Reinforced Concrete, with Park Playgrounds, will be Erected in Tokyo under the Reconstruction Program

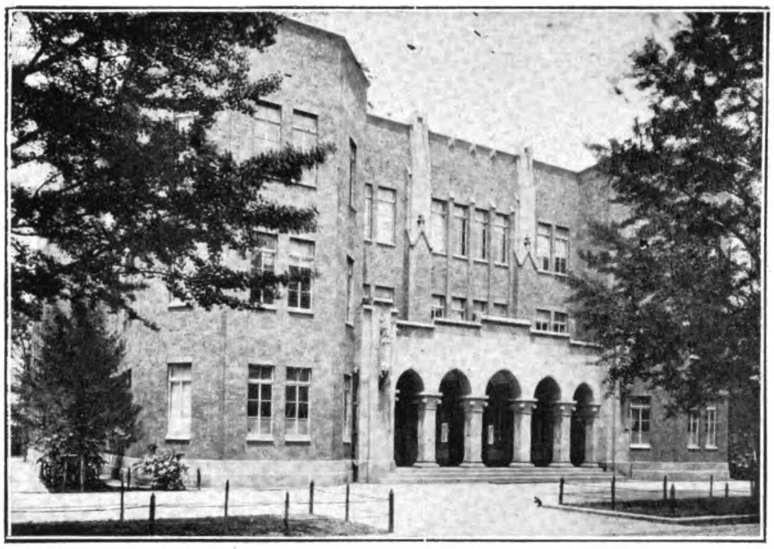
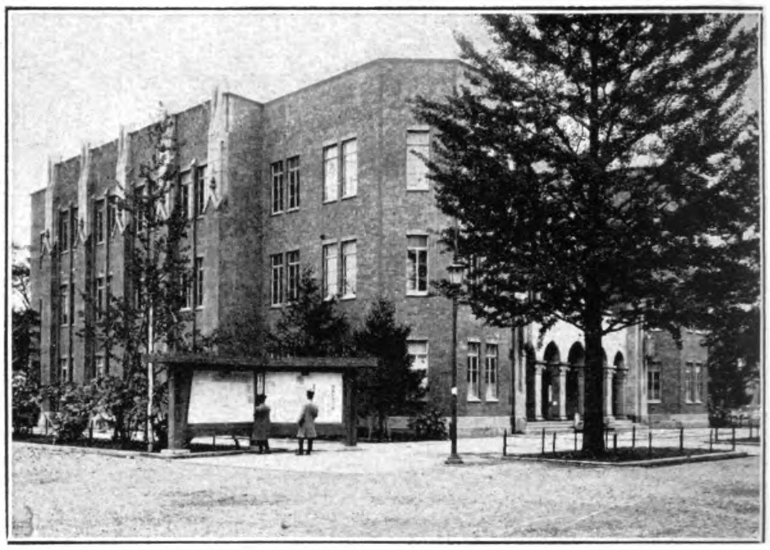
ONE of the largest items in the Reconstruction Budget is the appropriation of Y.54,810,000 for new school buildings in the devastated area. Of this sum, Y.38,-610,000 is allotted to Tokyo, Y.3,250,000 to Tokyo Prefecture, Y.10,950,000 to Yokohama City, and Y.2,-000,000 to Kanagawa Prefecture. Tokyo's allotment will be expended in rebuilding the 117 primary schools destroyed by the flames, of which 109 were district or ward schools, and eight under the direct supervision of the city. One new primary school, to occupy a site of 1,100 *tsubo,* is also provided for in the above appropriation.

The National Government will bear one quarter of the costs of construction and equipment, and make advances to the municipality to meet the annual interest charges on the bonds to be issued for this purpose. Five modern fire-proof primary schools have been erected since the earthquake and plans for all the others completed. Pending a settlement of the new land adjustment scheme and the laying out of streets, construction work on the new schools has been held up. It is anticipated, however, that during the present year these obstacles will be cleared away, and construction will proceed rapidly in order to get the children out of the present unsightly and unsanitary barracks hurriedly erected after the disaster as temporary schools.



One of the Handsome Commodious New School Houses replacing the Old-type Building: The Kasei Middle School at Nippori, Tokyo, erected by Takenaka Komten

A standard type of primary school house has been adopted for the 117 buildings. Each building will be of reinforced concrete, three stories in height, with 24 class rooms, gymnasium and public hall. The detailed plans of each building will vary slightly according to the formation of the lot, which is to be of sufficient area

Imperial Univerersity Buildings at Hongo, Tokyo, erected by Tokenaka Komten

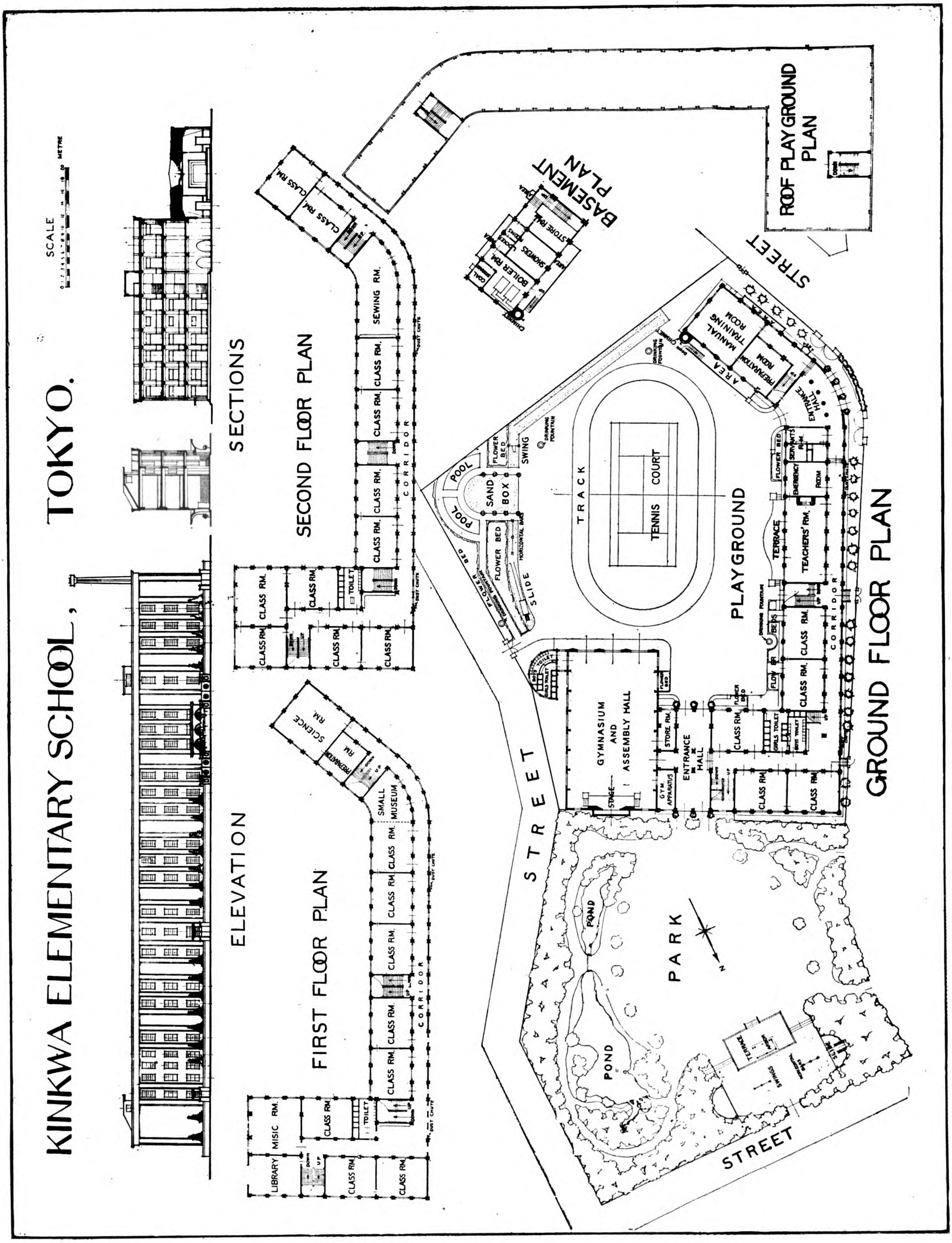
to permit of ample playground space. As far as possible, the sites for these schools will be located adjacent to the many small parks, of which 52 new ones are to be laid out by the city. The general lay out of these schools is shown in the plans on the opposite page. Each school is to be equipped with independent steam heating and ventilating plants and lighted by electricity. The grounds will be provided with various athletic facilities in addition to the well equipped gymnasiums in each building. Physical exercises form a large part of the training of Japanese school children. Each recess hour competent instructors put the youngsters through a setting-up drill, which is having a remarkable effect on the general physique and health of the new generation. The addition of a complete gymnasium equipment in every school house to supplement these exercises is an indication of the great interest shown by the authorities in developing the stature and physique of the children from the earliest age. These buildings, the last word in modern school construction, are an honor to the city and nation, the expression of a determination to maintain at all costs the high standards of education and hold the proud distinction which places Japan in the front rank of nations where illiteracy is almost unknown. It is regrettable that the appropriation for this work is spread over a period of five years instead of being immediately available.

Tokyo Commercial School

Tokyo Prefecture will construct and equip five schools with its allotment of Y.3,250,000, the Third Middle School, the First Higher School for Girls, a School of Industrial Technology, School of Industrial Chemistry, and a School of Technology. The full amount will be loaned to the prefecture by the National Government at a suitable rate of interest. These must be completed before the end of 1927, and as soon as the replotting of the city permits, construction will be taken in hand and pushed to completion.

Yokohama's allotment from the national treasury will be one-fourth of the total expense of Y.10,950,000. in addition to which the National Government will advance the funds to the city to meet the annual interest charges on the bonds issued for this pur-

One of the Reinforced Concrete Primary Schools Erected after the Earthquake. When the temporary Wooden Shacks are Removed, the Site Cleared of Debris and the Grounds Laid Out and Ornamented, this Building on its Irrigular Lot, will Present a more Diguified Appearance


KINKWA ELEMENTARY SCHOOL, TOKYO.
SCALE
METRE
SECTIONS
ELEVATION
SECOND FLOOR PLAN
FIRST FLOOR PLAN
BASEMENT PLAN
ROOF PLAYGROUND PLAN
GROUND FLOOR PLAN
CLASS RM.
SEWING RM.
CORRIDOR
TOILET
SCIENCE RM.
PREPARATION RM.
SMALL MUSEUM
LIBRARY
MUSIC RM.
STORE RM.
SHOWERS
BOILER RM.
COAL
MANUAL TRAINING ROOM
PREPARATION ROOM
AREA
ENTRANCE HALL
FLOWER BED
TEACHERS' RM.
TERRACE
PLAYGROUND
TRACK
TENNIS COURT
POOL
SAND BOX
SWING
SLIDE
GYMNASIUM AND ASSEMBLY HALL
STAGE
GYM. APPARATUS
STORE RM.
ENTRANCE HALL
GIRLS TOILET
STREET
PARK
POND
TERRACE
SWINGS
N

pose. The appropriation is made available over the period 1924-29, and covers the costs of erecting and equipping 31 primary schools (Y.10,230,000) and one Commercial College to cost Y.700,000. The primary schools are to be built to the same general plan as those in Tokyo and must be provided with 1,100 *tsubo* of ground, not to exceed a cost of Y.300 per *tsubo*. Sites have been acquired for the erection of four schools; plans are now completed for two, and preparations for construction are now being made. The Commercial School is to cover a site of 2,400 *tsubo*, and, like all other schools in the reconstruction program, will be built of reinforced concrete and equipped throughout with the most modern appliances.

The small towns in Kanagawa Prefecture suffered severely during the earthquake, and in the local fires at Kamakura and Odawara nearly all public buildings were damaged. The schools must be replaced by the prefecture, but the Reconstruction Budget allocates Y.2,000,000 as a loan from the national treasury on which the prefecture must pay interest. With this sum the prefecture will build and equip a Commercial and Industrial Training School, a Girls' Higher School, Girls' Normal School with an attached Primary School, the First Middle School in Yokohama and an Industrial School. The new schools are to cost Y.1,671,000 and repairs to old buildings Y.329,000. The costs of these schools are lower than those in Tokyo and Yokohama by reason of the low land values in the country districts.

The expenditure of the general school fund for the city of Tokyo is spread over five years as follows:

Fiscal Year (April 1-March 31)	Total	National Government	Municipality.
1924-25 ...	Y.8,000,000	Y.2,000,000	Y.6,000,000
1925-26	8,000,000	2,000,000	6,000,000
1926-27	8,000,000	2,000,000	6,000,000
1927-28	8,000,000	2,000,000	6,000,000
1928-29	6,610,000	1,651,500	4,957,500
Total	Y.38,610,000	Y.9,652,500	Y.28,957,500

The Municipal Central Market

ONE of the most important of the new public utilities to be built for the city of Tokyo is a great central wholesale market equipped with every modern convenience for the rapid receiving and dispatching of meat, fish, vegetables and produce of all kinds. This market will supersede the older Nihonbashi fish center and concentrate at one point the produce arriving from all parts of Japan, enabling the health authorities to exercise a more effective control over the food products before being exposed for sale in the retail shops. The site for the new market is to be somewhere along the Tokyo waterfront, preferably on the block owned by the Navy Department in Kyobashi. If this cannot be obtained, the site will be located on reclaimed land at Shibaura. Although the final plans have not as yet been approved, the municipal architects have perfected several different designs for the new market, of which the one shown on the opposite page will probably be accepted. The estimated cost of the site, covering 84,298 *tsubo*, is about Yen 6,547,500. The buildings will cost Yen 4,299,400, their equipment another Yen 3,561,143, while the cost of plans, supervision and inspection calls for another Yen 501,957, a total cost of Yen 15,000,000.

A special railway siding will connect every building in the market with the main railway at the Shiodome freight station, while on the waterfront side a large floating landing stage will enable trawlers and fishing boats to discharge their cargoes rapidly. Another wharf, equipped with special cargo handling machinery, will be constructed to accommodate fishing and other vessels of 2,000 to 3,000 tons, which, in turn, calls for dredging the channel to the outer bay and constructing protective banks.

A belt-conveyor system for the rapid and convenient handling of light-weight packages will be installed in all the buildings, fifty electric trucks will be used to transport heavier pieces within the market limits, and a special delivery service of 50 motor trucks will facilitate the assembly and distribution of produce throughout the city. There will also be two grain elevators and an independent water supply from six artesian wells. All of the buildings are to be of reinforced concrete equipped with ventilating, heating and refrigerating systems. The buildings, designed for the storage and handling of various products, will have storage and sales rooms under the same roof, the largest of the buildings being used for the storage and sale of fish, the principal food of the Japanese. The fish market will have 800 *tsubo* of floor space and an additional 5,800 *tsubo* for stalls. The vegetable building will have 200 *tsubo* of storage space and 2,500 *tsubo* for sales stalls. There will also be fruit, meat and egg storage and marketing buildings, 800 *tsubo* of packing rooms, and four auction rooms. Cold storage for fresh, dried and salted fish, meat and eggs will be provided by the installation of a plant of 2,000 tons refrigerating capacity per day in addition to a 30-ton ice machine. Special underground rooms for the ripening of fruits will be a feature of the market installation.

Offices for the market authorities, a bank and post office, stores for the sale of miscellaneous merchandise, inspection rooms, a fire station, police box, toilets, garbage and waste disposal bins, stables and other structures are included in the general scheme. All walls, floors, drying spaces, water drainage, moat, toilets, waiting rooms and buildings are to be of reinforced concrete, the whole conforming to the most advanced ideas for the handling of perishable food products for the population of a great metropolis.

Kanda and Koto Branch Markets

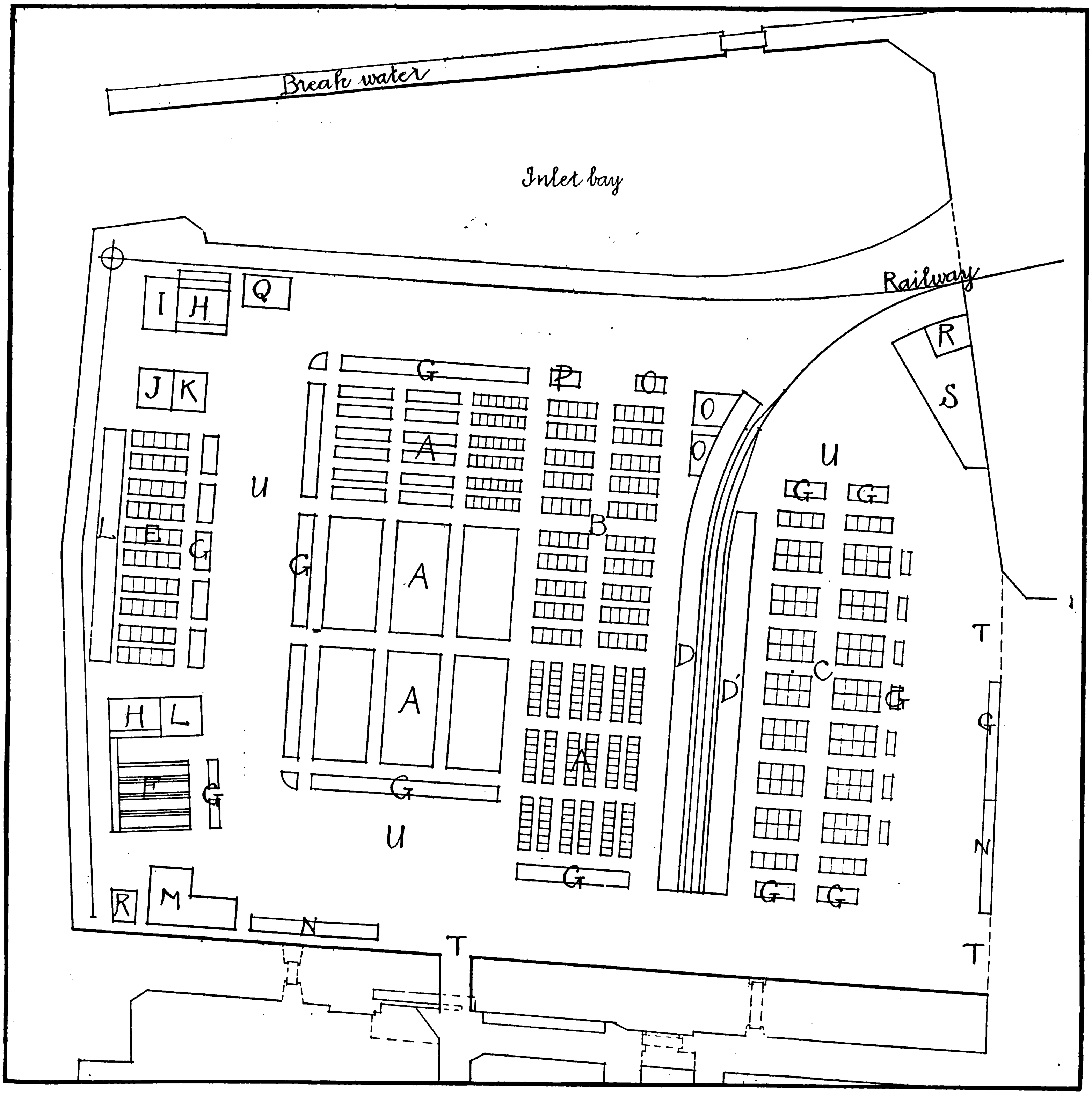
The main central market is ultimately to have two branches which will absorb all the existing privately operated markets scattered throughout the city whose excessive charges, it is claimed, add about fifty per cent. to the prices of foodstuffs. One of these branch markets will be located at Kanda, in the vicinity of the Akiwabara freight depôt, and the other at Koto, in Honjo, near the Ryogoku Freight Station. Most of the fruit, vegetables and garden produce from the country districts is received at these stations, and the new markets will be specially designed and constructed to receive these products direct from the railway cars on one side and deliver them for distribution throughout the city the other side by means of motor trucks or the navigable canals. Another Yen 7,500,000, exclusive of the cost of the sites, will be required for the construction of these branches.

Yokohama Market

The Reconstruction Budget also provides Yen 4,000,000 for the construction of a central wholesale market at Yokohama, of which the National Government will furnish one-fourth. The site for this market has not yet been decided upon, and construction may be delayed for another year or so. However, the general construction and equipment will correspond with that of the Tokyo Central Market, but on a smaller scale.

Garbage Disposal Plants

Supplementing its improved water and sewage systems, the public health of the city of Tokyo will be further safeguarded by the installation of an up-to-date garbage disposal system. The sum of Yen 1,850,000 has been appropriated in the Reconstruction Budget for the purpose of erecting 27 garbage collecting stations in various districts of the city, located for the most part on the banks of navigable streams and moats to permit of cheap and inoffensive transportation in barges to three main disposal plants. There are at present 18 garbage collecting stations scattered throughout Tokyo working under the old system. These are to be enlarged and their equipment modernized. The plans call for nine new reinforced concrete collecting stations two stories high, equipped with electric elevators, revolving bins, wagons, trucks, etc.



Ground Plan of the Proposed Central Market for Tokyo to be Erected on the Water Front at a Cost of Yen 15,000,000: A, Fish Stand; B., Wholesale Fish Stalls; C, Fruits and Vegetables; D. Platform for Fish; D, Platform for Vegetables; E, Dried and Salted Fish; F, Meat, Poultry and Eggs; G, Waiting Room; H, Refrigerating Room; I, Engine Room; J, Ice Plant; K, Ice House; L. Store; M, Bank, Post Office, Office, Dining Room; N, Shops; O, Wholesaler's Office; P, Dining Room; Q, Packing and Forwarding Room; R, Garbage House; S, Cattle; T, Gate; U, Car Field.

The three disposal plants, designed to handle about 1,666,000 lbs. of garbage per day, will be equipped with drying apparatus, and hydraulic presses calculated to reduce the gargabe 80 per cent. in volume and 40 per cent. in weight. Two of these plants will cover an area of 212 *tsubo*, while the other will be of double capacity and size. Their cost is estimated as follows: Sites, Yen 360,000; buildings, Yen 672,000; equipment, Yen 753,180; and construction supervision, plans, inspection, etc., Yen 63,920. The National Government will stand one-fourth of the total appropriation for this purpose, spread over a period of three years 1925-27. Detailed plans for the buildings and equipment have not been drawn, but the above general sketch will give a fair idea of their lay-out.

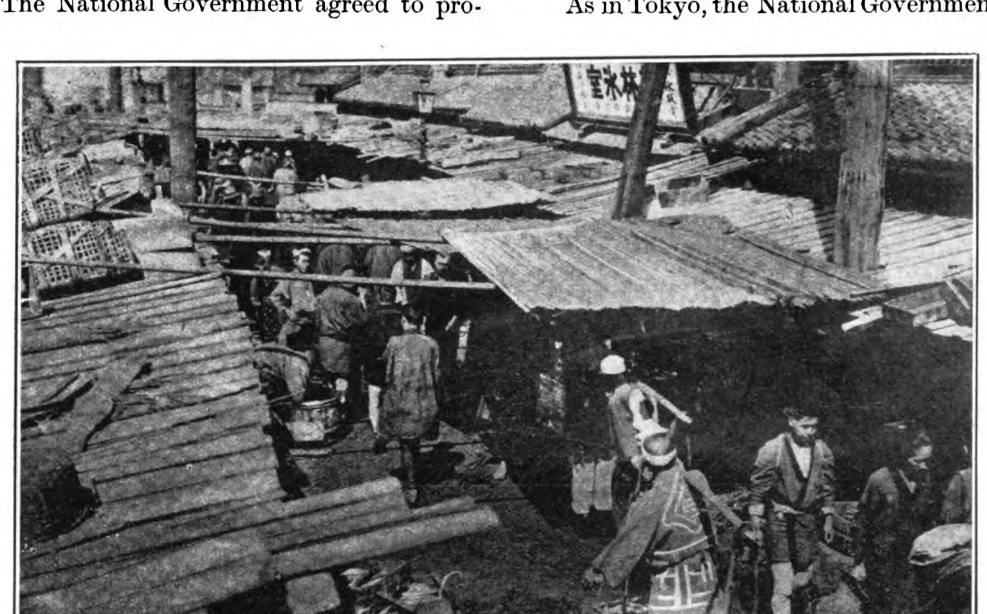
Social Welfare Work

Several years ago the Municipal authorities of Tokyo created a Bureau of Social Service for the purpose of providing comforts and necessary facilities that would alleviate the condition of the working and poorer classes. Under the direction of this Bureau, six employment agencies, two day nurseries, five restaurants, three bath houses and one lodging house were erected and thrown open to the public. The employment agencies gave their services free and were the means of obtaining work for thousands of men and women every month. The "official restaurants," so called, supplied wholesome meals at fixed hours at a maximum charge of 15 sen, but no drinks. The food was better than in many public

restaurants charging four and five times the price, but owing to the restriction on the sale of intoxicants, the service was not particularly popular with the classes it was desired to benefit. On the other hand, office clerks and the poorer students acclaimed the new innovation with great joy. The free public bath houses, located in the poorest districts of the city, were also a great boon to a people who set cleanliness above godliness.

The work of the Bureau became so popular and successful that the authorities appropriated the sum of Yen 4,525,000 in the reconstruction program for the erection of 62 new buildings to house its expanded activities. The National Government agreed to provide Yen 450,000, or half the estimated costs, to erect fifteen two-storied reinforced concrete buildings to be used for the public employment agencies. The land required for this purpose is 825 *tsubo*, of which the city now owns 390.

Day Nurseries: The program also calls for ten two-storied reinforced concrete buildings to cost Yen 500,000, to be used as day nurseries, accommodating 100 children each. These buildings will average 140 *tsubo* of floor space. The city now owns 634 *tsubo* to be devoted to this purpose and will purchase the rest as suitable locations are found.



TOKYO'S BILLINGSGATE

Tokyo's General Fish Market is situated in the Nihonbashi ward of the city, not far from the Stock Exchange. The catches of highly valued Pacific salmon, the popular New Year's gift, are brought to the adjacent Salt Fish Warehouses—a row of red brick godowns—whence they are distributed over the city and the South and despatched to Manchuria and China. The local distribution is largely carried out by canal-boats on the 63 main canals and their branches which intersect the various wards

Work Rooms for Women: Five two-storied reinforced concrete buildings covering 160 *tsubo* of floor space each will be erected in order to provide piece-work for women not steadily employed. The buildings are designed to accommodate 300 women each.

Public Restaurants: There are to be ten new public restaurants erected at a cost of Yen 500,000. There will also be two-storied reinforced concrete buildings averaging 100 *tsubo* of floor space each. Nearly 700 *tsubo* of the required sites are now owned by the city and the balance will be purchased in suitable localities.

Lodging Houses: One of the original lodging houses partially destroyed by the fire will be rebuilt and ten new two-storied reinforced concrete buildings erected for this purpose at a cost of Yen 500,000. These lodging-houses are designed to accommodate 200 persons and will average 360 *tsubo* of floor area. The city possesses 340 *tsubo* required for the sites of these buildings and will purchase the balance (1,800 *tsubo*).

Pawn Shops: Seven two-storied reinforced concrete municipal pawn-shops, averaging 38 *tsubo* of floor space each, are to be effected at a cost of Yen 175,000.

Bath Houses: Ten two-storied reinforced concrete public bath-houses, with dressing-rooms and laundry, to accommodate 1,000 persons each, are to be built at a cost of Yen 600,000. Each building will require 100 *tsubo* of ground, which is to be purchased by the city.

The appropriation for carrying out this program became available in 1924 and will extend over a period of five years. One work building for women has been started and the plans for all the others completed. The delay in pushing forward the work is due to the difficulty in acquiring suitable sites owing to the long-drawn-out negotiations surrounding the adjustment of the boundaries of the districts. As soon as these essential land questions are settled immediate work will be commenced on all the buildings embraced in the Social Service program.

Yokohama: The Government has authorized the expenditure of Yen 750,000 to construct the following Social Service buildings in Yokohama, the appropriation to be spread over a period of five years:

3 Employment Agencies to cost ..	Y. 90,000
10 Small Markets	100,000
2 Restaurants	100,000
2	60,000
3 Bath Houses	180,000
3 Work Houses	120,000

As in Tokyo, the National Government will pay half the costs of constructing the employment agencies and one-quarter of the cost of the other buildings.

Hospitals

Few hospitals escaped the devouring conflagration which raged for three days after the great quake, and with them went the dispensaries, physicians' and surgeons' consulting and operating rooms, their instruments, appliances and the drug and medical supply stores. Thousands of injured, maimed and dying cried for relief, which came rushing in not only from other parts of the empire, but from all parts of the world. The immediate hospital needs of the Capital and Yokohama were supplied within two weeks by the American army and Red Cross equipment hurriedly dispatched from Manila and San Francisco.

Practically all hospitals destroyed were private institutions with very limited accommodations for charity patients; in fact, the entire hospital accommodation of Tokyo of 15,000 beds was reduced to 6,000 by the disaster, and of this number only 3,700 were available for ordinary or charity patients. To meet this emergency, barracks were hastily erected by the Government to serve as hospitals and consulting dispensaries where certified physicians were permitted to receive their patients and perform operations in well-equipped operating rooms, without charge.

(*Continued on page 312.*)

Wholesale Fruit Stall in Market

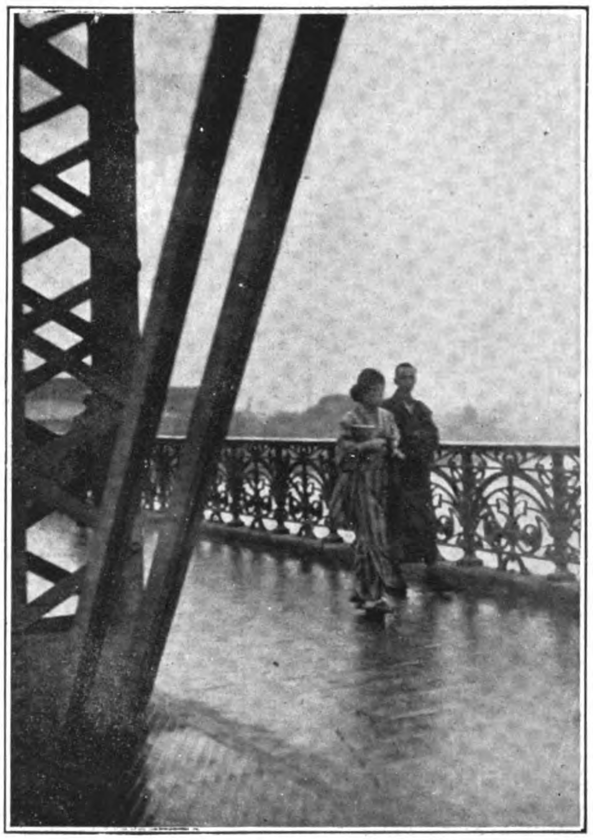
The Sumida River Bridges

Six Handsome New Steel Spans Will Connect the Main Part of Tokyo with Honjo and Fukagawa Wards.

Foundation Company's Exports Direct Caisson Work.

SOON after the great disaster of September 1923 the Japanese Government formed what is known as the " Bureau of Reconstruction " for Tokyo, Yokohama and adjacent districts within the devastated area. The fact that Tokyo, like Venice, is a city of waterways made these common carriers and the hundreds of bridges spanning them one of the chief problems of reconstruction. At the present time practically all of the old bridges are either being rebuilt or have been made temporarily safe for traffic. In addition, several new bridges have been planned and are being built to connect up old arteries of travel heretofore dead-ended at the banks of a river or canal.

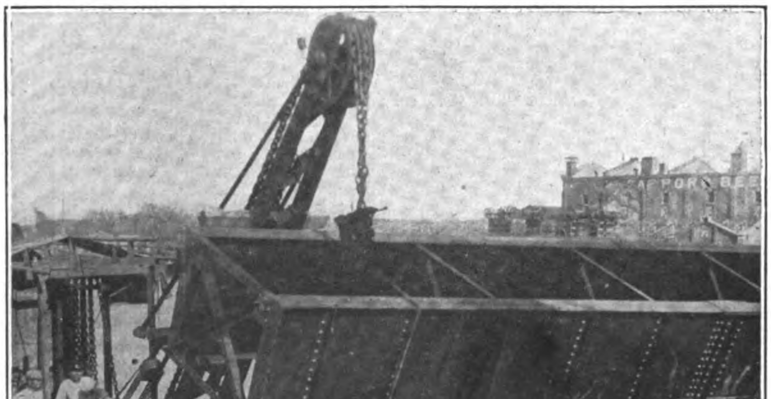
The principal and largest waterway is the Sumida river, which flows through the heart of Tokyo and divides the city into two districts, much the same as New York is separated from Brooklyn by the East river. The Sumida, which is a tidal stream, varies in width from 100 to 600 or 700 ft. and is a comparatively deep waterway throughout its course in Tokyo. Several bridges span the Sumida, and due to geographic conditions already mentioned are of the heavier type, as they carry the main trolley systems and other heavy traffic which naturally converges to them. Several of these bridges were made unsafe for travel by the earthquake, and it was here that the Reconstruction Bureau first turned its attention. Temporary wooden trestles were built adjacent to the damaged structures to carry the trolley cars and heavy vehicular loads, and the old steel structure was reinforced and made safe for the lighter traffic.

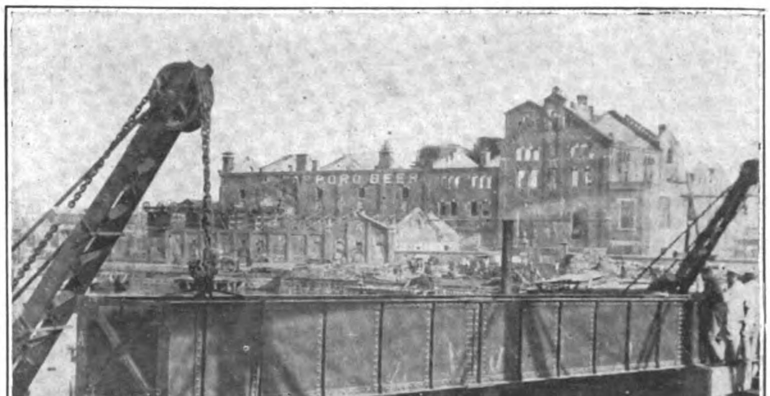


A Sumida River Bridge

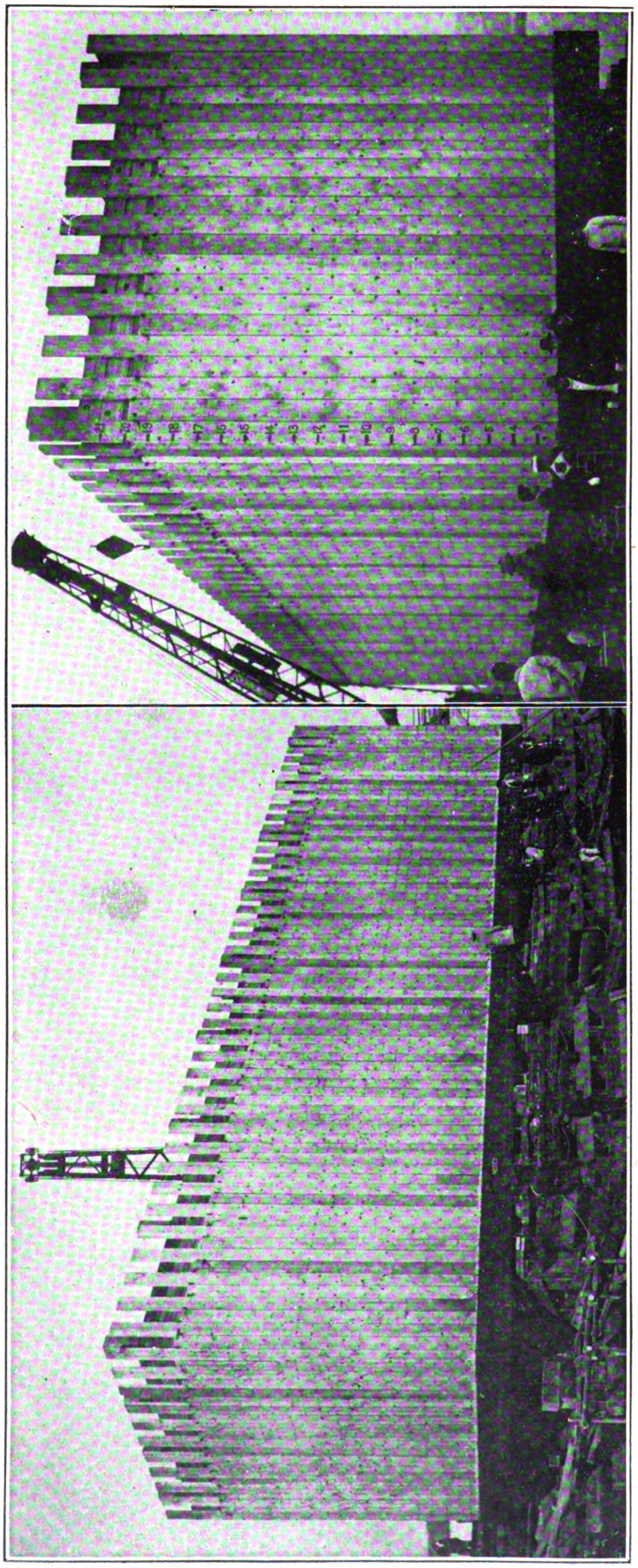
Due to poor sub-surface conditions and the absence of rock or other good materials for sustaining heavy bridge piers, it was decided that deep pneumatic caisson foundations offered a solution for the future Sumida river bridges. Inasmuch as pneumatic work has never been attempted in Japan, and the special machinery and devices necessary for employing compressed air was not available, it was decided to employ The Foundation Co. of New York City, specialists in this type of construction, to direct the work. At the present time Eitai Bashi and Kiyosu Bashi, two of the largest of the many bridges near the mouth of the river, are well under way and will be ready to receive the steel superstructure early in 1926.

There are several different methods and ways of sinking river caissons, and the one employed depends of course upon the conditions at and adjacent to the proposed site of operations. Some of the main factors to be considered are :—Depth of water ; whether river is a tidal or swift moving stream ; character and amount of traffic ; nature of river bottom and soil conditions and availability of space for building the caisson itself. This description will therefore be confined to the method employed in building and sinking the caissons in question, namely those for the Sumida river bridges.

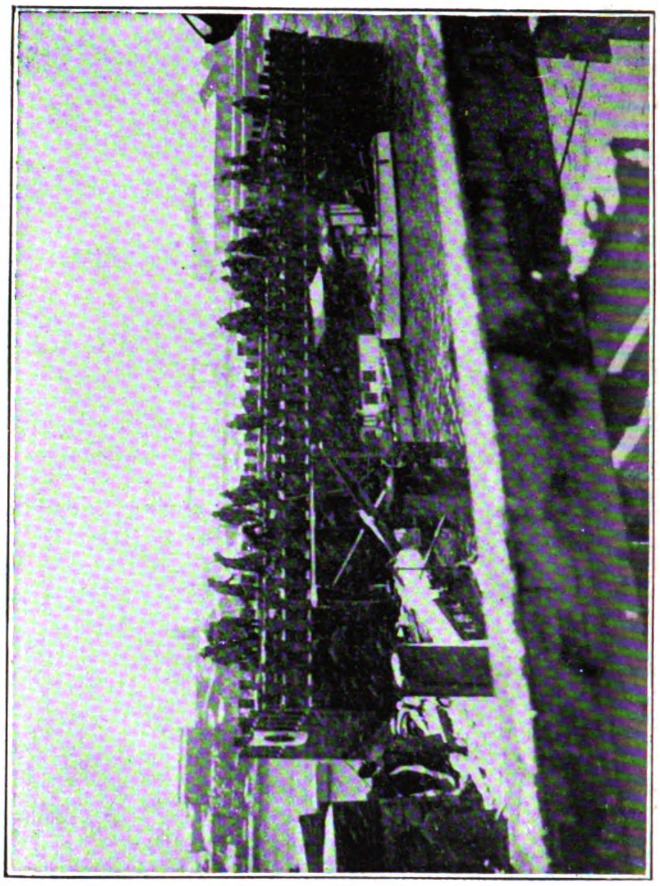


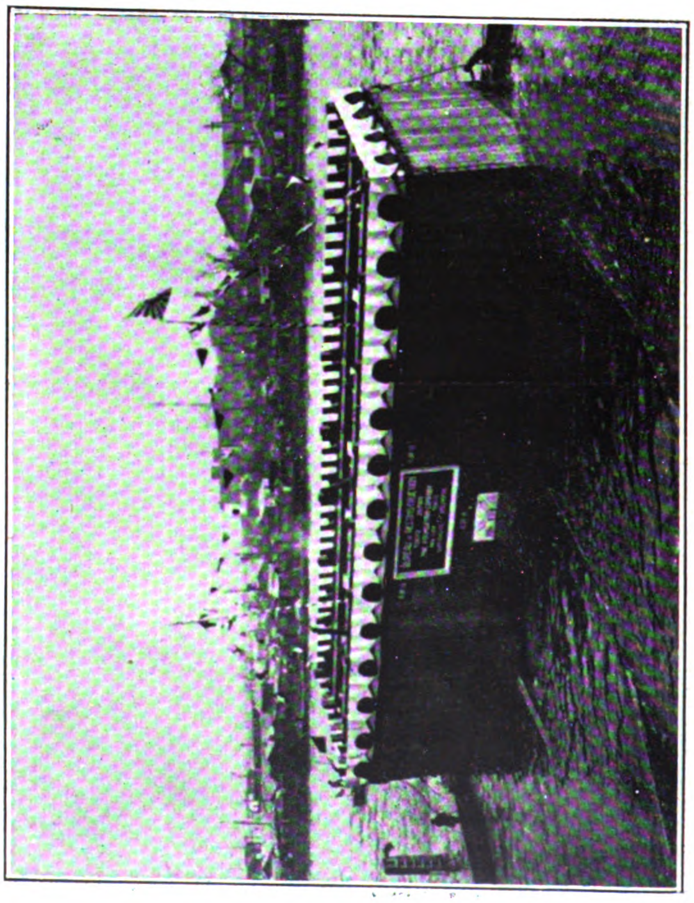


Repairing the Azuma Bridge over the Sumida River

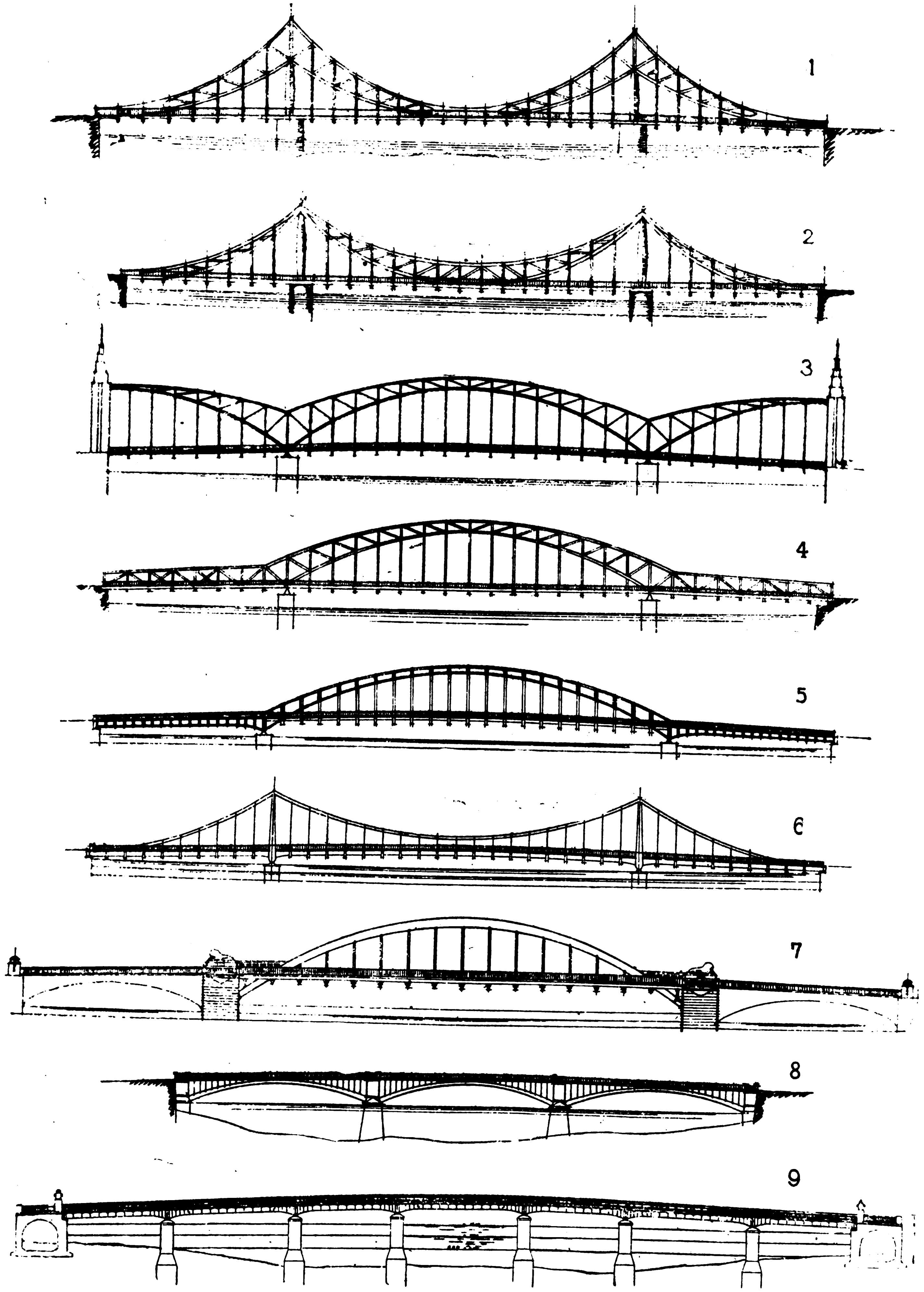


Caissons for the Eitai Bridge over the Sumida River, built at the Kuramae Yard of the Reconstruction Bureau, Ready for Launching



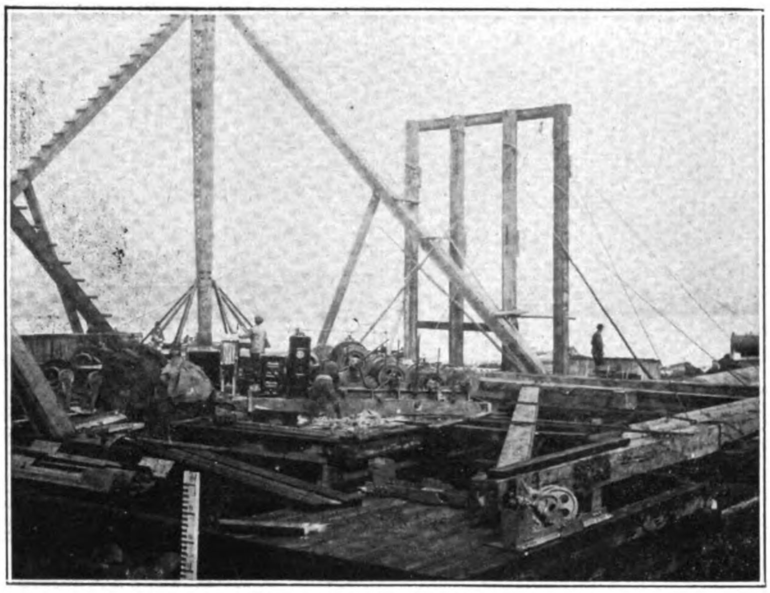


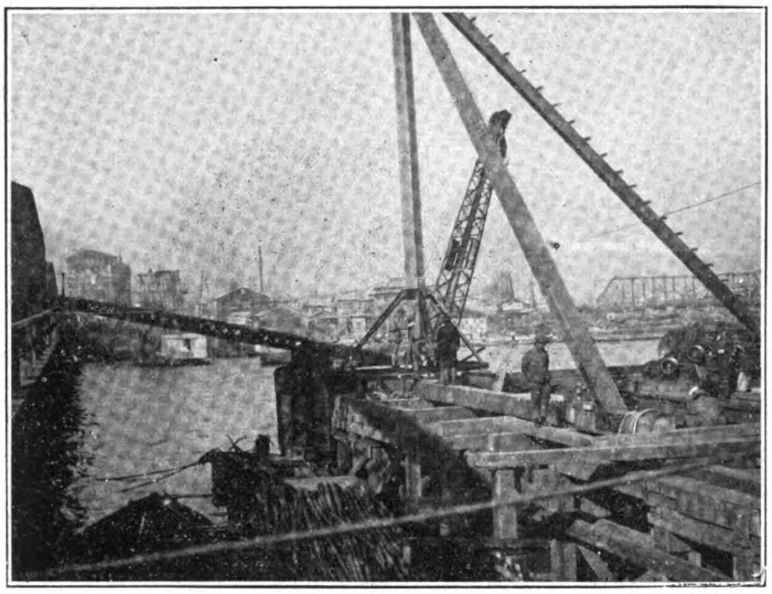
Caisson After Launching

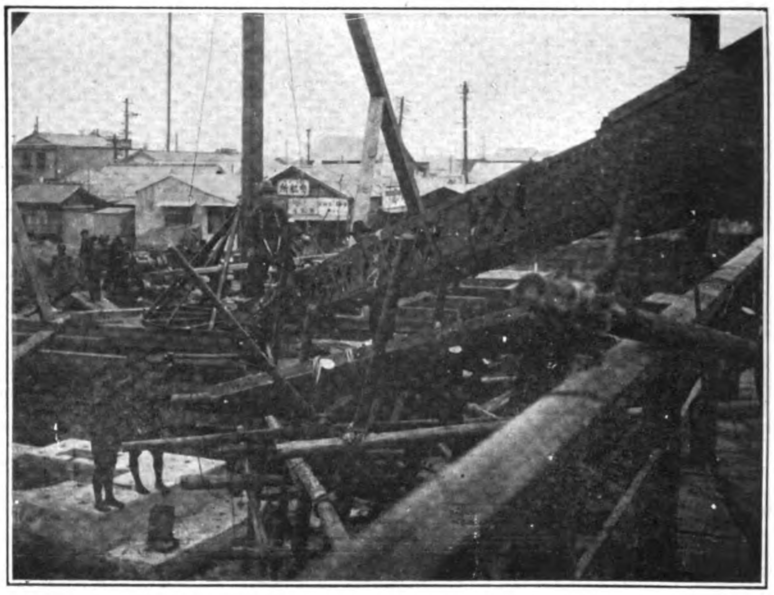


Types of New Bridges over the Sumida River:—5, Eitai-Bashi; 6, Kiyosu-Bashi; 7, Komagato-Bashi; 8, Koromae-Bashi; 9, Aioi-Bashi. The Steel Work for these New Bridges is being Fabricated at the Japanese Government Steel Works at Yawata

The Reconstruction Board's yard at Kuramae, which is about three miles north of Eitai, was chosen as the best available site for building and launching the caissons. Here again special care had to be taken not to get the caisson too heavy or build it too high on account of the depth of the river and the fact that it had to be towed underneath two bridges before reaching Eitai. Launching ways, similar to those employed in launching ships or scows broadside, were built on a pile foundation, the piles having caps running parallel to the shore line, and on top of these were placed four parallel timber runners spaced evenly over a distance of 70-ft. Timber cradles, each 22-ft. long, were placed on the runners and built in such a way as to make four level points of support for the steel-cutting edge superimposed upon them. The cutting edge, which is 20-ft. wide and 80-ft. long, forms a foundation on which to erect the "working chamber," or what is more commonly known as the first build-up of the caisson.

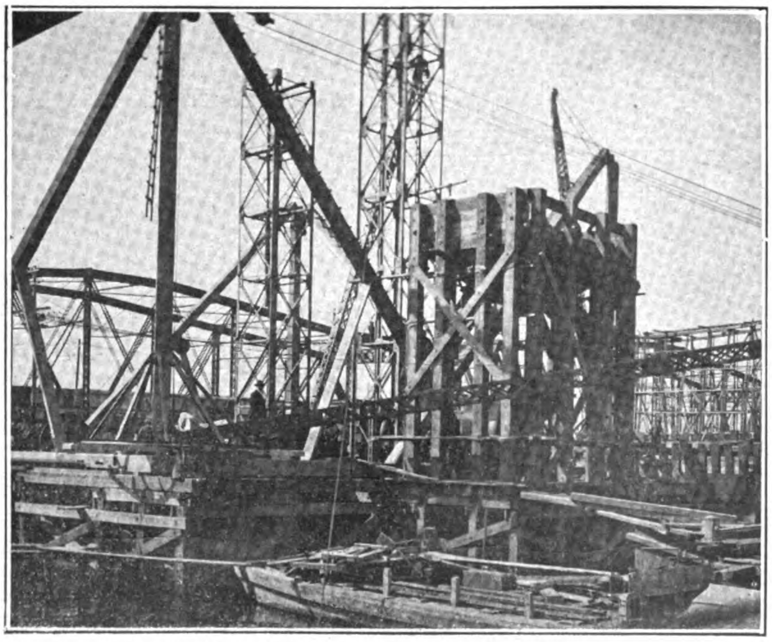






In the case of Eitai Bashi, the first build-up was 24-ft. high and 20-ft. by 80-ft. in plan. It was built much the same as the first storey of a heavy frame building except that the studs or upright posts were thoroughly bolted to the steel cutting edge. Bolted to the outside of the posts, and in horizontal layers, were 8-in. by 10-in. timbers for a height of 20-ft. This framework was rigidly cross braced and covered with vertical 3-in. by 12-in. sheeting. The length of the sheeting was alternately 18-ft. and 22-ft. in order to form a saw tooth effect at the top and provide for a staggered joint when the next build-up was added. Inside, and at the bottom, the working chamber, which is the place or room where the excavation is carried on, was built. The chamber is 6-ft. 6-in. in height, and the side slopes inward from the steel cutting edge, making it about 10-ft. by 7-ft. at the roof, or deck as it is more often called. Two 48-in. diameter holes were then cut through the deck at the one-third points and a length of steel shaft firmly bolted over each. The next move was to caulk the entire build-up, remove the temporary blocking and clear the site for launching. The entire structure weighed about 200 tons and was launched at high tide by cutting the mooring ropes holding the four cradles simultaneously.

While the above was in progress, clusters of guide piles had been driven at Eitai, to which were fastened vertical hard-wood rubbing blocks. The build-up was then towed to the site and placed in position between the rubbing blocks, with a clearance of about six inches on either side. Another 18-ft. lift of timber was then added and caulked as before. At the same time concrete was being placed inside to sink the caisson to river bottom. This process of building up, concreting and extending the steel shafts was continued until the caisson was 42-ft. high and the cutting edge firmly embedded in the mud or river bottom.



Sinking the Caissons for the Eitai Bridge

The air locks were next bolted to the top of the shafts and the air lines run from the compressor plant to the caisson. At this time the cutting edge was about 16-ft. below mean water, and it was therefore, according to the laws of physics, necessary to apply about seven pounds of air to lower the water to that point. By applying a greater pressure, however, the water was driven out of the working chamber in a very few minutes, and the pressure was then lowered to the balancing pressure mentioned above. A gang of twenty men

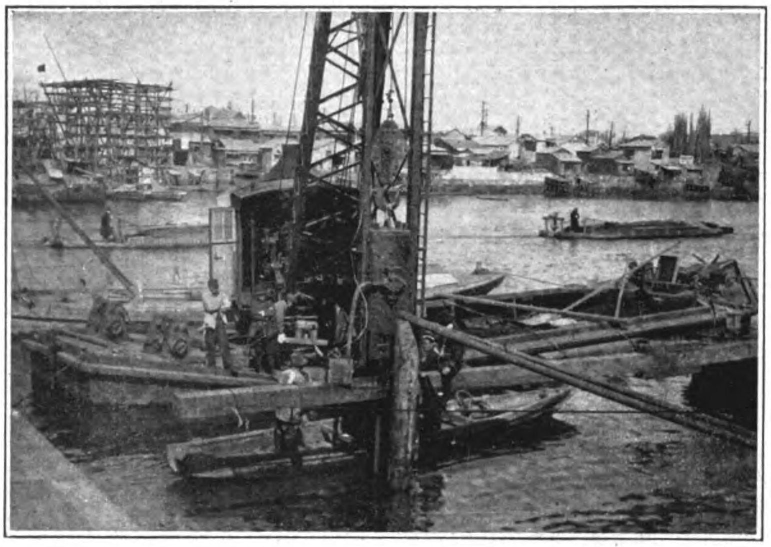
were then sent into the working chamber and the process of excavating or undermining the caisson started. Excavation is carried on night and day, and as the caisson settles or sinks additional build-ups and concrete are added, until the cutting edge reaches rock or soil of sufficient sustaining power to support the bridge pier and its corresponding loads. The working chamber is next filled with concrete, under air pressure, and the whole pier is complete, ready to receive the masonry shaft on which the bridge seats rest.

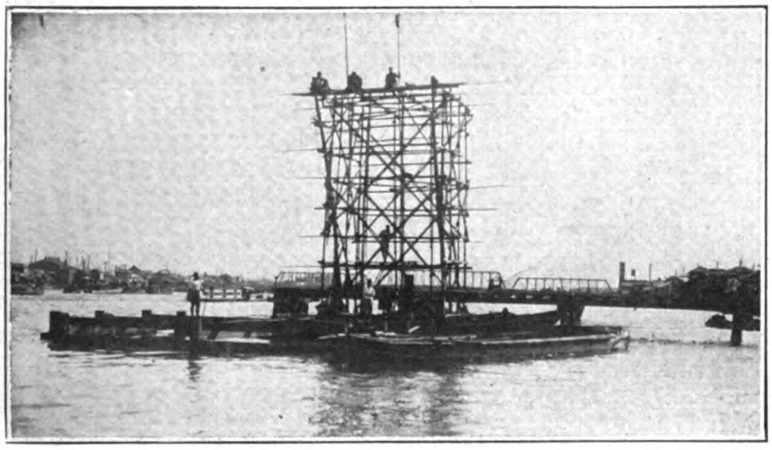
The two bridges, now under construction by the above process, each have four piers, two river piers and two abutment piers. The abutment piers are sunk in exactly the same manner, except that the water is very shallow and they are built in place on a temporary earth fill.

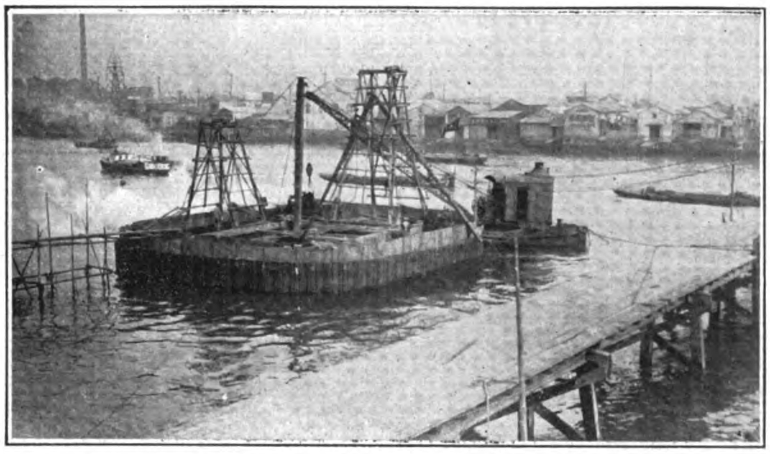
The air plant, which is described below, is mounted on scows and thus easily and quickly moved from the site of one pier to the next.

Unlike the ordinary or general construction operation, caisson work calls for specially designed machinery and equipment, and great care must be taken at the time of installation to make its operation as nearly fool-proof as possible. With few exceptions, once air work is started the caisson must be sunk as a continuous operation; this, of course, calls for an intercepted flow of air and a compressor plant equipped to meet the emergencies of large or small volumes at different ranges of pressure.

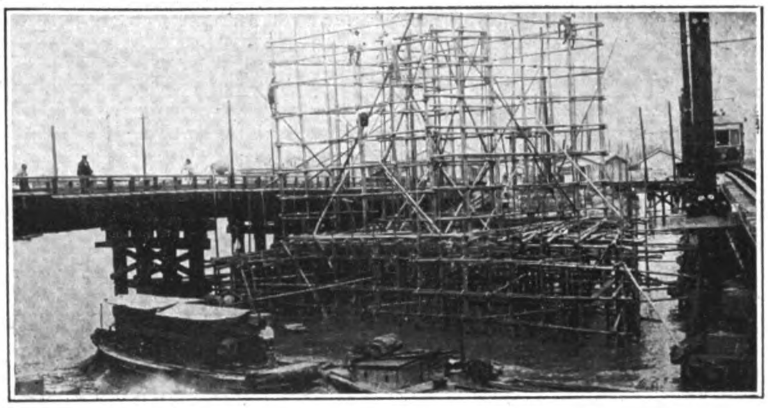
In general the air pressure applied to a caisson comes under the head of "low air," that is the pressure ranges from five to fifty pounds; and hence the machines are designed to supply large volumes at a comparatively low pressure. The air leaves the compressors at about 100 degrees Fahrenheit and passes directly to coolers of the circulating water type. It is customary to carry from ten to twenty pounds more pressure than the work demands; hence the decompression which takes place when the air enters the working chamber has an additional cooling effect. Between the coolers and the

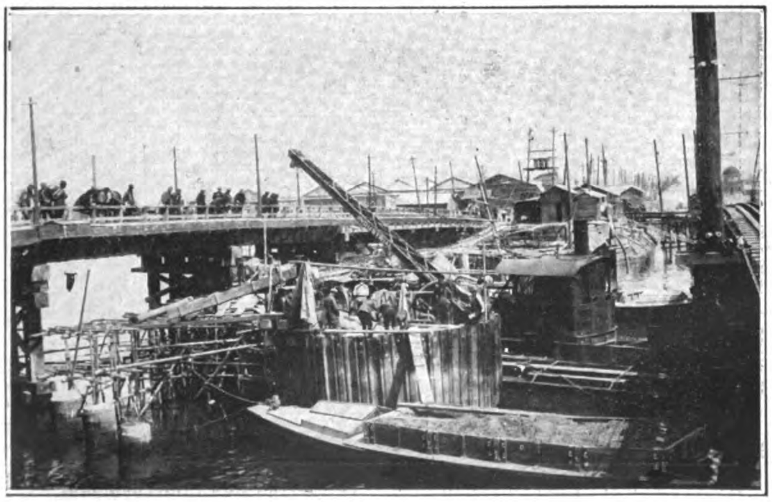


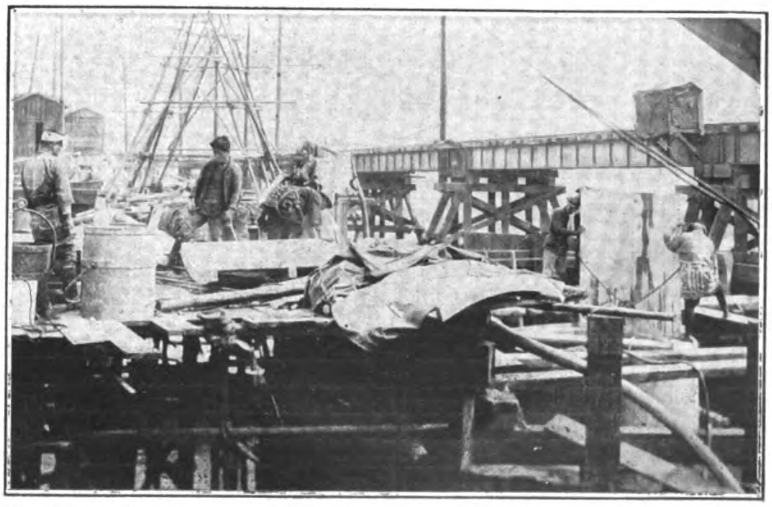




Pier Foundations for the Komagata Bridge over the Sumida River. "Lakawanna" Steel Piling is Used to Form the Caisson







Preparing the Pier Foundations for the Aio Bridge over the Sumida River. "Lackawanna" Steel Piling Used in Caisson Work

line leading to the caisson itself are placed air receivers of sufficient capacity to take care of any emergency demand for air while the compressors are being speeded up or another auxiliary unit cut in. The volume of air necessary to carry on any given caisson operation depends entirely on the nature of the soil encountered while sinking, and for this reason the capacity of the air plant is usually made large enough to fulfil the requirements of the worst conditions possible. Failure to observe the last mentioned fact has often been the cause of serious loss of property, not to mention occasional loss of lize.

There are several types of air locks in use at the present time, and all of them have their special features and advantages when applied to different jobs. The lock used at Eitai is as near a combination of all the different patterns as is possible, and at the same time it is easy to operate and positive. It is sometimes called the "direct lock," in that the same bucket that is loaded in the working chamber is taken through the lock and dumped on the spoil boat. The lock is bolted to the top length of shaft leading to the working chamber and is nothing more or less than a duplex check valve on a large scale. There is a chamber between the upper and lower check valve flappers, or doors, large enough to admit a one cubic yard dirt bucket; and a four-inch by-pass or equalizing line controlled by valves on the outside, leading from this chamber to a point underneath the lower door. The doors are so arranged that the edge of the upper one is directly over the centre of the lower one; in order that a cable stuffing box may be placed in such a position as not to interfere with the operation of the upper door and still allow the bucket to fall freely through the lower door. Assuming that the lower door is closed and held so by the pressure of the air in the shaft leading to the working chamber below, the bucket is lowered into the lock chamber and, after fastening the cable in the stuffing box, the upper door is closed and the equalizing valve opened. When the pressure in the lock chamber is the same as that below the bottom or lower door, the latter is opened and the bucket lowered to the working chamber, where it is loaded and again hoisted to the lock chamber. The lower door is now closed and the air exhausted from the lock, thus allowing the top door to be opened and the bucket to be hoisted out and over to the spoil boat. The shafting, mentioned heretofore, consists of 10-foot, 48-inch diameter steel cylinders flanged together with bolts and tubular gasket. The shaft is provided with two steel ladders, the edges of which serve as a guide for the bucket and give ample clearance for a man to clear the bucket when ascending or descending the shaft.

Outside of the usual equipment, derricks and concrete plant, the only other special piece of apparatus is the hospital lock. This lock is a large steel cylinder 6-feet in diameter and 20-feet long, placed in a horizontal position and operated much the same as the Muck lock on the caisson proper. Its purpose is to treat patients afflicted with caisson disease, or commonly known as "bends." It is provided with heat, light and benches, where the men may rest while being treated by the always present nurse.

Schools for the People

(*Continued from page 306*).

The need for larger hospital services for the poor was so clearly demonstrated at the time of the disaster that one of the first items approved in the Reconstruction Budget were those providing for the early erection of a Municipal charity hospital to cost Y.600,000. This building is to be of two-storied reinforced concrete construction, covering about 1,100 *tsubo*, and equipped to accommodate 300 beds, with consulting rooms to attend to an equal number of out-patients. In addition to the hospital, the Reconstruction Budget includes the sum of Y.2,500,000 for the purchase of sites and the erection of four dispensaries for the city of Tokyo, each building to occupy not less than 1,500 *tsubo*. A plot of 2,318 *tsubo* was purchased before the end of 1924 at a cost of Y.345,000 for the site of one of these dispensaries, on which will be erected a two-storied reinforced concrete building with 900 *tsubo* of floor space, capable of accommodating 175 beds in the various wards and 175 out-patients. The estimated cost of the building is Y.270,375, with an additional Y.169,950 for furnishing and equipment. Consulting rooms will also be provided for the use of physicians having no offices of their own, equipped with all modern appliances and instruments for medical examination and ordinary surgical operations.

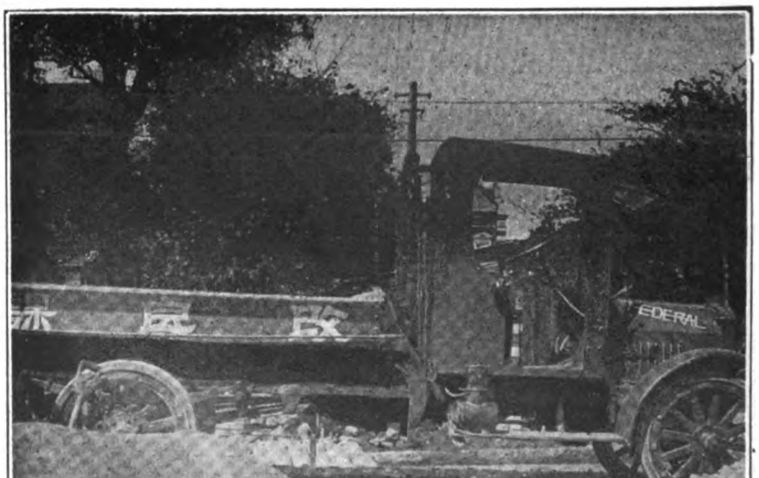
In addition to the program of the Reconstruction Bureau, the Tokyo Municipality will erect six new hospitals, located in Azabu, Okubo, Fukagawa, Kojimachi and Hongo, at a total cost of Y.5,380,000. The sixth will be built in Matsukura-cho, Honjo, for the exclusive treatment of laborers and persons living in the slum districts. This hospital will cost Y.2,520,000.

A feature of all these new hospitals will be the isolation ward, in which persons suffering from infectious or contagious diseases will be treated. At present it is necessary to send all such cases to the Komagome isolation hospital, the only one of its kind in the city, and the delays consequent to getting patients to Komagome has not only been the cause of a large number of deaths, but has also been a handicap in checking the spread of epidemics. Upon the completion of the new hospitals the patients will be taken to the one nearest, and it is hoped in this way to save a number of lives which otherwise would be taken by epidemics.

The first of the hospitals is to be constructed in Horoo, Azabu, the plans for which are now being drawn and on which the work is expected to be started in September. The second will be in Okubo, a suburb of Tokyo, and the other three will be finished before the end of 1926.

All the buildings will be of reinforced concrete, three stories high, with basements and gardens on the roofs. They will be equipped with modern instruments and apparatus and will have adequate staffs of doctors and nurses.

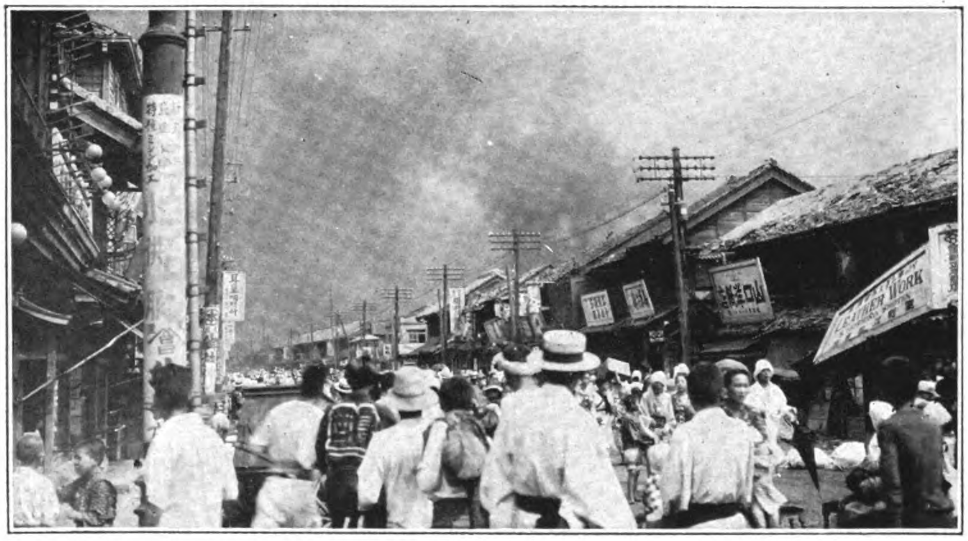
The sanitation situation of Yokohama was even worse than Tokyo, as only one hospital escaped the fire. However, the Juzen Byoin, a municipal institution, although severely damaged by the quake, escaped the flames. An appropriation for its repair, together with the necessary funds to construct a Contagious Diseases and a Tubercular Hospital, were provided for in the general Reconstruction Budget. The total appropriation for this purpose is Y.4,600,000, of which Tokyo's share is Y.3,100,000 and Yokohama's Y.1,500,000. The National Government will contribute one-fourth of the costs allotted to Tokyo, one-fourth of the repairs to the Yokohama Municipal hospital, one-third for the Contagious Diseases Hospital and one-half of the cost of the Tubercular Hospital, estimated at Y.700,000, Y.450,000 and Y.350,000 respectively. In addition, the national treasury will advance the sums necessary each year to cover the deficiency on interest charges of the loan bonds to be issued for covering the municipal government's share in the construction expenses.



Federal Two-Ton Dump Car, used by the Road Improvement Bureau of Tokyo Municipality

The Bridges of Tokyo

PRE-EARTHQUAKE TOKYO held the world's record for the number of bridges within municipal limits, mostly flimsy wooden structures designed for light foot passenger and cart traffic. The repeated conflagrations which swept over and destroyed the old picturesque tinder-box capital of the Shoguns so many times during the past three centuries were invariably accompanied by great loss of life, due to the inability of the people to escape from their water-surrounded districts. The old city was a veritable death-trap. Yet the people of Tokyo rebuilt their homes and shops in the same old flimsy cardboard fashion and restored the wooden bridges which at the next conflagration once more automatically closed their only avenue of escape and locked them in to face death in the roaring hell from which only the strongest escaped. As it was in the past, so it was in the great earthquake of 1923, although by this time many new steel and concrete bridges had been erected over the principal avenues of traffic and opened a way for people to escape. Hundreds of the old wooden bridges, however, still remained, and when they failed as a result of the quake or were consumed by the devouring flames, thousands of people were cut off from escape and perished miserably in the flames. Many times the people of Tokyo have paid the price for their neglect to properly protect themselves, and with the last great sacrifice fresh in their memory, have determined that never again will they be caught like rats in a trap during a conflagration; so in addition to the other modern improvements for remaking the city, all new bridges will be of steel, stone or reinforced concrete.

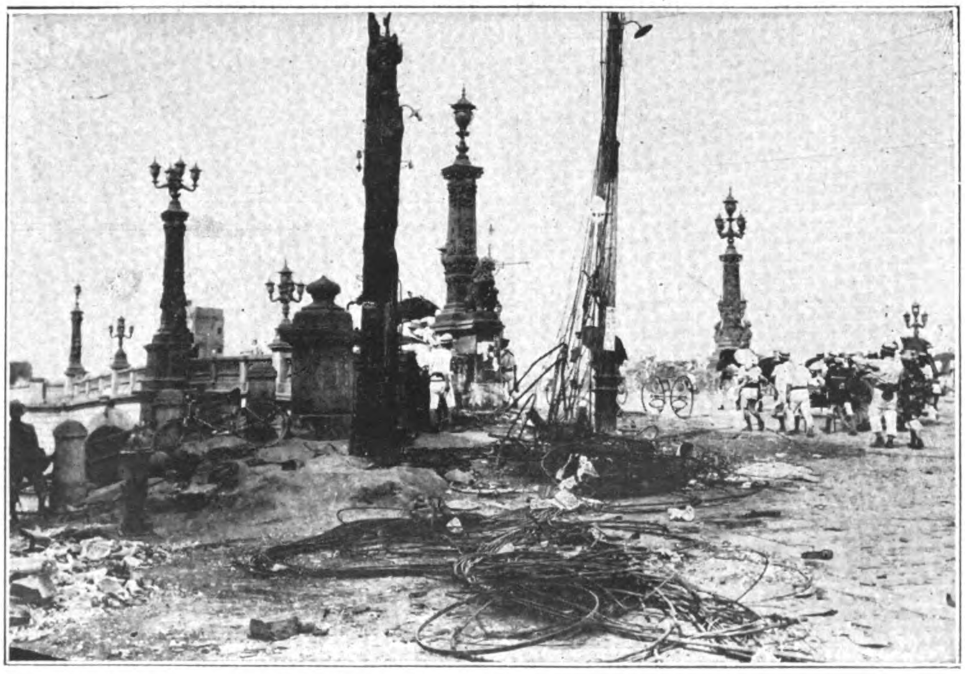


TRAPPED

All avenues of escape cut off by the collapse and burning of the Bridges, thousands were caught in the fire-traps of Tokyo. This photo was taken in the Honjo Ward. Here over 30,000 perished in one small open space, where they flocked for safety

When Tokyo was organized as a Municipality in 1869 almost all the bridges, numbering 298, with the exception of the iron bridges over the Sumida River, were constructed of wood. The rapid increase of river and canal traffic to a point where more than 60 per cent. of the Municipal freight traffic was carried by water, compelled the erection of many new bridges. In 1922 there were 583 such structures, classified into 47 iron, 189 stone and 347 wooden bridges, covering an area of 24,183 *tsubo*. Besides these, there were 309 private bridges open for general traffic. The development of surface car and motor truck transportation, coupled with the abnormal extension of the tramway lines, compelled the adoption of a bridge building program that would meet the new traffic requirements, and in 1921 the Municipal Assembly approved a project for the construction of the Eitaibashi and 16 other large bridges extending over a period of four years. Work on this program was well under way when the earthquake and fire presented the opportunity to the Government to lay out the new street system with an entirely new bridge-building program.

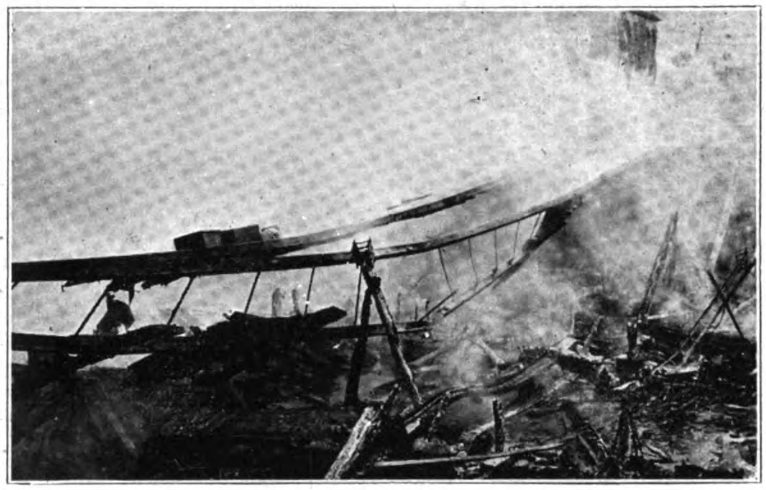
The names of the bridges of Tokyo are as familiar to the people of Japan as Wall Street, Broadway and Fifth Avenue are to Americans, as Pall Mall, Picadilly and the Strand to the British, and the Place de l'Opera or Concorde to the French. Nihonbashi, "The Bridge of Japan," is not only the center of Tokyo, but the center of the Japanese Empire, the starting-point for the measurement of distances. The present magnificent stone structure carrying the traffic of the Ginza was erected in 1912 at a cost of Y.524,000. Many of the wards and districts of Tokyo take their name from the main bridge connecting it with the next ward. Many of these bridges have the same significance as street addresses in other cities. Before the earthquake there were 675 of these structures. Of these, the earthquake shook down 69 and the fire consumed 289, about fifty per cent. of the total, amongst which were several of the important steel structures crossing the Sumida river and the principal bridges over the canals in the devastated wards of the capital. When the Reconstruction Bureau and the municipal and prefectural governments complete their new program there will be a total of 867 new bridges in the city of Tokyo.

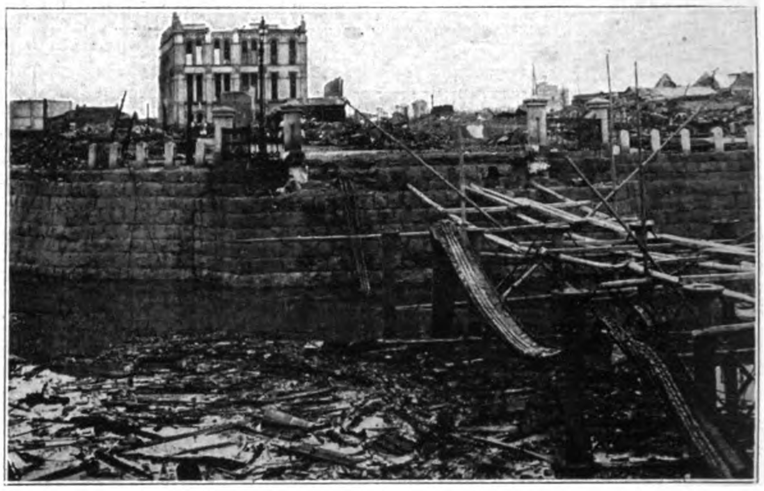


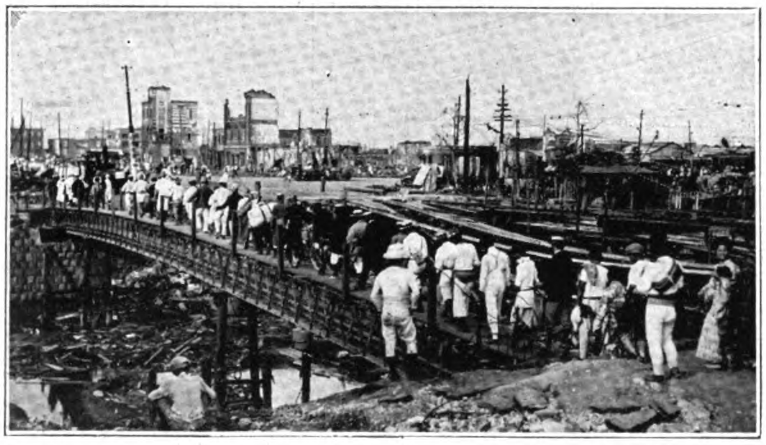
Nihonbashi, the Center of Tokyo, immediately after the conflagration

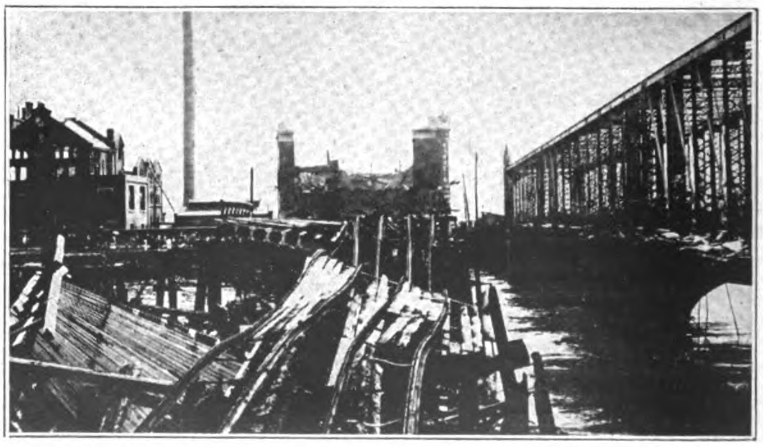
During the first reconstruction period (1923-1929) the Bureau will build 136 new bridges and the municipality and prefectural governments over 270.

WHEN THE BRIDGES FAILED









Typical Scenes of Bridge Destruction by the Earthquake and Fire, Cutting off the Escape of the People from Death in the Flames.

Nihonbashi, The Bridge of Japan

The Reconstruction Bureau will build 118 bridges for roads of more than 22 meters wide, and 18 in connection with new canal construction. All bridges will be of steel, stone or reinforced concrete designed to carry 30-ton tram cars, 15-ton road rollers, and 15-ton trucks.

The most important of the new bridges are the six structures which will span the Sumida river, details of which are given in a separate article appearing in this number of THE FAR EASTERN REVIEW. The estimated cost of the 136 bridges to be built under the direct supervision of the Reconstruction Bureau is Y.34,000,000, of which one-third represents the cost of the Sumida river spans. The cost of the 330 bridges to be erected by the municipality and prefectures will be about Y.28,000,000, but at least half of this sum will be expended in emergency repairs to the old structures which later on must be entirely rebuilt of fireproof material.

Amongst the important new bridges in Tokyo are two of special design, one to be called the Hijiri Bashi, 80 meters long, and the other a 160-meter viaduct leading up to Kanda Hill. Another new bridge of special design called the Yaesu Bashi will connect the east side of the Tokyo Central Railway Station with the business districts of the city from which direct approach is now cut off by the railway yards and a drainage canal. This bridge will lead into a wide new thoroughfare cutting through the heart of Nihonbashi ward to the Sumida river.

The new Edo Bashi, spanning the Nihonbashi Canal near the Central Post Office, will be a 100-feet metallic arch structure. The Kanda Bashi, one of the important main street bridges, is being entirely rebuilt. The new Shimbashi, at the beginning of the Ginza, is a reinforced concrete arch, 80 feet long, a decided ornament to the business district. The majority of the other new bridges are to be constructed to standard designs under the following classification :

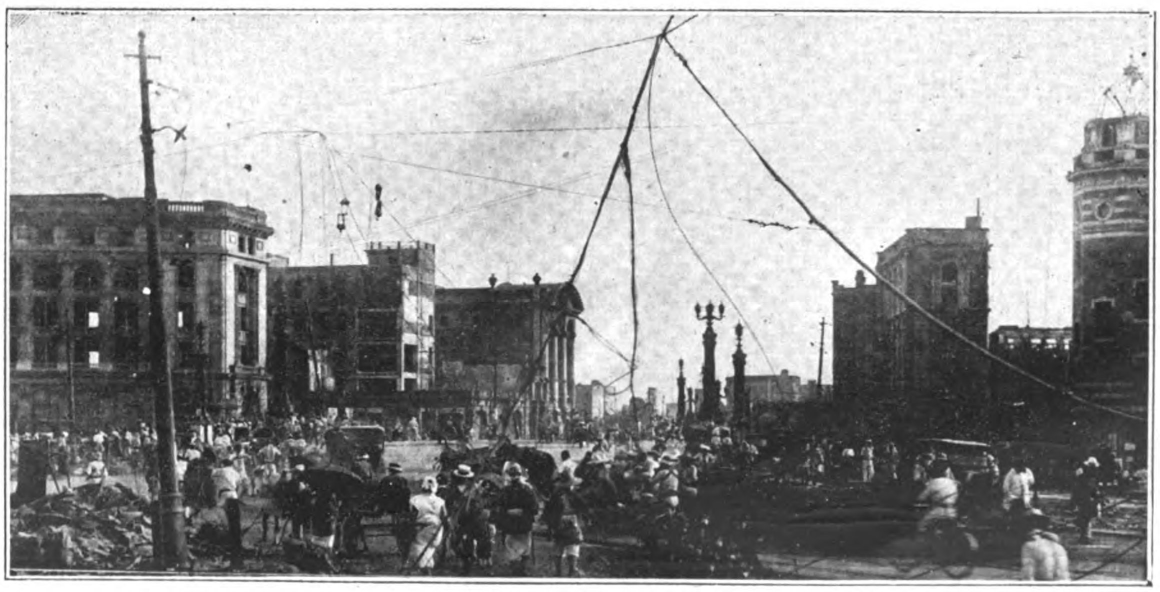
1. *First Class* :
   More than 360 feet long
2. *Second Class* :
   From 180 to 360 feet long
3. *Third Class* :
   a. from 150 to 180 feet long
   b. ,, 132 to 156 ,,
4. *Fourth Class* :
   a. from 108 to 132 ,,
   b. ,, 84 to 108 ,,
   c. ,, 60 to 84 ,,
5. *Extra Class* :
   all bridges under 60 ft. long.

Standard depths of Rivers and Canals: *First Class*, 15 feet ; *Second Class*, 7 feet ; *Third Class*, *a* and *b*, 6 feet; *Fourth Class*, *a* and *b*, 4 feet ; *c*, 3 feet : *Extra Class*, 2 feet. The height of the lowest bridge beam is to be 3.5 meters above mean water level in order to provide ample clearance for barges loaded to a maximum height of 15 feet at low water. Such bridges are to be of the arch type with long street approaches.

The regulations provide that that the clearance between the lowest bridge beams and mean water level on the Arakawa and its brancles is to be 5½ meters, with 16.4 meters between piers. On the Sumida river the clearance in height is the same, with a minimum distance of 10 meters between piers. The width of many of the older bridges in Tokyo has been less than their street approaches, disorganising traffic at both ends. The new plans provide that all bridges under 180 feet in length are to be the full width of the street, and all longer bridges are to be two-thirds wider than the street.

As with every other phase of reconstruction, the bridge building program is being retarded and held up in many important places, due to the delay in settling the delicate and complicated property problems involved in the Land Adjustment or Replotting Plan. As a consequence of the rapid rebuilding of the city with temporary wooden structures the authorities have been compelled against their better judgment to erect temporary wooden bridges at various points in order to facilitate traffic.

The most important bridges to be built in Tokyo are as follows :

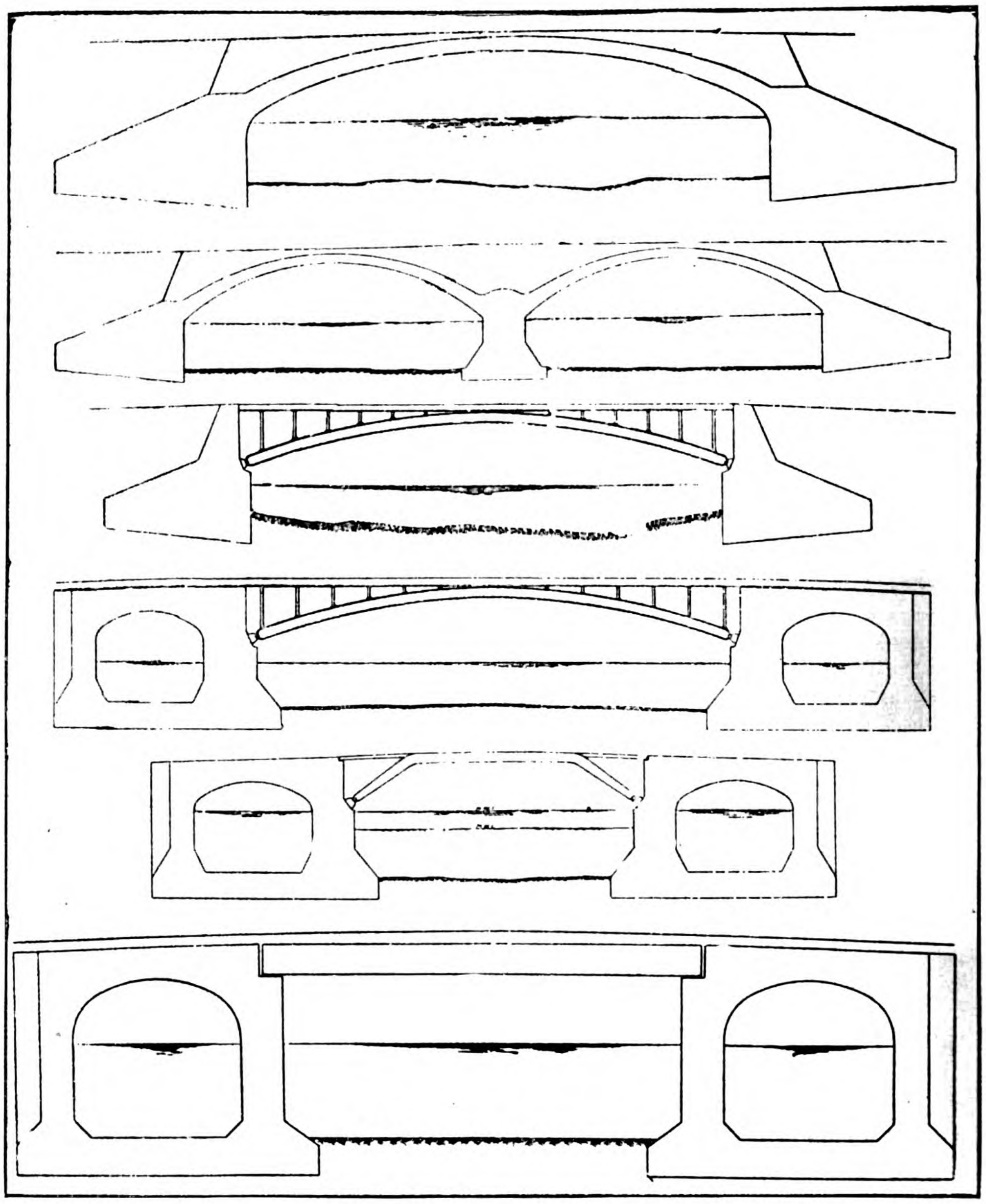


NIHONBASHI, AFTER THE FIRE.

Murai Bank — Morimura Building — Imperial Hemp Co.

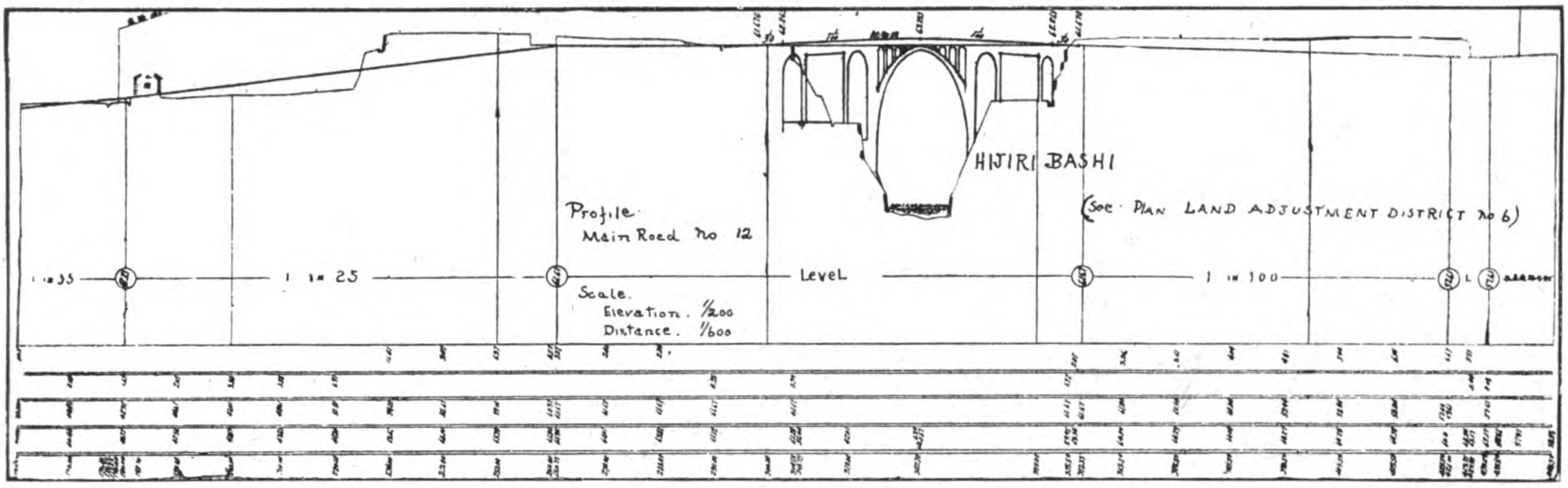
Name	Length. Meters	Width. Meters	Superstructure	Foundation
Aioi	191	22	Cantilever plate girder	Pile
Eitai	182	22	Tied arch with cantilever side span	Pneumatic caisson
Kiyosu	182	22	Suspension	,,
Kuramae	160	22	Two-hinged metallic arch	Pile
Komagata	150	22	,,	,,
Kototoi	145	22	Cantilever plate girder	Open caisson
Edo	63	44	Hingless metallic arch	Pile
Horai	35	44	Reinforced concrete arch	,,
Yaesu	38	44	,,	Concrete slab
Kanda	33	33	Reinforced concrete arch and plate girder	Well
Hijiri	92	22	,,	Pile
Sukiya	41	36	Reinforced concrete	,,
YOKOHAMA				
Hagoromo	36	25	Two-hinged metallic arch	Pile
Senshu	28	22	,,	,,
Tsukiji	35	36	Cantilever plate girder	,,

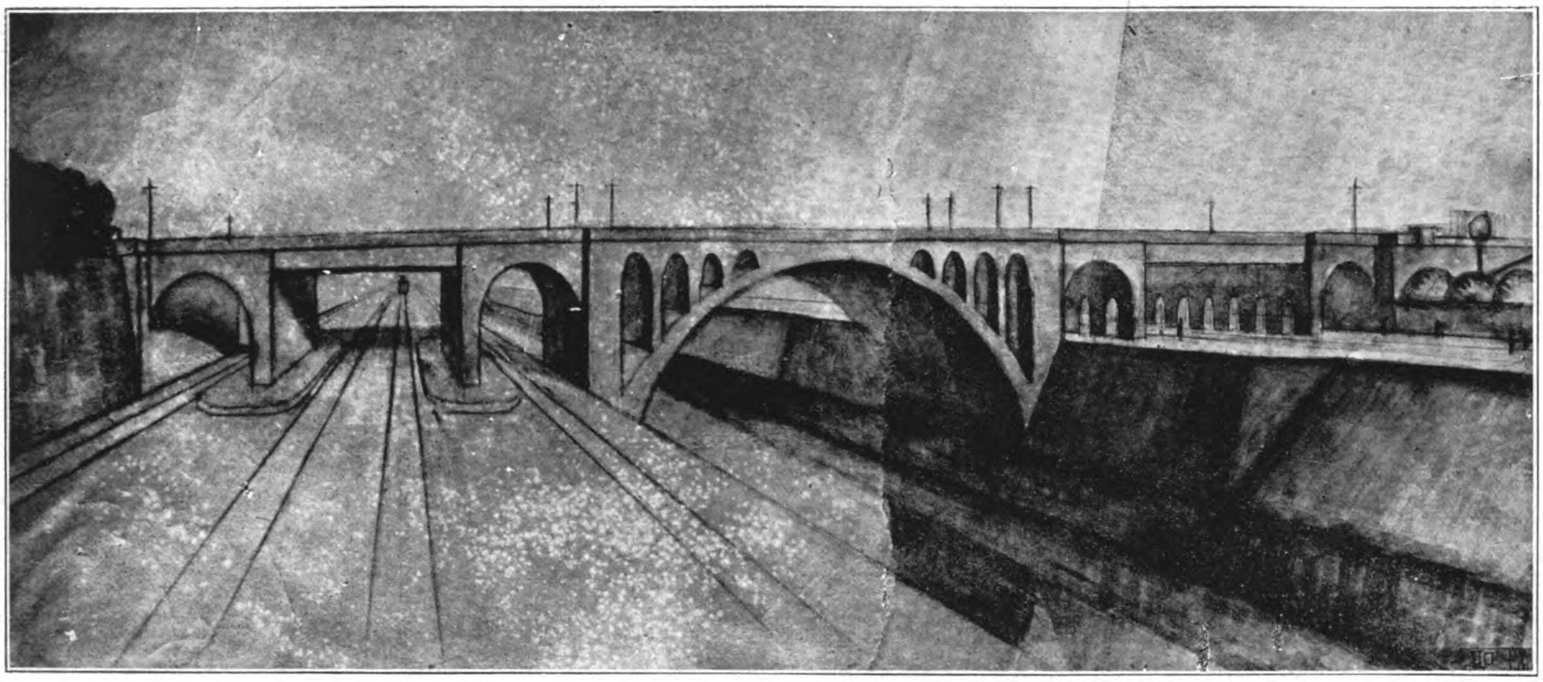
Practically all the material used in the construction of the many bridges in the new program will be purchased from Japanese manufacturers. The steel requirements have provided an opportunity for the domestic mills to dispose of their products at a fair price, though in the heavier spans, plates, reinforcing bars, etc., the Government has assured itself of the lowest prices by having the material purchased from the Government Steel Works at Yawata. The Kokura Steel Works and other establishments are furnishing the rivets, bolts and bars. In all, there will be about 40,000 tons of steel involved in the major bridge contracts. For the reinforced concrete structures over 400,000 cubic yards of gravel and sand and 200,000 cubic yards of crushed stone will be required, in addition to some 600,000 barrels of cement. The Japanese cement industry has advanced to such a high state of perfection and quality of product that all the cement requirements for the entire reconstruction program will be supplied by home manufacturers.

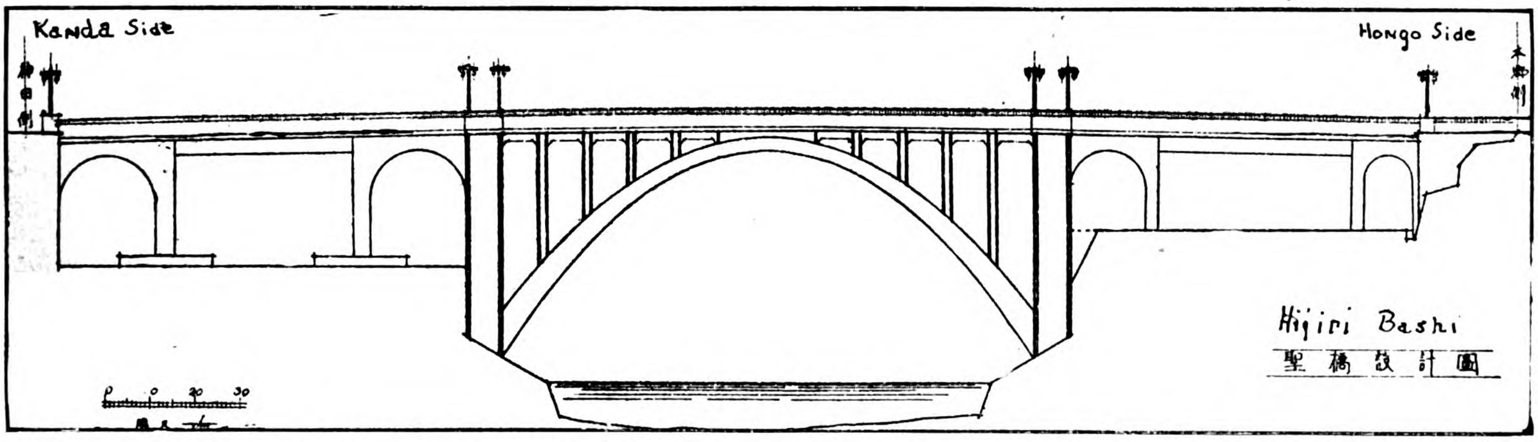


Types of New Concrete Bridges for the City of Tokyo. Top: Bridge near Tsukiji Market; Yaesu Bashi; Kondo and Iida Bashi; Yokohama, Shin Yoshida Bashi; Bottom: Chiyoda and Kando Bashi

Types of Reinforced Concrete Ornamental Posts for the New Bridges of Tokyo





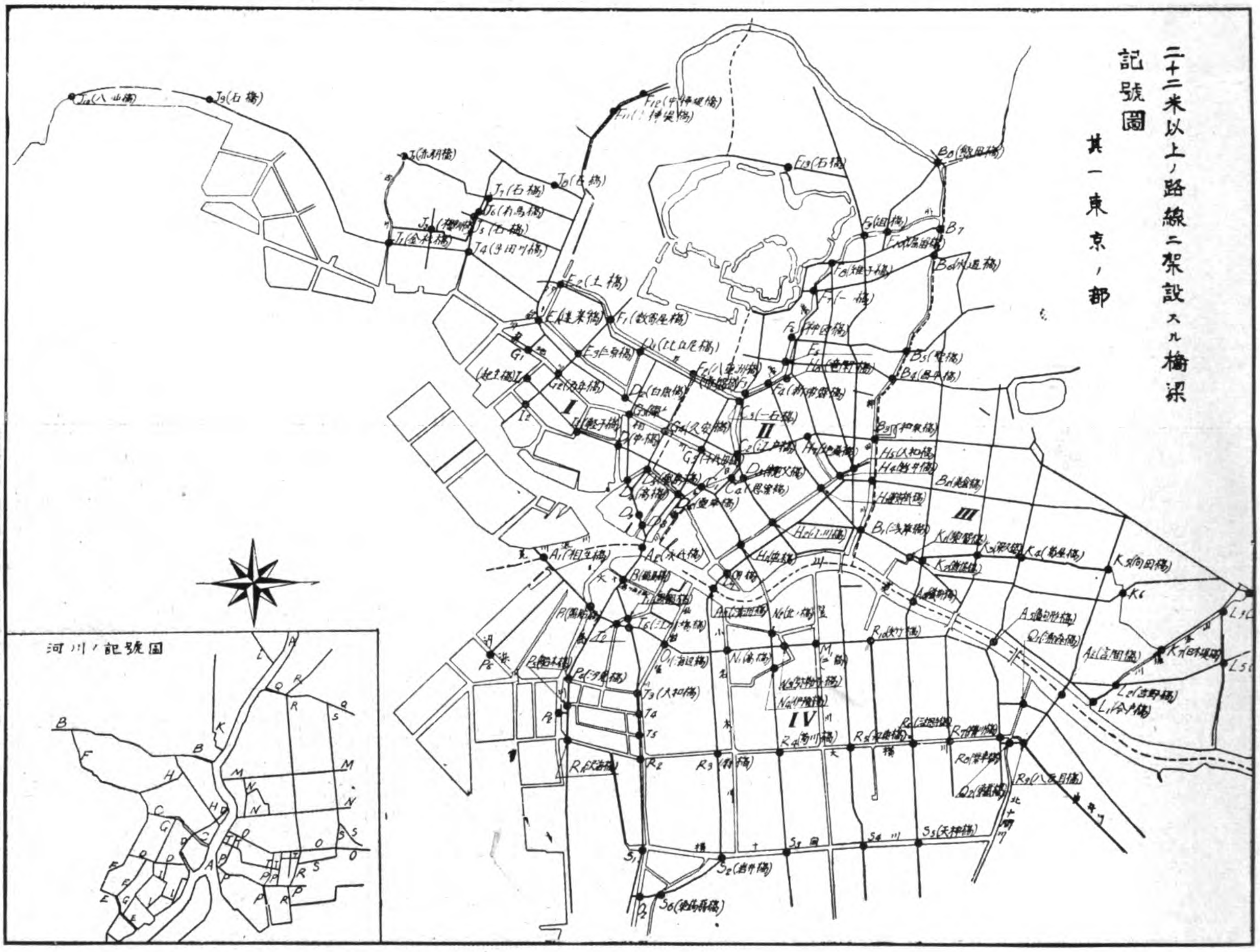


Hijiri-Bashi, one of the Finest Reinforced Concrete Bridges in Tokyo's Reconstruction Program, to be built over the Kandagawa Canal and the track of the Chuo Electric Railway by the Reconstruction Bureau

The following table shows the state of bridge construction in Tokyo at the end of December 1924:

Name or Bridge	Percentage of Appropriation Used	Percentage of Actual Construction Completed	Date Begun	Date Work is to be Completed
Aioi	—	0.17	Aug. 1924	Aug. 1926
Eitai	0.40	0.06	Nov. 1924	Dec. 1926
Kuramae	0.10	0.02	Sept. 1924	Oct. 1926
Komagata	0.70	0.07	Oct. 1924	Sept. 1926

Name of Bridge	Percentage of Appropriation Used	Percentage of Actual Construction Completed	Date Begun	Date Work is to be Completed
Hijiri	0.75	0.20	Sept. 1924	June 1926
Ichibei...	0.10	—	Feb. 1925	Mar. 1926
Edo	0.50	0.04	Dec. 1924	Feb. 1926
Oyaji	—	0.38	Sept. 1924	Sept. 1925
Bikuni...	0.10	—	Jan. 1925	June 1926
Otoko	0.80	0.23	Oct. 1924	Aug. 1925
Shirokane	0.60	—	Feb. 1925	Oct. 1925
Echizen	—	—	„	Aug. 1925



Sketch Plan of Tokyo, showing Main Canals and Location of Principal Bridges. The black dots show the location of New Bridges to be built by the Reconstruction Bureau, and does not include the Municipal and Private Bridges

Name of Bridge	Percentage of Appropriation Used	Percentage of Actual Construction Completed	Date Begun	Date Work is to be Completed
Horai	0.50	0.02	Dec. 1924	Mar. 1926
Sukiya...	0.10	—	Dec. 1924	Mar. 1926
Yaesu	0.50	0.16	Nov. 1924	Oct. 1925
Tokiwa	0.50	0.11	Nov. 1925	Mar. 1926
Kamakura	0.60	—	—	—
Kanda...	—	0.53	Aug. 1924	Sept. 1925
Hitotsu	—	0.29	Oct. 1924	Sept. 1925
Shin Kiji	0.95	0.02	Nov. 1924	Oct. 1925
Horitome	0.20	—	Feb. 1924	Mar. 1926
Shimo Ryutei ...	—	—	Jan. 1925	July 1925
Naka Ryutei	—	—	Jan. 1925	July 1925
Ichiba	0.90	0.21	Oct. 1924	June 1925
Danjo	0.80	0.08	Dec. 1924	Sept. 1925
Chiyoda	—	0.54	July 1924	May 1925
Nakanohashi	0.15	—	—	—
Ogawa...	0.15	—	—	—
Kisho	0.70	—	Jan. 1925	Feb. 1926
Monzeki	0.70	0.10	Oct. 1924	Feb. 1926
Karuko	0.60	0.11	Dec. 1924	Mar. 1926
Kanasugi	0.10	—	Mar. 1925	Mar. 1926
Akabane	0.20	0.12	Jan. 1925	Mar. 1926
Shimbori	0.80	—	Jan. 1925	Sept. 1925
Eikyu	0.80	—	Jan. 1925	July 1925
Imado	—	0.08	Feb. 1925	Mar. 1926
Fukushima	—	0.04	—	—
Shiomi...	—	0.24	Sept. 1924	Aug. 1925
Funaki	—	0.07	—	—
Sawami	0.40	0.07	—	—
Momori	0.90	0.16	Dec. 1924	Jan. 1926
Kikugawa	—	0.29	Oct. 1924	Dec. 1925
Koto	—	0.23	Oct. 1924	Dec. 1925

Name of Bridge	Percentage of Appropriation Used	Percentage of Actual Construction Completed	Date Begun	Date Work is to be Completed
Hoonji...	—	0.30	Sept. 1924	Oct. 1925
Honmura	0.10	—	Feb. 1925	May 1926
Kurogame	—	0.11	—	—
Aburabori	—	—	Mar. 1925	May 1926
Ogibori	0.60	0.02	Dec. 1924	Feb. 1926

Bridges to be built in connection with Canal construction:

Naimon	1.00	—	Feb. 1925	May 1926
Owari	1.00	—	Mar. 1925	Mar. 1926
Hafuri	0.90	—	Feb. 1925	Feb. 1926
Kabuto	0.40	—	Feb. 1925	Feb. 1926
Renpei...	0.40	—	Feb. 1925	Feb. 1926

To be built in connection with Zoning system:

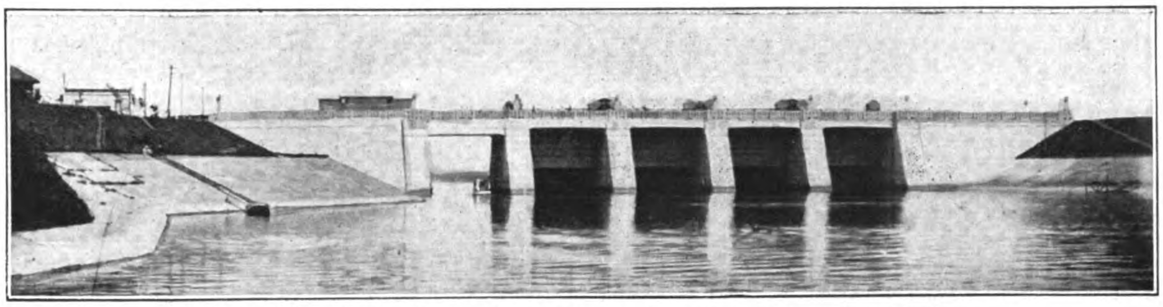
Nakamu	1.00	—	Feb. 1925	Feb. 1926

The following bridges in Yokohama are now under construction:

Shin Yoshiya ...	0.50	—	Mar. 1925	Mar. 1926
Hagoromo	—	0.10	Nov. 1924	Aug. 1925
Midori	0.75	—	Mar. 1925	Mar. 1926
Senshu...	0.75	0.28	Dec. 1924	Nov. 1925
Shin Nihonbashi ...	0.75	—	Mar. 1925	Mar. 1926
Suruga...	0.50	—	Mar. 1924	April 1926
Tsukiji	0.75	0.003	Feb. 1925	Mar. 1926
Kinko	0.75	0.08	Dec. 1924	Dec. 1925

Bridges to be constructed in Yokohama in connection with Canal work:

Hiraoka	0.50	—	April 1925	Mar. 1926
Numano	0.50	—	"	"

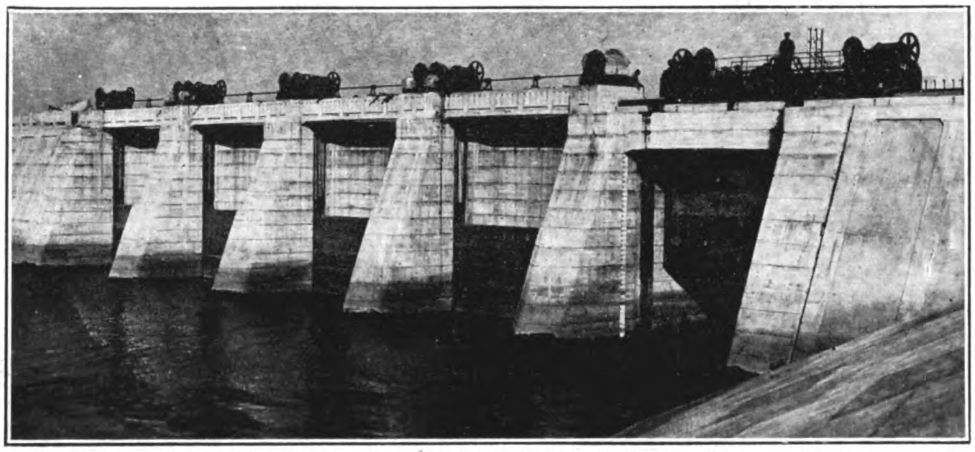


Iwabuchi Main Regulating Gates of the Arakawa Flood Prevention Works

The Arakawa Flood Prevention Works

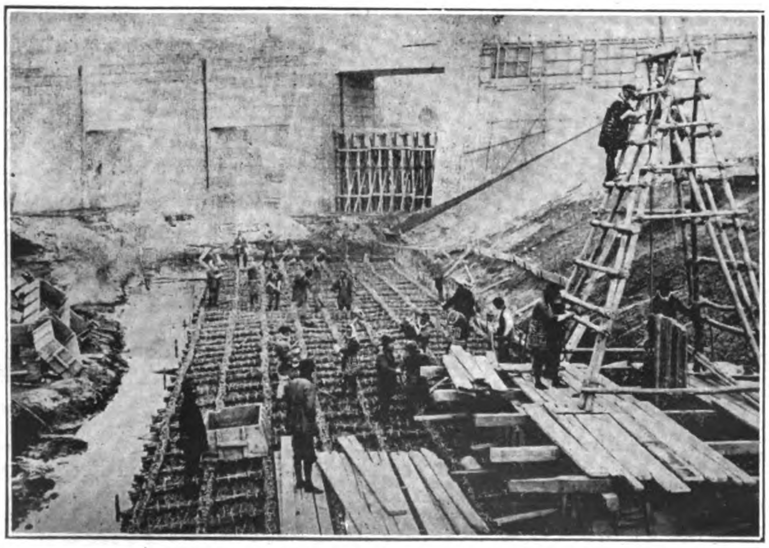
Cutting a New River Bed that Preserves the Lower Districts of Tokyo from Annual Inundation. One of the Most Important Engineering Undertakings for Safeguarding Lives and Property in the Metropolitan District

LIFE in old Yedo was full of adventure. Earthquakes and conflagrations varied the monotony of viewing the cherry blossoms and watching the daimyo processions go by, and to add to the excitement the Arakawa went off on an annual rampage of its own and swept the houses in the low-lying districts of the city out into the bay. Like the boulevards of Paris, the rivers, canals and streets in Japan change their name at the slightest provocation, and the Arakawa after it enters the city limits becomes the Sumida-gawa. Ever since Tokyo was founded, the river has been a mixed blessing to the people, building up and tearing down as its vagaries seemed to warrant. The well-watered Kwanto plain, at the head of Tokyo Bay, is the richest district of Japan, and one of the reasons for Tokyo's rise to power and prosperity was the convenient inland water transportation afforded by the network of rivers, creeks and canals tributary to the two large rivers, the Arakawa and Tamagawa, emptying into the bay at this point. The total length of the Arakawa is only 107 miles, but with its branches it provides 330 miles navigable by lighters. In addition, over 200 miles of artificial canals have been dug to connect the main streams of the system.

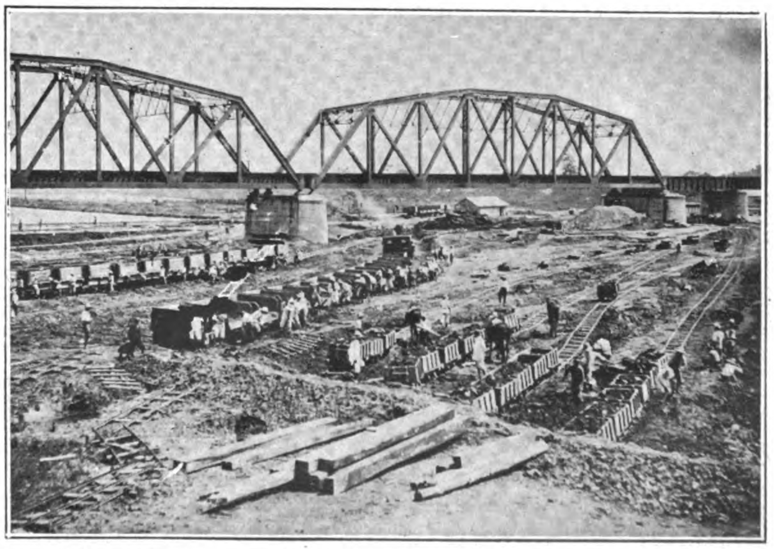


Down Stream View of the Iwabuchi Regulating Gates.

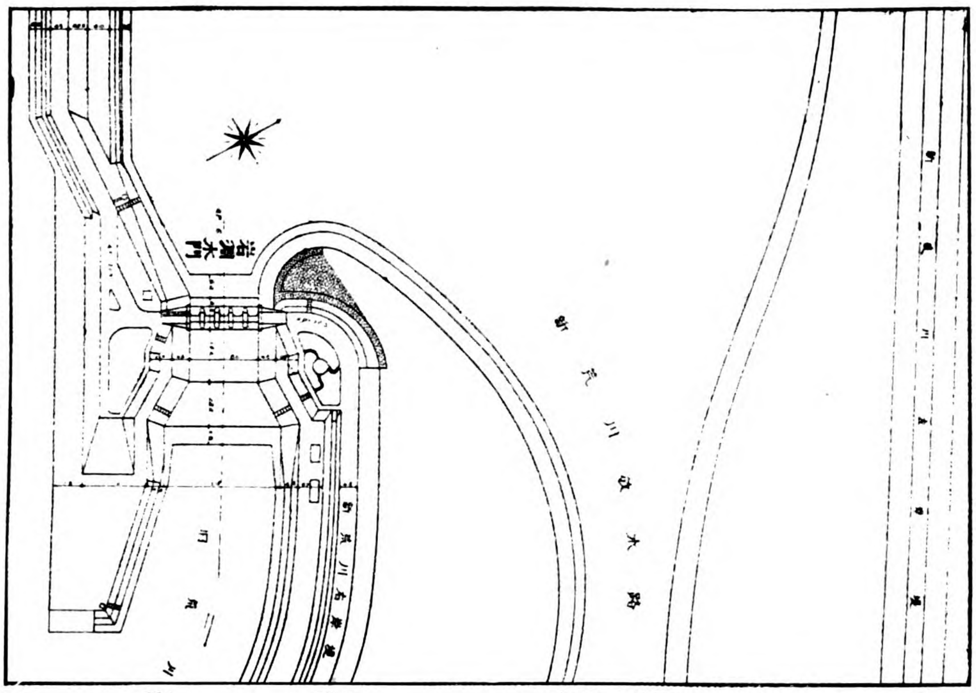
The most important of these rivers is the Arakawa, whose meanderings were looked upon by the people as acts of God, and nothing was ever done to control it. At its source, deep in the mountains of Saitama Prefecture, north-west of Tokyo, it is a harmless little mountain stream which widens out after two other equally peaceful rivulets add to its volume. At Kumagaya it becomes a real river. From this point to Kanegafuchi, north of Tokyo, it flows through peaceful fields for forty-three miles. Here it is joined by the Ayase river, and thereafter becomes known as the Sumida, passing through Tokyo and emptying into the bay. For thirty-five miles from the bay it is affected by the tide, and when a combination of high water and typhoon hits the Tokyo district the river just naturally spreads out over the surrounding country to a depth of many feet. Heavy rainfall back in the mountains and the Kwanto plain is followed by floods along the lower



Laying Brush Mattress Foundation for Cement Blocks above the Iwabuchi Regulating Gates.



Railway Bridge over the Arakawa Flood Water Canal near Senju.

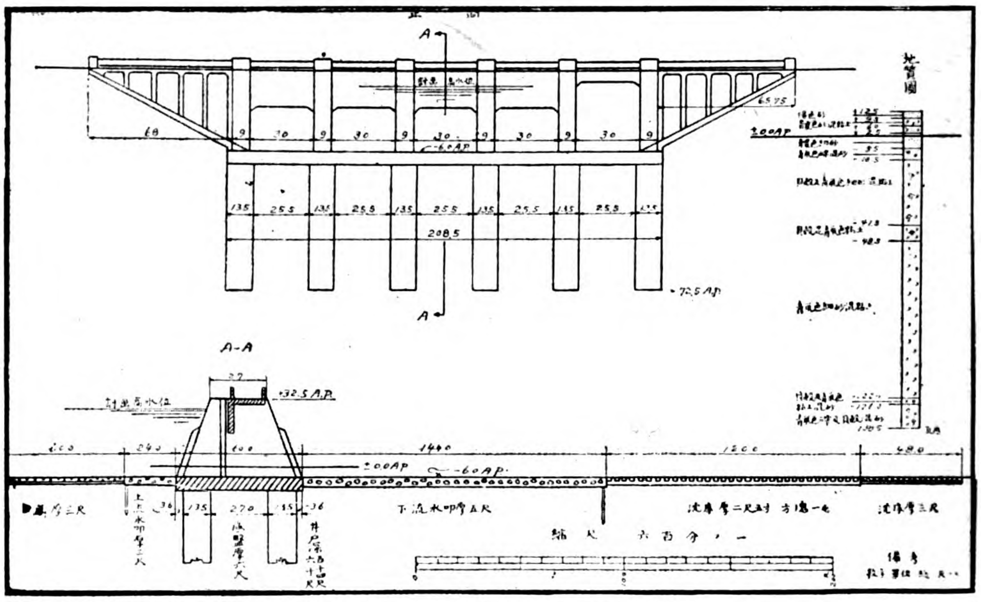


Plan of Flood Regulating Works at Iwabuchi

reaches of the Arakawa. In a period of 322 years there have been 132 floods, 68 occurring during the typhoon season. Several of these floods were national disasters of no less severity then the terrible fires and earthquakes which so often have overwhelmed the unfortunate city of Tokyo. The average annual loss during the Meiji Era (1868-1912) is calculated at over Y.2,000,000.

On the other side of Tokyo is the Tonegawa, another snow-fed mountain stream which rises to the distinction of being a real river when it reaches the Kwanto plain. During the rainy season it can usually be depended upon to work in close sympathy with the Arakawa, breaking through its embankments at the same time and inundating the eastern part of the city until the meeting of the two floods turns the district into an immense swamp. Since 1868 several attempts have been made to control these rivers, and up to 1907 more than Y.20,000,000 was spent in building embankments and sluice gates, but in 1907 it overflowed again, and in 1910, the last time the two rivers got out of bounds at the same time, Tokyo was cut off from the rest of the world for ten days. The entire industrial district was several feet under water and communication with Yokohama was maintained by boats. This catastrophe occasioned such an enormous loss that the Government finally decided that it was time to put into effect some permanent flood prevention scheme that would effectively control the Arakawa.

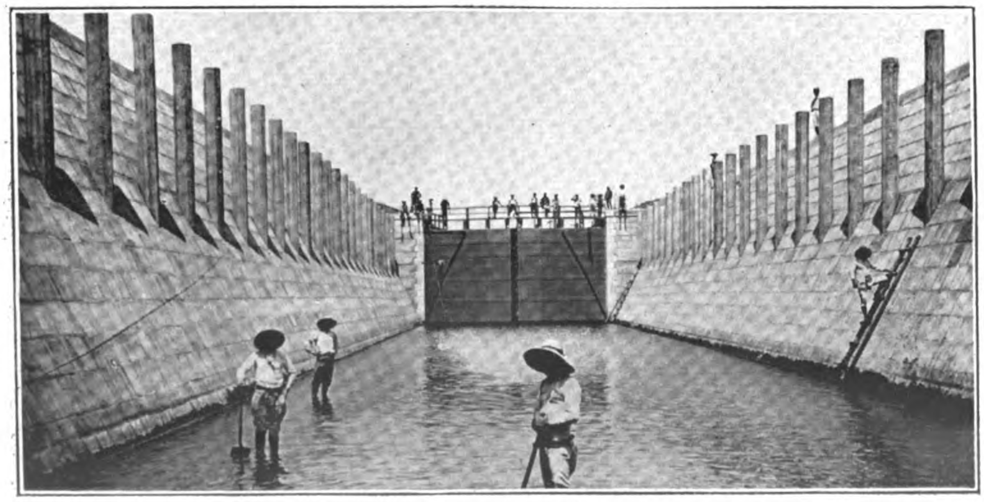
From the village of Hirakata to its mouth the Arakawa is 275 to 600-ft. wide at low water, spreading out to 3,000 and 9,000 in places at high water, causing great damage to the many villages crowded along its both banks. From Iwabuchi to Tokyo the river had been dyked on the left bank only, the right bank opening into the fields, which it flooded for miles. The new flood prevention scheme approved by the Diet in 1910 provided for the digging of a new channel for the Arakawa, starting at Iwabuchi and running along its left bank for a distance of five miles to Nishi Arai. At Motoki the stream is divided and a new river bed excavated as far as North Senju there crossing the Ayase river, thence to the Koyase river and south-east to the Kine river. It then crosses the Nakagawa and on south to the east bank of the Komatsu river down to the mouth of the Nakagawa, a distance of ten miles. From Motoki this new river bed will carry off the flood waters of all the streams, discharging into the bay to the east of the Fukagawa Ward.



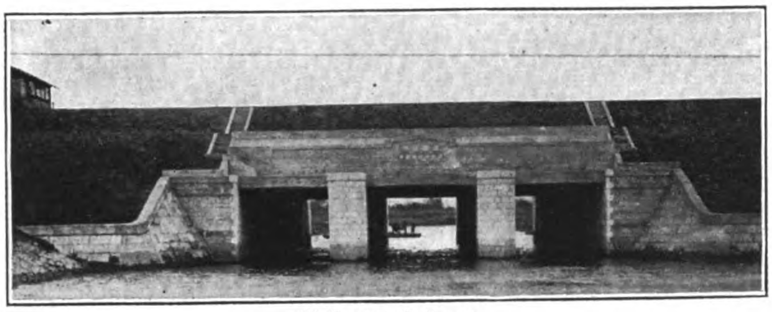
Section of Iwabuchi Gate.

This great work, now practically completed, constitutes one of the great engineering feats for safeguarding the capital against further floods, and permits the development of the Honjo and Fukagawa Wards into comfortable factory districts and residence quarters. The divergence of these flood waters into the new canal relieves the Sumida of the vast volume it was formerly called upon to carry, and permits the practical closing of one of its mouths by reclaimed land for industrial sites. The added volume flowing out into the bay through the channel between Tsukujima and past the Shibaura wharves will tend to scour and keep the channel open for large ships.

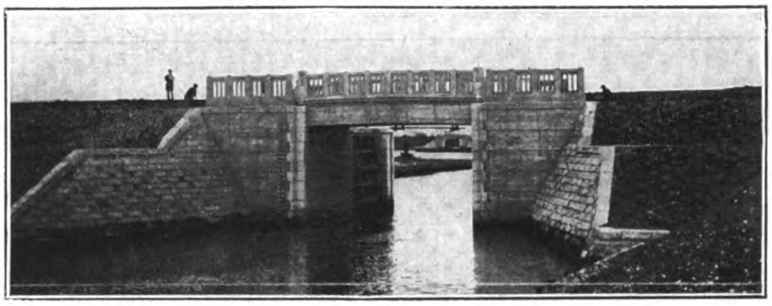
Investigations at the time of drafting the plans for regulating the Arakawa showed that in 1907 the greatest flow per second at



Onagigawa Lock; Under Construction

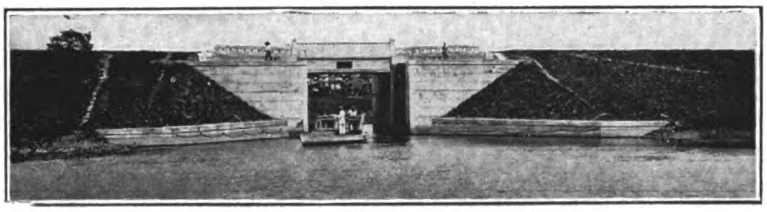


Shibaura Culvert



Kinegawa Sluice Way.

Iwabuchi was 150,000 cubic feet, but in 1910 this record was broken by a flow of 200,000 cubic feet. It is at this point that the main regulating gate, the most important feature of the flood prevention works, was located. It is intended to regulate the flow from the main river into the old Arakawa or Sumida channel to 30,000 cubic feet per second at low water and provide a constant depth for vessels which navigate the Sumida. It consists of five gates, each thirty feet wide, the right gate always remaining open for boat traffic.



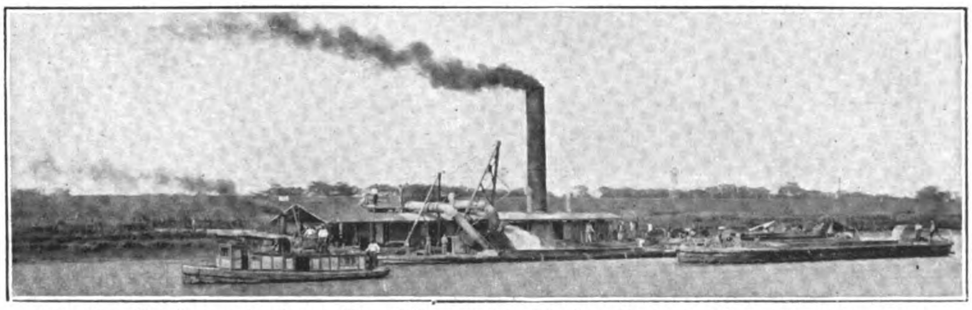
Ayase Sluice Way.

The foundations for the piers and abutments, six in number, are built on a row of six caissons, two under each pier and abutment. Each caisson is 13½-ft. square, 60-ft. long, with walls 2½-ft. thick down to 42-ft. and from there on 3-ft. thick. These caissons are filled with concrete, and over them is laid a bed of concrete 6-feet thick, on which the piers and abutments are built. These are 9-ft. wide, 60-ft. long, and spaced 30-ft. apart, supporting the water gates made of four horizontal and six vertical steel beams covered with ⅜-in steel plates. The gates are 31-ft. wide and 15-ft. high, weighing 30 tons each, opened and closed by electric motors operated by an oil-generating set installed at the works.

Excavator at Work on New Arakawa Flood Prevention Canal: Made by the Niigata Iron Works.

The water apron leading under the gates is laid with cyclopean concrete 6-feet thick for a distance of 60-ft. on the down-stream and 24-ft. on the upstream side. The next 120-ft. on the downstream side is laid with concrete blocks on a brush mattress. The gate was completed in March of last year at a cost of Y.1,198,000.

The new flood prevention canal, or the Shin Arakawa (new Ara river) as it is called, is 1,500-ft. wide between the Iwabuchi Gate and Sumida Machi, a distance of seven and a half miles, and from this point to its mouth it gradually widens until it reaches 1,920-ft. In this main bed a stream from 180 to 840-ft. wide will be kept flowing at all times on a slope of 1-5,000, making possible a discharge of 120,000 cubic feet a second.



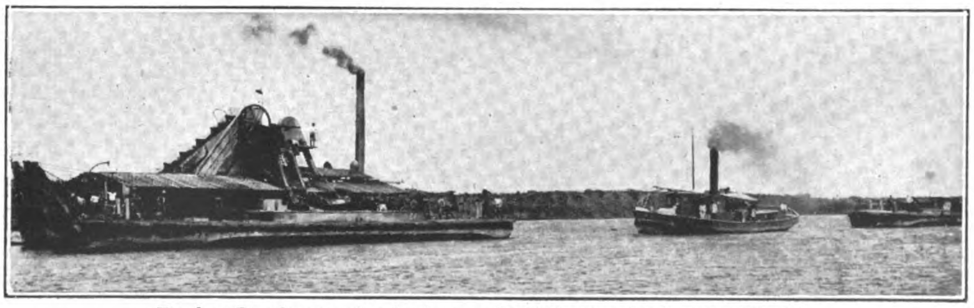
Suction Dredge on Arakawa Flood Prevention Works: Made by Uraga Dock Co., Ltd.

The old Arakawa between Iwabuchi and Senju is 316-ft. wide, widening to 480-ft. at the Azuma Bridge in Tokyo. This old river bed has been improved and dredged so that it now carries a regular flow of 30,000 cubic feet a second, which will be its normal at all times, even in a flood.

Along both sides of the Shin Arakawa dykes have been erected to a height of 7-ft. above the highest recorded flood level. On the right bank the dyke is 48-ft. wide, and on the left bank 36-ft., with slopes of 20 per cent. on the channel side and 30 per cent. on the inside. A road twelve feet wide has been laid out 6-feet below the top of the dyke on the outside of both the banks.

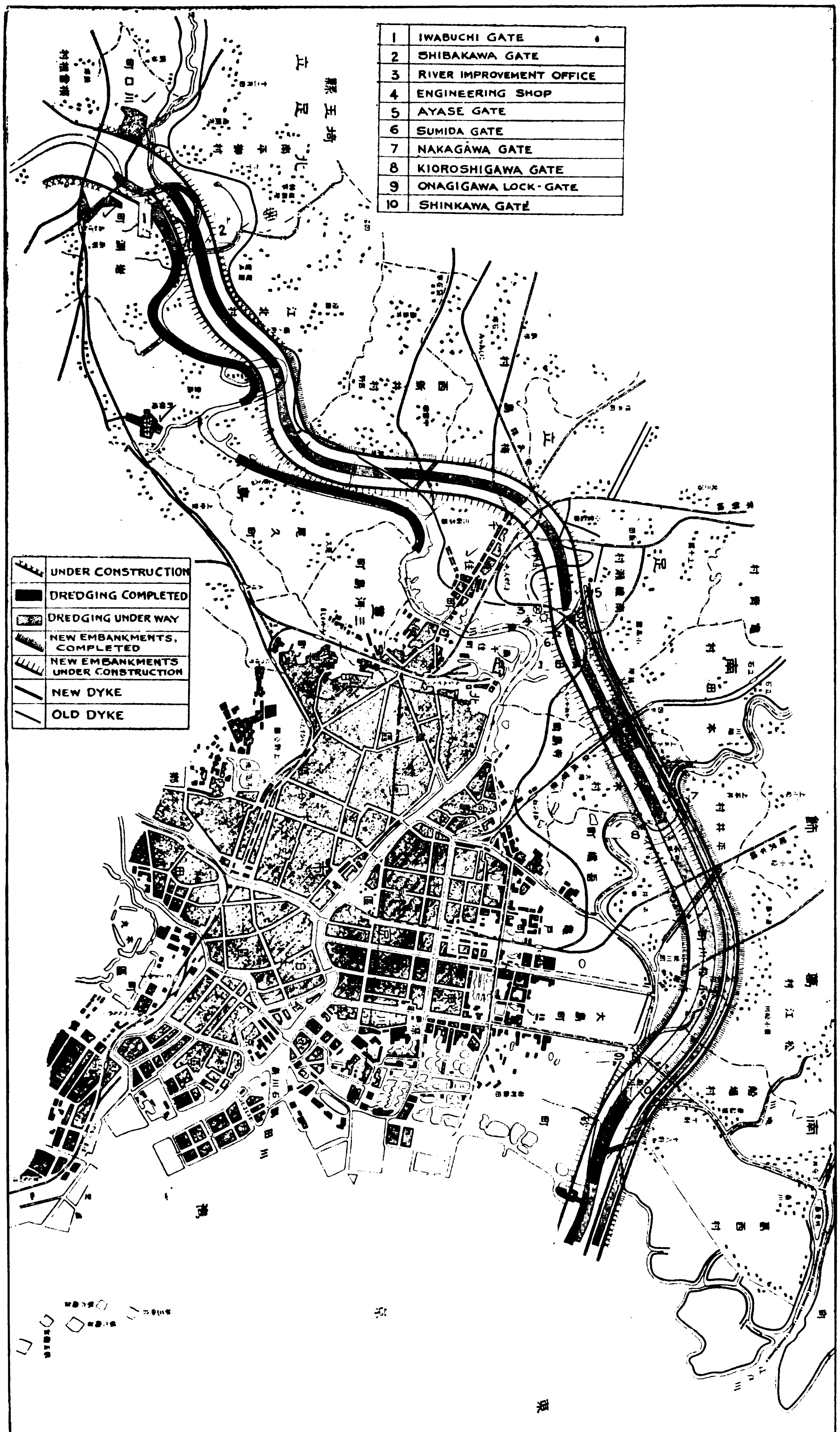
Where no protecting banks previously existed the old river has also been dyked on both sides, so that from Iwabuchi to the sea the river is confined effectively to its channel.

In order to construct the new flood prevention channel, the Nakagawa was cut off at Kami Hirai, and a lock built at that point to permit traffic between the old Naka river and the new river. Paralleling the new Arakawa, another canal, 27,000-ft. long and from 240 to 540-ft. wide, has been dug to carry off the waters of the old Naka river.



Bucket Dredge on the Arakawa; Built by the Osaka Iron Works.

Where the new Arakawa crosses the Ayase river a sluice way has been built, and the old stream of the Ayase is discharged through a new canal built along the left bank of the New Arakawa into the Koyase river, crossing thence to the Kine river and finally discharging into



PLAN OF THE ARAKAWA FLOOD PREVENTION WORKS.

Showing the Course of the New Drainage Canal starting at Iwabuchi and Discharging into Tokyo Bay East of the City of Tokyo

the Naka river. On the left bank of the new river a sluice gate has been built to permit traffic to pass from the Kine river to the Edo river. To connect the Ayase river and the Sumida river four locks have been constructed, and with the arrangement at Iwabuchi providing a special waterway for the use of boats, a flow of traffic up and down all these important streams is established.

In the construction of the new beds for the Arakawa, Ayase, and Nakagawa, 3,300,000 cubic *tsubo* (*tsubo*=216 cubic feet) were excavated, of which about 1,657,000 cubic *tsubo* was used to build the embankments. Excavations on the upper level were carried out by hand labor and on the lower levels by machinery.

The final improvements of the lower stream of the Arakawa will be completed in 1927 at a cost of Y.29,144,000. The effect on the prosperity of Tokyo will be inestimable, while upstream from Iwabuchi, where the flood water will no longer be able to back up and inundate surrounding fields, the towns and country will also be greatly benefited.

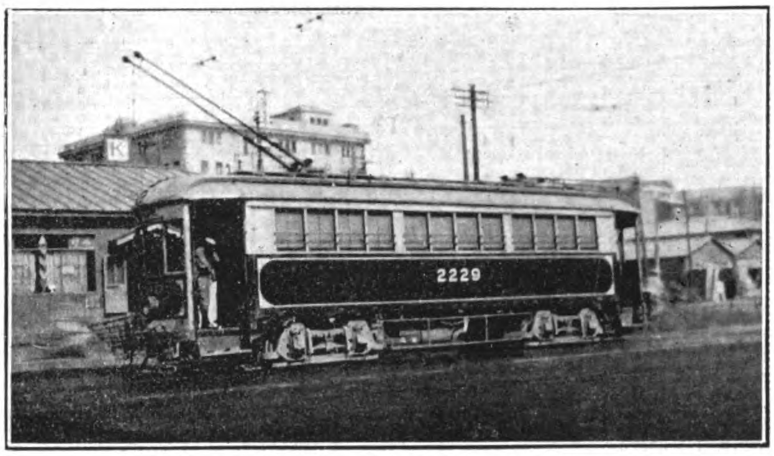
The new channel shortens the distance from Iwabuchi to the sea by one-fifth, thus permitting the discharge of the upstream flow in a greatly lessened time than before. In the past the discharge of the Ayase river has backed up the flow of the Sumida, but now that this river discharges into the sea through an entirely new channel this cause of loss has been for ever done away with. As a result of joining the Ayase, Naka and New Ara rivers the industrial districts of Honjo and Fukagawa are now better provided with transportation facilities by water than ever before.

The Arakawa flood prevention works is considered by experts to be one of the most important pieces of engineering work ever undertaken in Japan, not so much because of its engineering difficulties, but because of the favorable effect its completion will have on the industrial development of the capital and the surrounding territory.

Tokyo's Tramway System

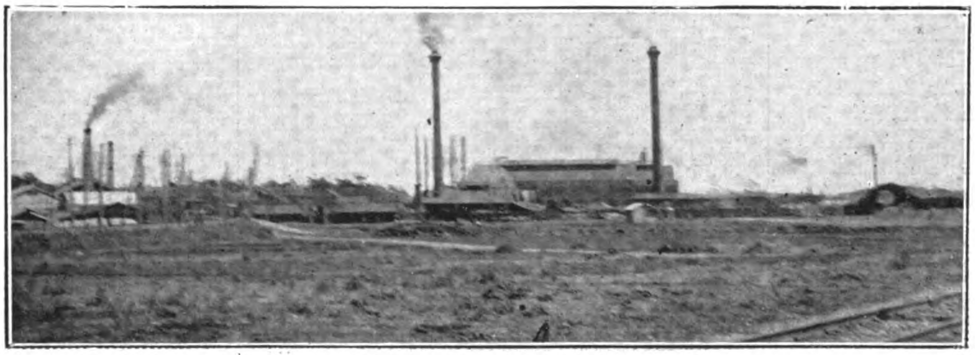
With Nearly 200 Miles of Track and 1,400 Cars the System Cannot Be Extended Rapidly Enough to Meet the Growing Transportation Demand

IT was not until 1911 that the surface tramways of Tokyo were taken over by the city from the Tokyo Railway Company, which at that time operated 119.5 miles of track, under a franchise which covered rights to about 200 more miles. The traffic requirements of the city seemed to grow farther than new lines could be constructed, and in order to meet this demand, and provide adequate and efficient service, many changes were carried out, which, together with new construction, temporarily helped to relieve the traffic congestion. The extension of the surface lines out to the city limits was followed by an immediate and rapid development of the suburbs. This growth has continued to the extent that the surface lines are no longer capable of providing rapid transportation for these new districts, and as a consequence, the elevared electric lines of the Imperial Government Railway Department now handle a large percentage of the long haul traffic that pours into the city from the private suburban lines, while several motor services have also been placed in operation in order to relieve the pressure.



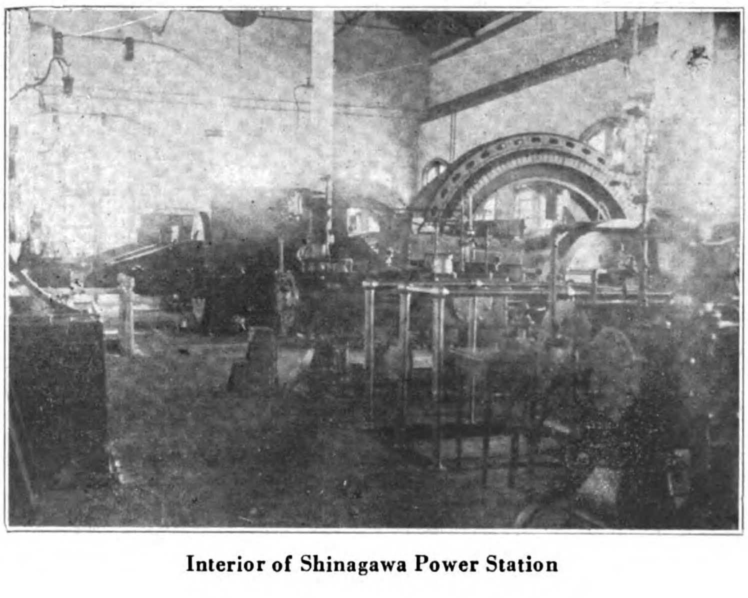
New Type of Car for the Tokyo Municipal Tramways

Ten years after taking over the tramway lines (1921) the Tokyo City Electric Bureau had increased the track mileage to 183.3, operating 926 bogie and 795 four-wheel cars. In the fiscal year ending March 31, 1922, the daily average of passengers carried was 1,450,231, with receipts at Y.95,935 from 1,427 cars running 130,570 miles a day. The system at that date represented an investment of Y.105,910,000, covered by municipal bonds issued on the domestic and foreign markets.



Shinagawa Power Station of the Tokyo Municipal Tramways

In 1918 the city was authorized to construct 86 miles of new lines before the end of 1925, the program being completed by March 1924. Further extensions are now necessary to cope with the demand for transportation, and all future construction will come under the general program of the Reconstruction Bureau.



Interior of Shinagawa Power Station

In order to understand something of the task which has confronted the Electric Bureau since the earthquake, a brief description of the damages inflicted is necessary. With the first earthquake shocks the power from the Kinugawa generating plants, distributed to the city through the Konuma substation, was cut off. All the overhead trolley wires were more or less damaged, but fortunately were easily and quickly repaired. Of the 95 route miles of tramway in operation at the time, 49.6 miles were on streets in the burned district; and although the rails in general were uninjured, there was considerable damage in places where construction work was in progress and the ties not yet covered with concrete. In such places 27,410 ties were burned and the rails twisted like wire. A further 15,000 ties were destroyed in the storage yards. The greatest loss, amounting to Y.13,000,000, was in buildings, cars and supplies.

The wiring was hopelessly confused and entangled, but was brought into service again after slight repairs. The underground high pressure cables were uninjured, which made possible the rapid restoration of light and power in the unburned districts during the first week after the disaster.

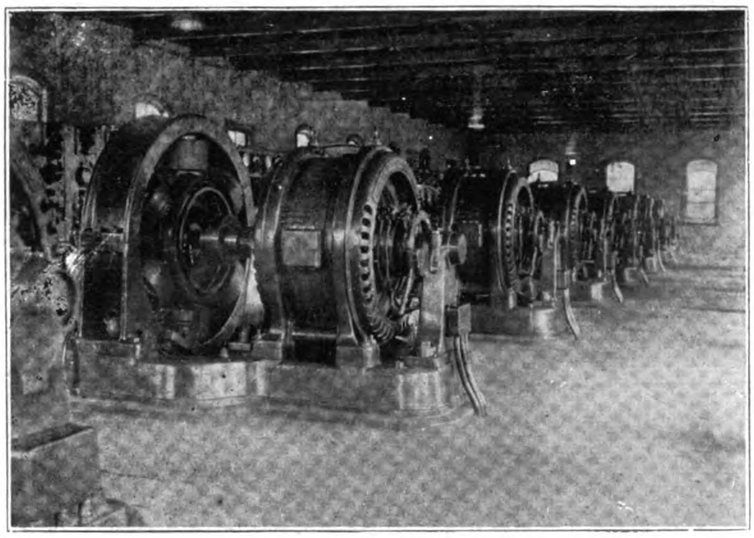
Twenty-six minor bridges carrying tram lines were burned, while the destruction of the larger bridges across the Sumida river, cutting communication between the west and east of Tokyo, was a severe blow to the transportation facilities. With the help of the army, temporary structures were hastily thrown across the river and opened to tramway traffic by the end of October.

Of the 1,905 trams cars owned by the Bureau, 777 (509 bogie and 207 four-wheel) were destroyed by fire, 375 being burned on the tracks.

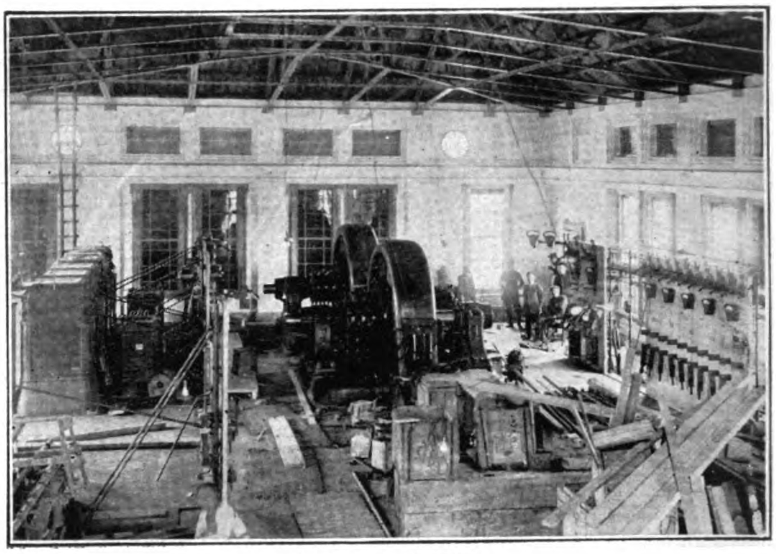
Only two out of sixteen transformer stations (Shirokane and Komagome) owned by the Bureau were undamaged. These were rapidly put in working condition and power supplied for lighting the city and running the trams during the first weeks of September 1923.

Wire supports were not damaged by the quake, although 288 were burned. All the 148 electric clocks just installed before the disaster at important tram stops and transfer points were put out of order, and the master clock and 66 others were burned.

The fact that the high tension transmission line was unharmed, and the two transformer stations at Komagome and Shirokane were speedily repaired, made it possible to

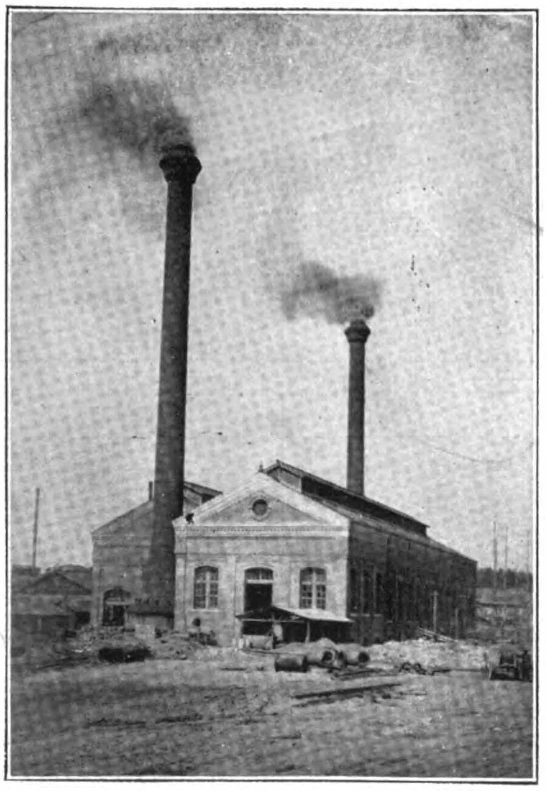


Yokonami Sub-station



Shitaya Sub-station

restore a measure of traffic normalcy to Tokyo before a week had passed. The Electric Bureau of Tokyo City was the pioneer in reconstruction work, and its subsequent efforts to restore its services to pre-earthquake conditions have been untiring. On the fourth of September current for lights in the unburned districts was turned on, and on the sixth the first trams were run between Shiba, Shinmeicho and Uyeno. Temporary bridges were constructed on the most important lines and the tangle of wires straightened out in the following weeks. The principal obstacle to the restoration of normal traffic was the loss of cars. Even by working all the car factories in Japan to capacity, new cars could not be delivered rapidly enough to meet the demand. However, by the end of June 1914, 470 new bogie trams were delivered. All material and parts of these cars, with the exception of the air brake equipment from the Westinghouse Air Brake Co., were made in Japan. Thirty air brakes made by the Knorr Bremsel Co., of Germany, were also bought for experimental purposes. The burned poles were replaced by Mannesmann steel poles, 23 to 26-ft. long, set 100-ft. apart and imbedded in concrete six feet below the street level. All poles which before the fire were set in the middle of the street were changed to the sides.

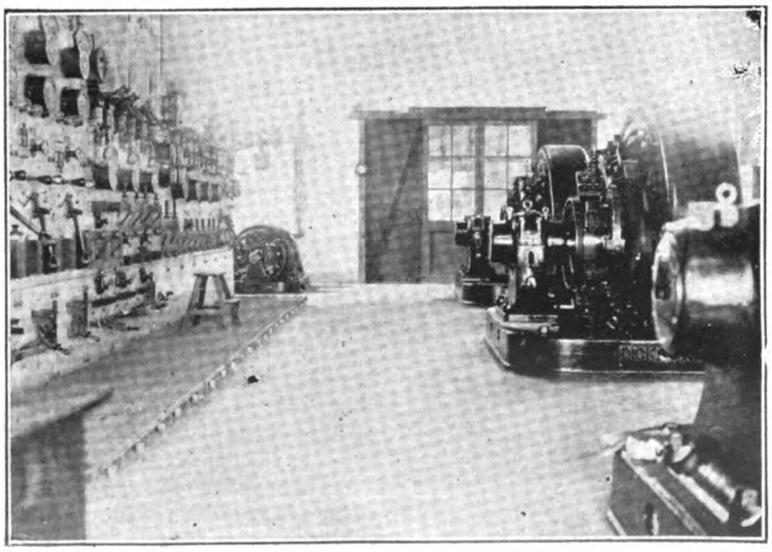


Shinagawa Power Station

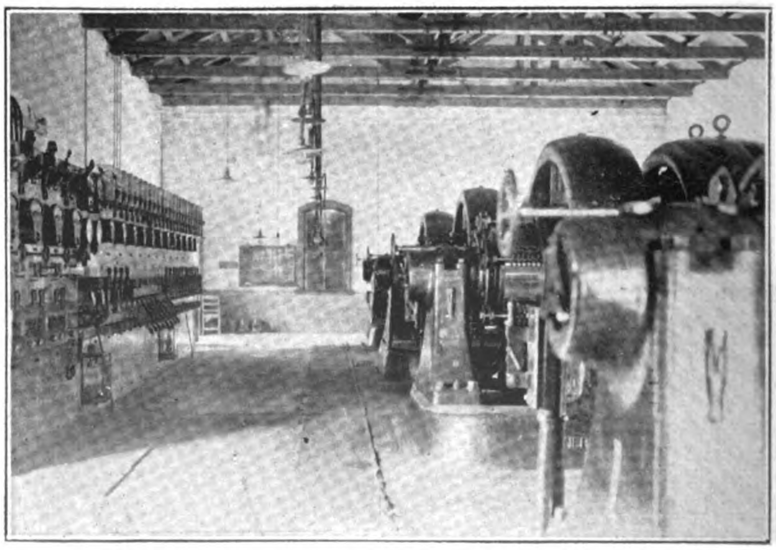
By the end of April 1924 repair work had so far advanced that 98.66 route miles, 195.15 track miles, and 23.5 miles of service track were again in operation. This is a slight increase in mileage, about 5/6ths of a mile, above that in operation on the morning of September 1, 1923. At the beginning of April 1923 there were 188 track miles in operation. So, despite the earthquake, 3.46 miles of new track were added to the system during the fiscal year 1923-24.

The following table, gives the tramway property owned by the Bureau on March 31, 1924, as compared to September 1923 :

	Sept., 1923.	Mar. 31, 1924.
Track :		
Route Miles ...	98.26	98.62
Track Miles ...	194.32	195.15
Service Track,	23.65	23.60
Bridges :		
Number ...	55	69
Area of surface	1,924 tsubo	2,389 tsubo
Wires :		
Trolley, 600 v.	1,038,439 feet	2,146,744 feet
High Voltage :		
Underground...	227,240 „	783,315 „



Ichigaya Sub-station

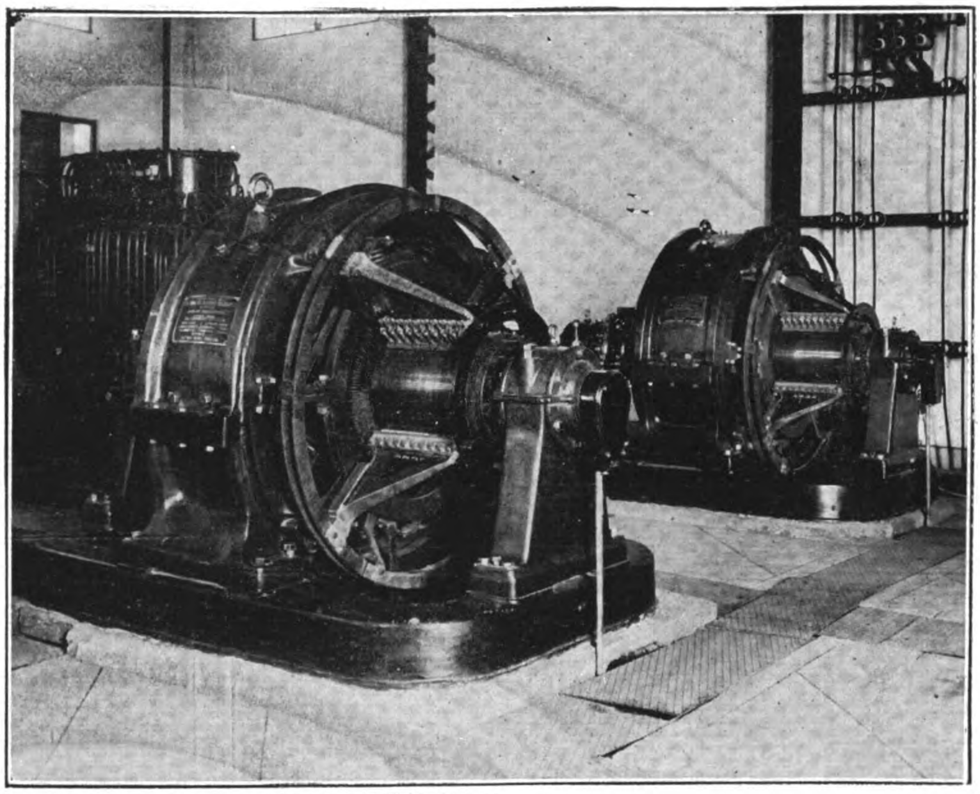


Iidamachi Sub-station

	September, 1923.	March 31, 1924.
Transmission Lines :		
Overhead, 600 v. ...	38,375 feet.	98,153 feet.
Underground, 600 v.	478,367 „	855,970 „
Supply Lines :		
Overhead, 110 v. ...	489,186 feet.	1,026,712 feet.
„ 3,330 v. ...	46,125 „	46,125 „
Underground, 110 v.	3,740 „	5,740 „
„ 3,300 v.	315,085 „	316,485 „

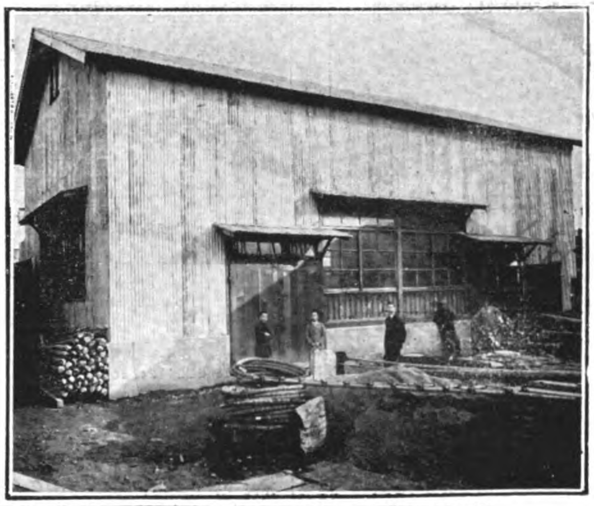
Thirteen of the sixteen transformer stations used by the tramways were destroyed. These were all rebuilt or repaired by the end of March 31, 1924. The equipment of these stations is as follows :

Name of Station	Rotary No.	Converters, Tower, Total	Transmission Switches No.	Circuit Breakers, No.
Ichigaya (Generators 3—330 k.w. each)				
Yuraku Cho ...	4	2,000 k.w.	48	162
(Also 2 Frequency changing condensers, 2,000 k.w.)				
Yokonami ...	3	1,200	21	24
Hamamatsu Cho	2	800	15	18
Shitaya ...	2	2,500	24	45
Kasuga Cho ...	4	3,000	16	36
Shinobu Cho ...	3	2,250	22	30
Shirokane ...	2	2,000	24	24
Tokiwa Bashi ...	2	1,000	15	30
Asakusa ...	1	750	12	33
Kasumi Cho ...	2	1,000	10	9
Kuroe Cho ...	1	500	12	21
Iida Machi ...	2	1,500	7	9
Komagome ...	1	400	13	21
Koishikawa ...	1	400	11	18
Konuma ...	2	1,000	7	6



The Tokyo Electric Bureau also owns a steam power plant for the use of the tramways, located at Shinagawa, equipped with (March 31, 1924) :

Boilers, 8, of 350 h.p. each ; Prime Movers, 3 of 1,800 h.p. each and 1 of 2,800 h.p.: Generators, 6,060 volts, 3 of 1,200 k.v.a. and 1 of 2,000 k.v.a.



The car shops at Hamamatsu Cho entirely destroyed by the fire have not yet been restored to their pre-earthquake condition. The branch shop in Shibaura was unaffected by the disaster, and on March 31, 1924, was equipped with 57 various machine tools and 10 electric motors of 210 h.p. each. The Mita shop has 21 machine tools and 2 motors of 22 h.p. each. The clothing factory, where uniforms are made for the employees of the Bureau at cost, and the printing shop are in full operation with the most up-to-date machinery.

The Electric Bureau owns 237,346 *tsubo* of land, including right of way, and 54 buildings. The land is valued at Y.5,721,923.18, but no valuation is placed on the buildings in the latest report. Besides this, 20,444 *tsubo* of land and 26 buildings are rented for the use of the tram section.

The old-fashioned four-wheel cars are being replaced by 82 passenger bogie cars. There are many routes on which only small cars can be operated, so some new four-wheelers have been added to the Bureau's equipment.

At the end of the 1923-24 fiscal year the rolling stock was as follows :

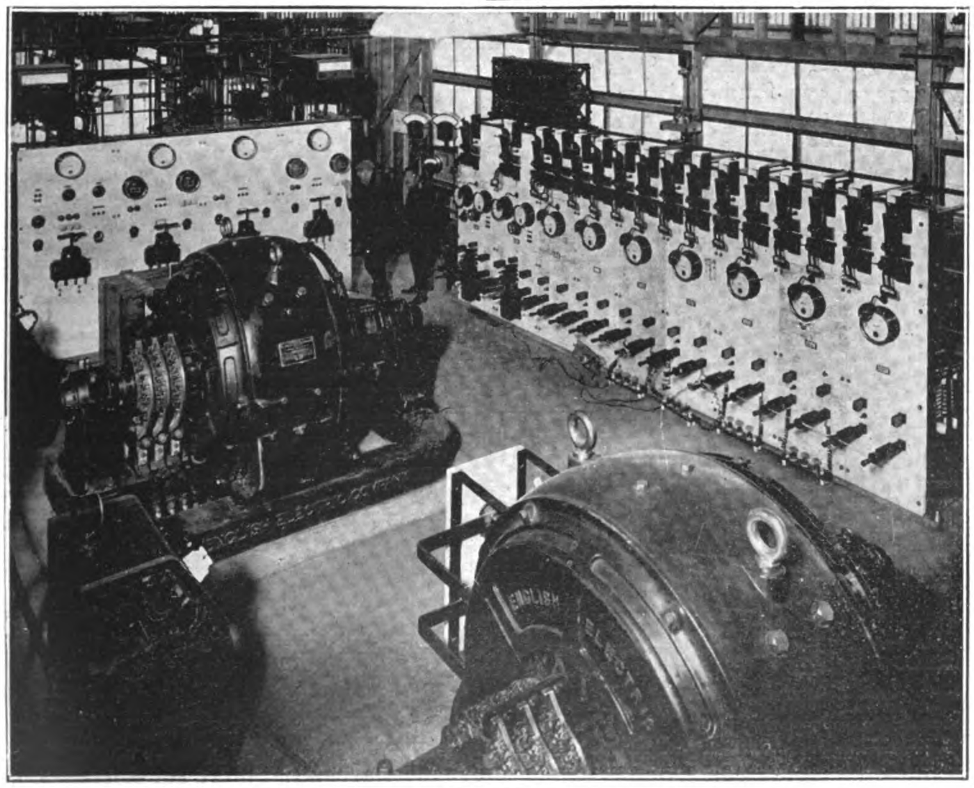
424	40-passenger	4-wheel cars
323	66 „	bogie „
97	76 „	„ „
458	82 „	„ „

Total 1,380 passenger cars. In addition there are 62 five-ton freight cars.

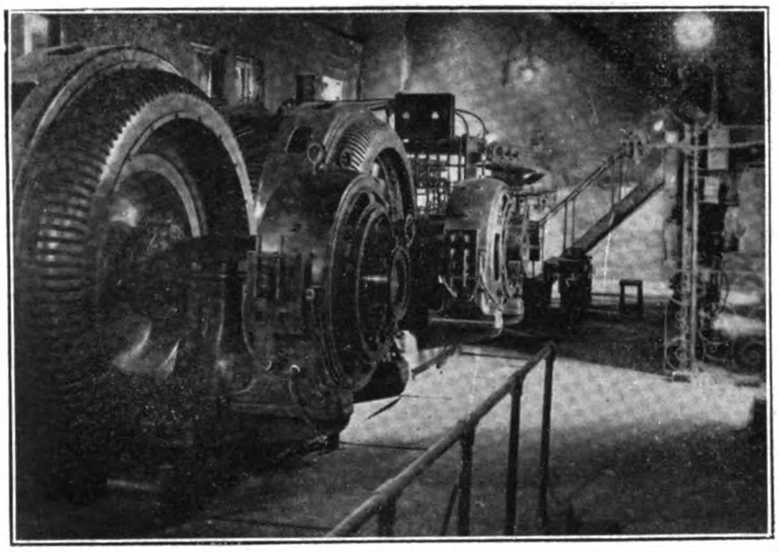
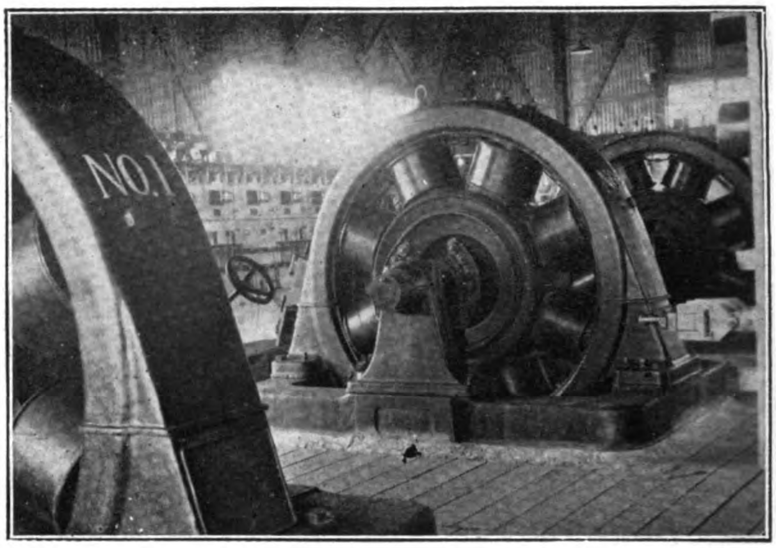
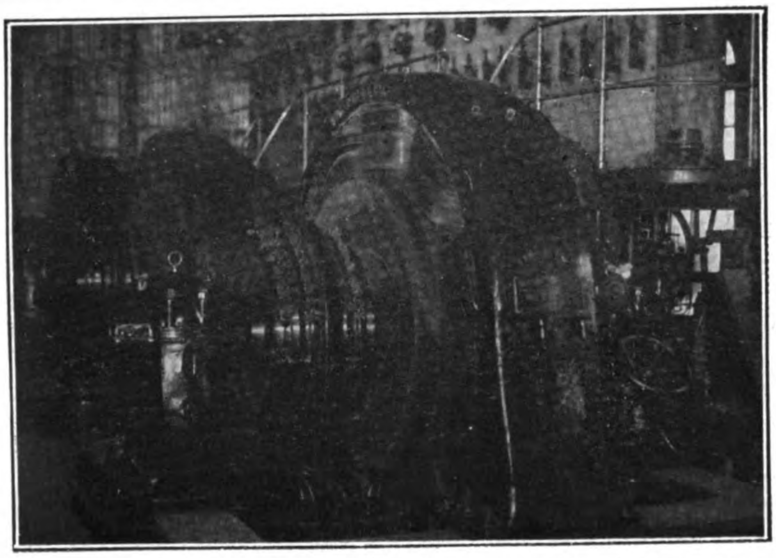
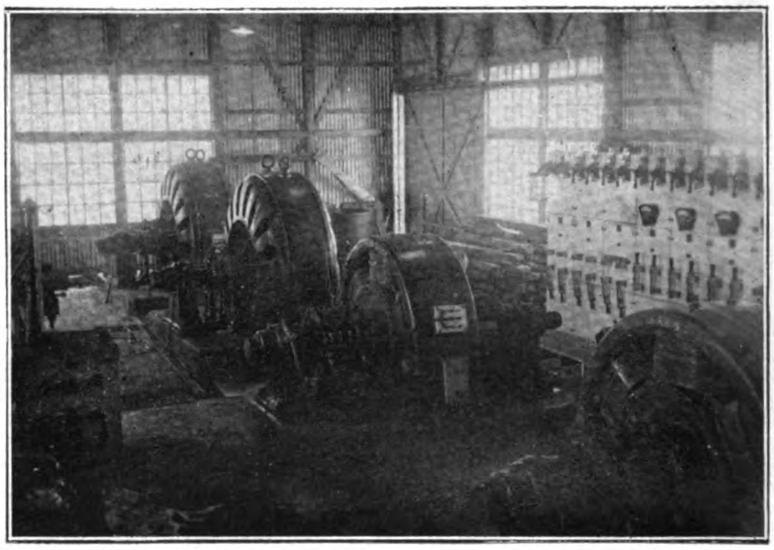
From April, 1, 1923, to March 31, 1924, 59,191,243 k.w.h. of power was used in operating the tramways, an average of 1,253 k.w.h. per car per mile ; 2,371,981 k.w.h. was used for lighting the tracks, offices and works, making the total power used by the tramways 61,893,031 k.w.h.

The number of passengers carried during the year was 450,542,846, with revenues of Y.24,635,141.53. The number carried in March 1924 was the greatest for the year, but the fares collected did not approach the highest paid before the earthquake. During the earthquake month only 9,535,965 passengers were carried, but in December 1923 the number of passengers had again reached the monthly average before the disaster. The average number of miles run per month was 4,021,468.

The original purchase of the tramways and their subsequent extensions have been financed by the issue of Municipal debentures. The status of these issues on March 31, 1924, is shown in this table :



Types of "Barrack" or Temporary Sub-stations for the Tokyo Municipal Electric Bureau, hastily erected after the Earthquake. Top right, Shinagawa Sub-station. Center and Bottom Left, Exterior and Interior of the Nihonbashi Sub-station, equipped by the English Electric Co., Ltd.

Thirteen of the Sixteen Sub-stations operated by the Tokyo Electric Bureau were destroyed by the Earthquake and Fire. The above Illustrations are typical of the Temporary Stations erected to meet the emergency

Class of Bond.	Face Value Issue	Amount redeemed up to March 31, 1923	Amount redeemed April 1, 1923 to March 31, 1924.	Unredeemed March 31, 1924.
Electric Industry Deb. :				
A. English Issue ...	£5,175,000	£650,700	£84,000	£4,440,300 Y.43,276,020.30
B. French Issue ...	F.100,880,000	F.8,981,500	F.1,458,000	F.90,440,500 Y.34,881,304.23
Second Issue				
Electric Industry Debentures :				
"i"	Y.10,000,000	Y.968,700	Y.309,000	Y.8,822,300
"ro"	5,000,000	40,000	49,300	4,910,700
Electric Industry :				
Short Term Loan				
Bonds	Y.10,000,000	—	—	Y.10,000,000
Second Issue ...	15,000,000	—	—	15,000,000
Third Issue... ...	20,000,000	—	—	20,000,000
Fourth Issue ...	20,000,000	—	—	20,000,000

The total amount unredeemed on March 31, 1924, was Y.156,-890,324.53, of which Y.78,733,000 was in domestic and Y.78,157,-324.53 in foreign issues.

After the earthquake the Municipality was induced by the Chief of the Electric Bureau to start a motor bus service as an auxiliary to the surface lines. An order for 1,000 Ford chassis was given to Sale & Frazar, and these fitted with a rough passenger bus body, but the service has not proved a success. After a year most of the old Ford buses were superseded with new ones equipped with proper passenger bodies. These have proved popular, and the service is now being expanded and extended. By January 1924 135 buses were in service; in February 274; and by the end of March the number had increased to 800. These buses were 5-ft. 5¾-in. wide, 15-ft. ½-in. long, and 7-ft. 5⅛-in. high. The city also owns 40 motor cars for other service.

The Bureau's income from tramway operation in 1923-1924 was Y.26,299,438.075, with expenditures of Y.18,277,268.87, leaving a profit of Y.7,982,169.205. This was insufficient to pay the fixed interest charges, annual deposits to legal reserves, and payments into the general account of the Municipality, by Y.2,002,-300.255. This sum, however, was paid out of the special reserve fund, which was exhausted by the payment.

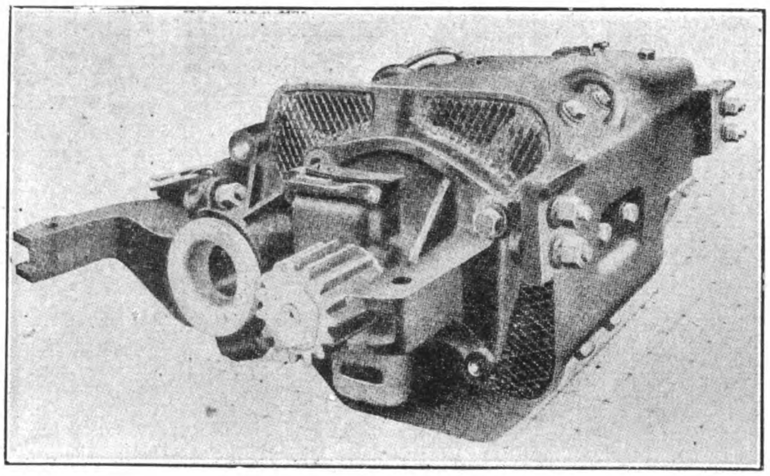
The future extension of the surface tramways of Tokyo is now linked with the Rapid Transit Program of the Municipality.

At the present time the surface trams on 180 odd miles of track carry the same number of passengers per mile as New York's rapid transit system of 600 miles. It has been decided by the Reconstruction Bureau that in future tram lines will be prohibited on roads less than 72-ft. wide, and as there are only 150 miles of 72-ft. wide streets in Tokyo to-day, this ruling restricts the future extension of surface tramways to 300 miles. The extreme limit of extension of the surface lines in Tokyo as planned provides a total of 372 track miles, or 182 miles more than are now in operation. At the present rate of new construction it will take two decades to arrive at this limit. In 1924, 480,000,000 passengers were carried on the surface lines and it is estimated that this will increase to 530,000,000 in 1925. The actual number of passengers carried per track mile should not exceed 700,000 a year, as in London, Paris and Berlin, limiting the transportation capacity of the 372 miles to about 600,000,000 passengers.

It is estimated that the number of passengers carried annually will reach 980,000,000 in 1937, and in another ten years (1947) to a total of 1,500,000,000, or more than double the capacity of the surface tramlines as limited by the new street regulations.

This traffic problem has naturally caused deep concern to the Electric Bureau, and many plans have been drawn up from time to time in order to find some practical solution. To supplement the

transportation capacity of the surface lines four private, companies were licensed in 1919 and 1920 to construct underground railways serving the most important traffic routes in the city. This, it was hoped, would attract the long haul traffic, and leave the short haul for the trams. Financial difficulties, however, prevented three of these companies from carrying out their franchises, and their rights reverted to the city. One company, the Tokyo Underground Railway Company, began construction of the first section of its line on May 1, 1925. Convinced that little help was to be expected from private enterprise, the authorities have completed plans for the construction of about 50 miles of rapid transit lines to be built by the city, and operated by the Electric Bureau. These plans have been approved by the Municipal Assembly and the Government departments concerned and the budget estimates are now awaiting approval.



MITSUBISHI TRACTION MOTOR

1,500-50 H.P. Traction motors manufactured by The Mitsubishi Electrical Engineering Company, Ltd., at their Kobe and Nagasaki Works were Supplied to the Tokyo Municipal Electric Bureau Immediately After the Earthquake, Permitting the Early Restoration of Traffic.

Visitors to Tokyo who travel from Yokohama on the railway cannot fail to notice the large number of street-car trucks, frames and motors piled up in the yard of the Tokyo municipal railways repair shop at Hammatsu-cho. The shop itself was completely destroyed by the fire, and had to be entirely re-equipped, though the reinforced concrete buildings themselves stood the earthquake very well.

The number of destroyed cars (800) was over half of the total available for service before the earthquake, so that in re-establishing the service it was necessary to order a large number of new bodies, trucks and electrical equipment.

Some of the equipment, not too seriously damaged by the fire, has been repaired, so that many of the equipments supplied by the General Electric Co. (U.S.A.) and the Dick Kerr Works of the English Electric Co., or the Toyo Denki in Japan, are still running.

A new type of double truck car has now been standardized having a lower floor than the previous double truck cars used. For the present the railway authorities have decided to standardize on motors and control made by Japanese manufacturers, and orders placed since the earthquake have been to these firms. All of these new cars have been furnished with air brake equipment. It is understood that the railway will dispense with the use of single truck cars on the lines having heavy traffic as rapidly as new equipment can be provided. This will, in part, remedy the congestion of traffic in many parts of the city where the schedule speed of the cars has been rather low.

As well as being faced with the destruction of a large part of its rolling stock, the railway had to provide for sub-station equipment destroyed or seriously injured by the fire. One of the large down-town sub-stations at Yuraku-cho, containing General Electric rotary converters, was completely destroyed, but the rotaries themselves were of such sturdy construction that they passed through the fire and are now being rewound and reconditioned by a local electric works preparatory to being again placed in service. Likewise, the three 1,000 k.w. General Electric frequency changer units in the Kyobashi sub-station were located in a building destroyed by the fire, but after having field coils replaced and a few minor repairs made, they are now operating as usual.

The Railway was in a way fortunate in having placed orders some time prior to the earthquake for automatic sub-station equipment to be supplied by the Westinghouse Electric and Manufacturing Co. and by the General Electric Co., these equipments being automatic rotary converter sub-stations. The Brown-Boveri Co. have supplied some mercury arc rectifiers. This equipment has since been installed and is now operating supplying power to the Railway's 600- volt trolley system.

The Tokyo Municipal Electric Bureau, of which the Tokyo Municipal railways is a part, receives its power from private hydro-electric companies which during the dry season are not always able to maintain their output, so that the Railway is now calling for tenders on a 100,000 k.w. steam station to be located in the Shibaura district of Tokyo. It is understood that a decision will be made in regard to the equipment for this station and orders placed during the current year, so that construction may be started next year.

In view of the fact that its load is continuously increasing, the Municipal authorities have recently acquired the water rights owned by the Kanto Dento, and are now studying how the available power may best be developed and brought to Tokyo by high tension transmission lines.

The English Electric Co., Ltd. assisted to no small extent in restoring the tramway damages by placing their organization at the disposal of the Municipal authorities, and in response to urgent telegraphic instructions many hundreds of their D.B. 1 Form K tramway controllers and type "A" 1 circuit breakers were manufactured and shipped to Tokyo in a remarkably short space of time. The products of this company were the first to be installed in the city of Tokyo over 22 years ago.

The question of replacing sub-station machinery was not so easy, such apparatus requiring a considerably longer period to manufacture. With 13 sub-stations either totally or partially destroyed it was necessary for the Municipal engineering department to apply for assistance to industrial areas of Japan unaffected by the catastrophe. Fortunately, the Keihan Electric Railway Co. of Osaka, also equipped with Dick Kerr apparatus, immediately shipped to Tokyo such rotary converters, transformers and switchgear as could be

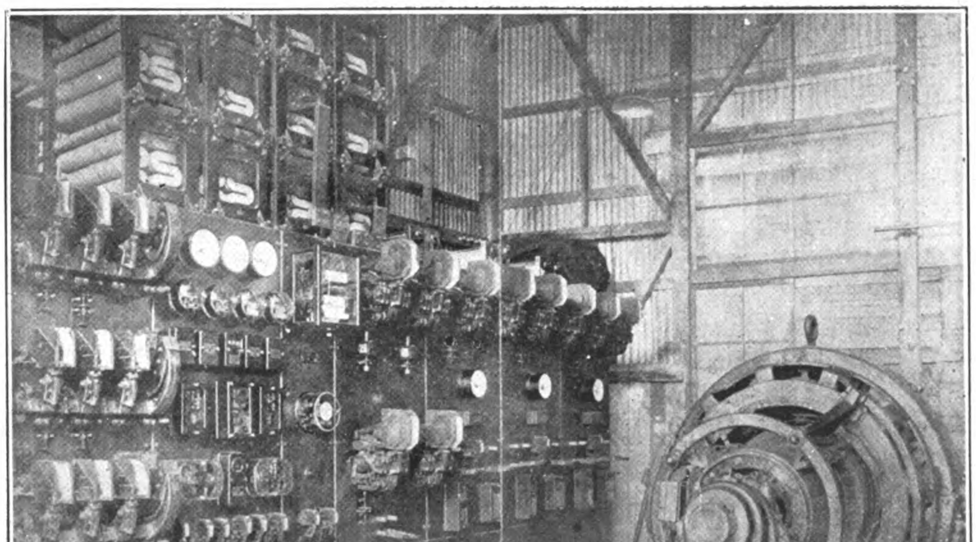
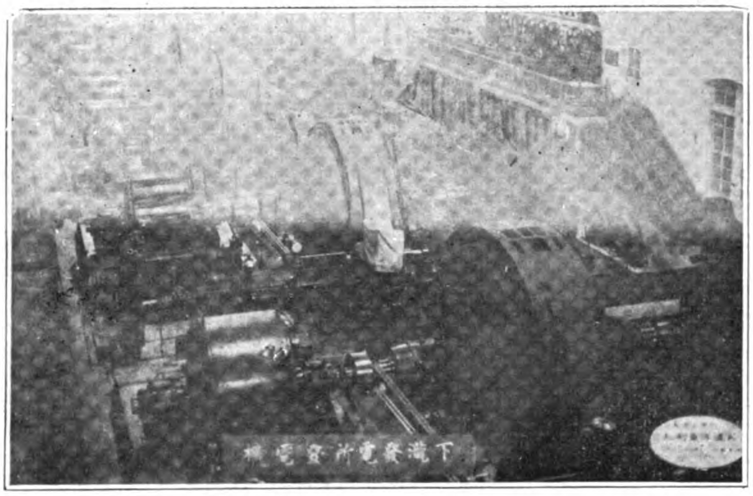
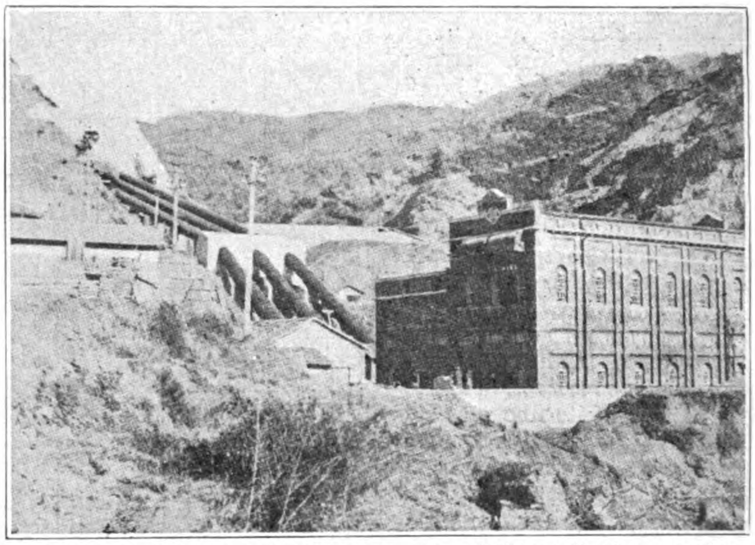


Fig. 1—Westinghouse Automatic Sub-station for the control of a 1000 k.w., 600 Volt d.c., Synchronous Converter Sub-station for the Tokyo Municipal Electric Bureau, Tokyo, Japan

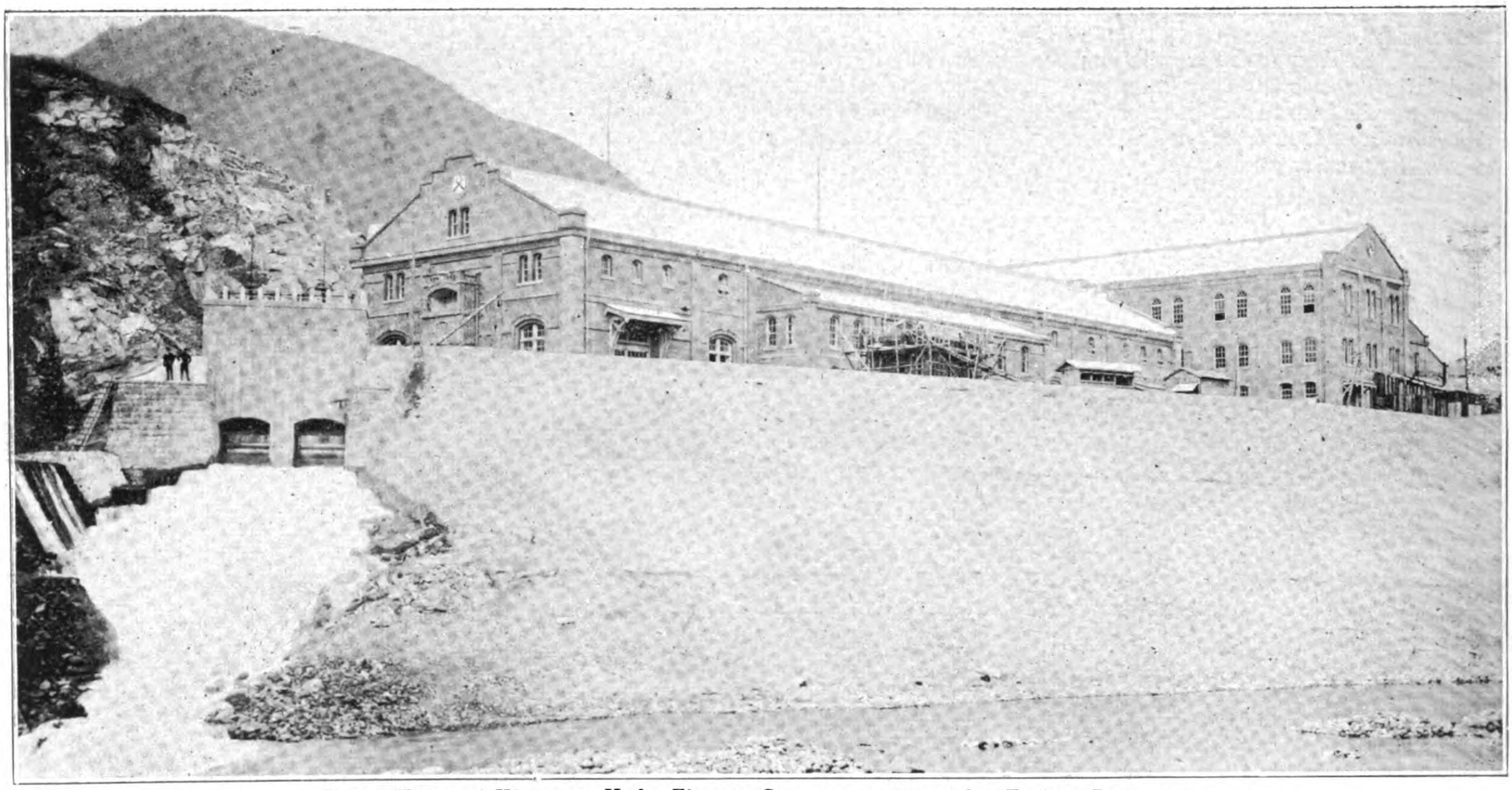
Tokyo's Tramways are Operated by Power Purchased from the Kinugawa Hydro-Electric Company



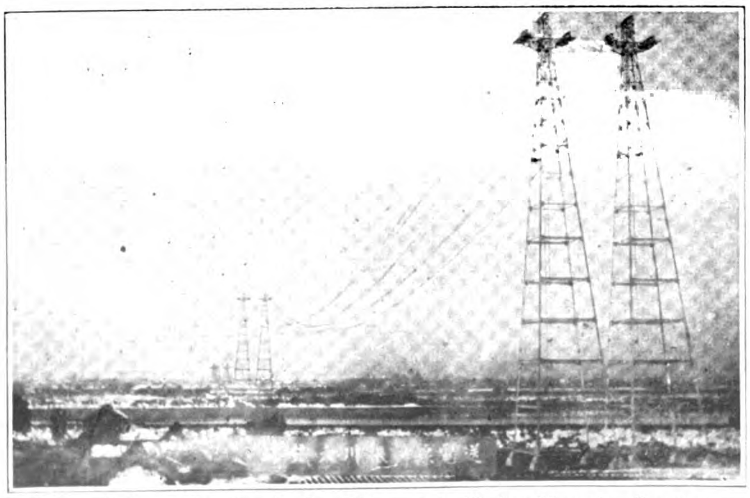
Interior of the Shinotake Power House of the Kinugawa Hydro-Electric Company



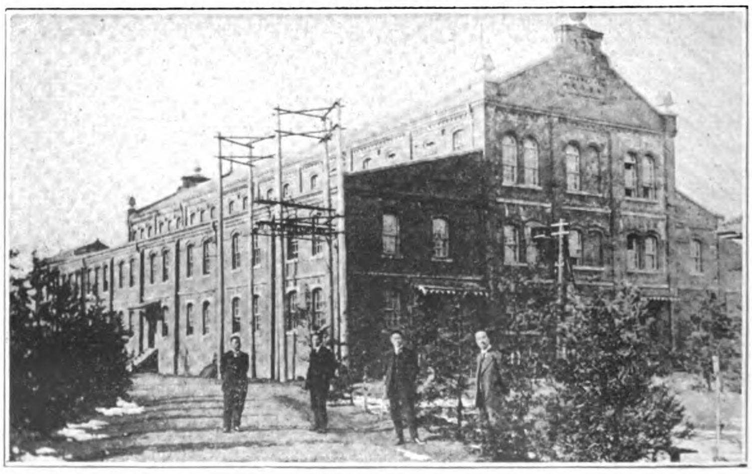
Wakayama Suiryoku Denki Kaisha, No. 2 Power Station on the Hidaka-gawa



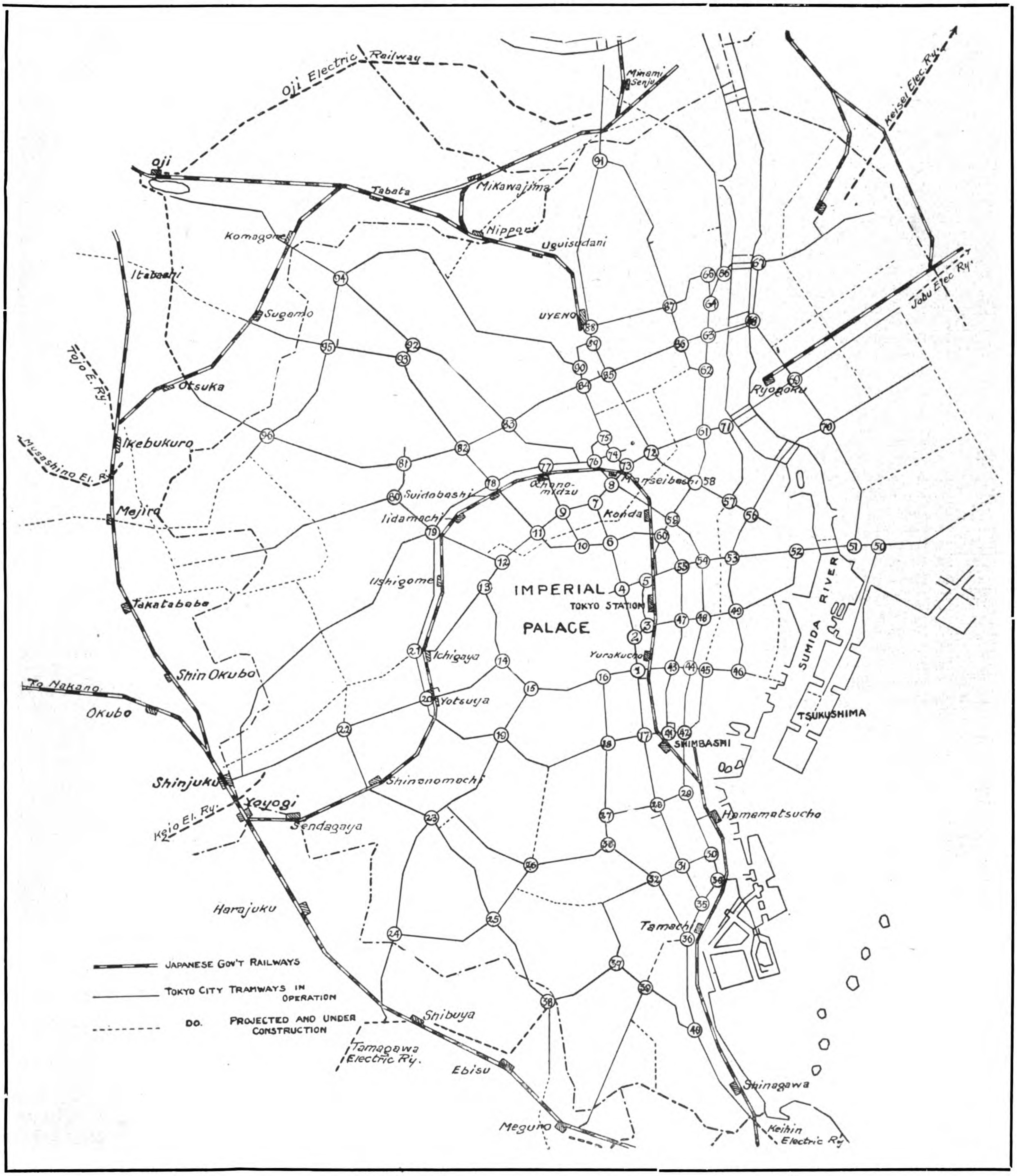
Power House of Kinugawa Hydro-Electric Company at Shinotake, Tochigi Prefecture



Transmission Tower of the Kinugawa Hydro-Electric Company Crossing the Tone River



Transformer Station near Tokyo of the Kinugawa Hydro-Electric Co.



THE MUNICIPAL TRAMWAY SYSTEM OF TOKYO

Nearly 1,400 passenger cars are operated over 200 track miles and 100 route miles of tramways by the Municipal Electric Bureau of Tokyo. The map shows the various tramway lines in relation to the Electrified Belt Line of the Japanese Government Railways and the Private Suburban Electric Tramways Feeding into the Urban System at the City Line.

The numbers on the map represent the principal street corners and tramway passenger exchange points throughout the city and correspond to the names given on the opposite page.

MAP OF TOKYO MUNICIPAL TRAMWAY

Street Junctions Corresponding to Numbers on Map

1. Hibiya
2. Babasakimon
3. Shiyakusho-Mae
4. Otemachi
5. Eirakucho
6. Kandabashi
7. Ogawamachi
8. Sudacho
9. Surugadai
10. Nishikicho-Gashi
11. Jinbocho
12. Kudan-Shita
13. Kudan-Ue
14. Hanzomon
15. Miyakezaka
16. Sakuradamon
17. Sakurada-Hongocho
18. Toranomon
19. Akasaka-Mitsuke
20. Yotsuyamitsuke
21. Ichigaya-Mitsuke
22. Shiocho
23. Aoyama-Ichome
24. Aoyama-6-Chome
25. Kasumicho
26. Roppongi
27. Kamiyacho
28. Onarimon
29. Utagawacho
30. Kanasugibashi
31. Shibazonobashi
32. Akabanebashi
33. Iigura
34. Honshiba
35. Satsumahara
36. Fudanotsuji
37. Furukawabashi
38. Tengenji
39. Gyoran-Sakashita
40. Sengakuji-Mae
41. Dobashi
42. Shibaguchi
43. Sukiyabashi
44. Ginza
45. Miharabashi
46. Honganji-Mae
47. Kajibashi
48. Kyobashi
49. Sakurabashi
50. Monzen-Nakamachi
51. Kuroecho
52. Eitai
53. Kayabacho
54. Nihonbashi
55. Gofukubashi
56. Suitengu-Mae
57. Ningyocho
58. Kodenmacho
59. Honkokucho
60. Shintokiwabashi
61. Asakusabashi
62. Katamachi
63. Umayabashi
64. Komagatacho
65. Kaminarimon
66. Adzumabashi
67. Adzumabashi
68. Sotodemachi
69. Kamezawacho
70. Morishitacho
71. Ryogokubashi
72. Idzumibashi
73. Manseibashi
74. Manseibashi
75. Hatagocho
76. Matsuzumicho
77. Ochanomidzu
78. Suidobashi
79. Iidabashi
80. Omagari
81. Denzuin-Mae
82. Kasugacho
83. Hongo-Sanchome
84. Ueno-Hirokoji
85. ——
86. Misujicho
87. Kikuyabashi
88. Kurumazakacho
89. Ueno-Hirokoji
90. Ueno-Mihashi
91. Minowa
92. Hongo-Sakanamachi
93. Hakusan-Ue
94. Kamifujimaemachi
95. Kagomachi
96. Otsukamachi

spared. These machines were quickly installed in the Yuraku-cho, Oshi-cho and Ichigaya sub-stations, and supplied to no small extent the pressing need of the moment.

The manufacture of new sub-station machinery was put in hand immediately, the English Electric Company receiving orders for their " R. J." type of rotary converters together with the necessary transformers and control switchgear apparatus.

The typical illustration of the temporary " barrack " substation located in the well-known Nihonbashi quarter of Tokyo is shown in the accompanying illustration. In this station the high tension supply of 6,600 volts 3 phase 25 cycles is stepped down through single phase transformers. The rotary converters are two " R.J." type 4 pole 25 cycle high speed machines fitted with roller bearings giving a continuous output of 1,000 k.w. at 600 volts.

The Shinagawa sub-station of the Keihin Electric Railway Company temporarily supplying tramway power to the Tokyo Municipality is also illustrated. The installation consists of two " R. J." type, high speed rotary converters of 500 k.w. capacity, running at a synchronous speed of 1,500 r.p.m. In this case the high tension supply is 3,300 volt, 50 cycles, and stepped down through 3 phase transformers. The machines are also fitted with roller bearings.

Electric Bureau's New Power Scheme

One of the interesting developments in connection with the expansion of the Municipal tramway, subway and lighting system is the project for acquiring sufficient water power rights and generating stations as will make the Municipal Electric Bureau self-supporting and independent of the private power companies. As a result of negotiations extending over a period of several months a contract was entered into on June 19 whereby the City of Tokyo acquired water-power rights from the Tokyo Electric Company, the Kwanto Hydro-Electric Company and the Tokyo Electric Power Company, which, when developed, will give 90,000 kilowatts for the operation of the Municipal electric enterprises.

This scheme, however, has yet to receive the sanction of the Municipal Assembly, and although it is expected that the bill will pass this body with certain modifications it is problematical whether the present Cabinet will give its consent to floating a foreign loan for carrying out the scheme at a time when the borrowing capacity of the city of Tokyo is restricted to Y.100,000,000, which privilege is being guarded as the security for issuing a loan for subway construction. However, as both schemes are spread over a period of years and come under the heading of productive enterprises, they are both sound and well within the borrowing capacity of the Municipality.

The estimate for carrying out the program of the Electric Bureau, including purchase price, working expenses and reserve funds, aggregates Y. 63,050,000, spread over an eight-year period beginning with the 1925 fiscal year, in the following proportions: 1925, Y. 7,390,000; 1926, 9,870,000; 1927, 11,300,000; 1928, 14,480,000; 1929, 5,760,000; 1930, 4,410,000; 1931, 6,980,000; 1932, 2,960,000.

The purchase price is placed at Y. 5,834,000 for the three water rights, Y. 100 per k.w. for the Kwanto Hydro Electric Company, and Y. 20 per k.w. for the water rights of the other two companies. The land value is placed at Y.1,537,000, buildings at Y.3,896,000; canals, reservoirs and waterways, Y. 24,635,000; electric installation, Y. 22,873,000; general expenses, Y. 2,260,000; and reserve Y. 2,112,620.

It is proposed to raise the funds by issuing a Tokyo city loan on the foreign market that will net the city 86 points with an annual interest charge of six per cent. redeemable in thirty years, with amortization to commence in five years.

The scheme embraces the erection of two power plants on the Tone river in the vicinity of Shibukawa served from one reservoir with open canals aggregating 3,118-ft. in length, 30,000-ft. of tunnels and 3,900-ft. of covered culverts. These two plants will have a capacity of 45,000 k.w., and according to the program are to be completed by the end of the 1929 fiscal year and ready for service for 1930. At Karabori on the Azumagawa another plant of equal capacity (27,500 k.w.) is also to be erected and completed by the end of 1932. An impounding reservoir will be built with 3,150-ft. of open canal, 42,000-ft. of tunnel and 3,540-ft. of covered culvert. Over 100 miles of transmission line will be required to carry the current to Tokyo, eighty miles from Tokyo to Shibukawa, and 20 miles from Yatsumata to Karabori.

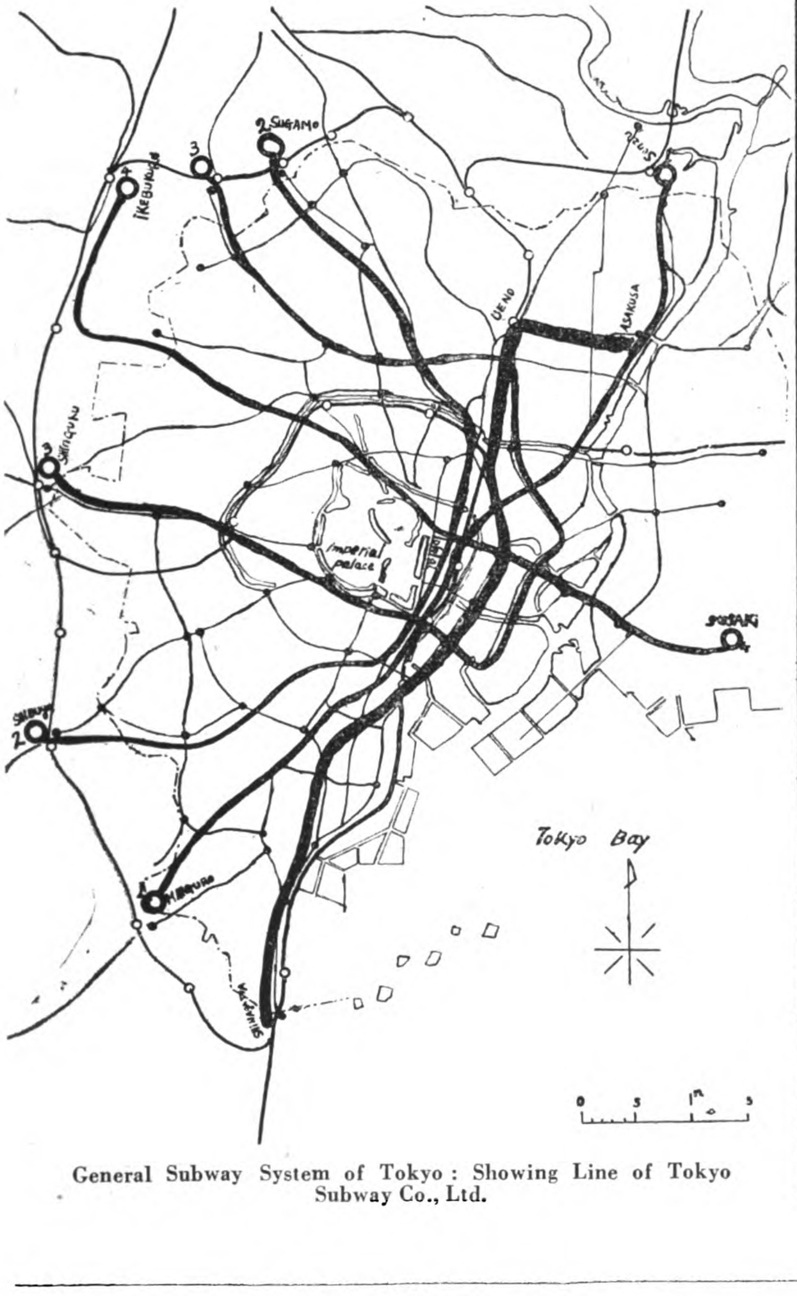
In order to guarantee a continuous supply of power at peak load during the low-water season (December, January and February) a large steam generating station will be erected at the site of the present power-house operated by the Electric Bureau at Shibaura in Tokyo. This part of the program is to be completed by the end of 1926.

The Electric Bureau of the Tokyo Municipal Government now purchases some 45,000 kilowatts from the Tokyo Electric Light Company, the Kinugawa Hydro-Electric Company and the Tokyo Electric Power Company at a uniform rate of .025 sen per kilowatt. Under the new self-supporting scheme it is estimated that the city can supply its own power at a cost of .0203 sen per kilowatt during the period the loans remain unredeemed, and after their redemption the cost will be reduced to .008 or .009 sen per kilowatt. Under this scheme, by the end of 1932 the city would be able to provide 72,800 kilowatts from its own power plants and supply current to the subway lines then open for traffic. At the cost price per unit the Electric Bureau would become self-supporting from the revenue of its own enterprises.

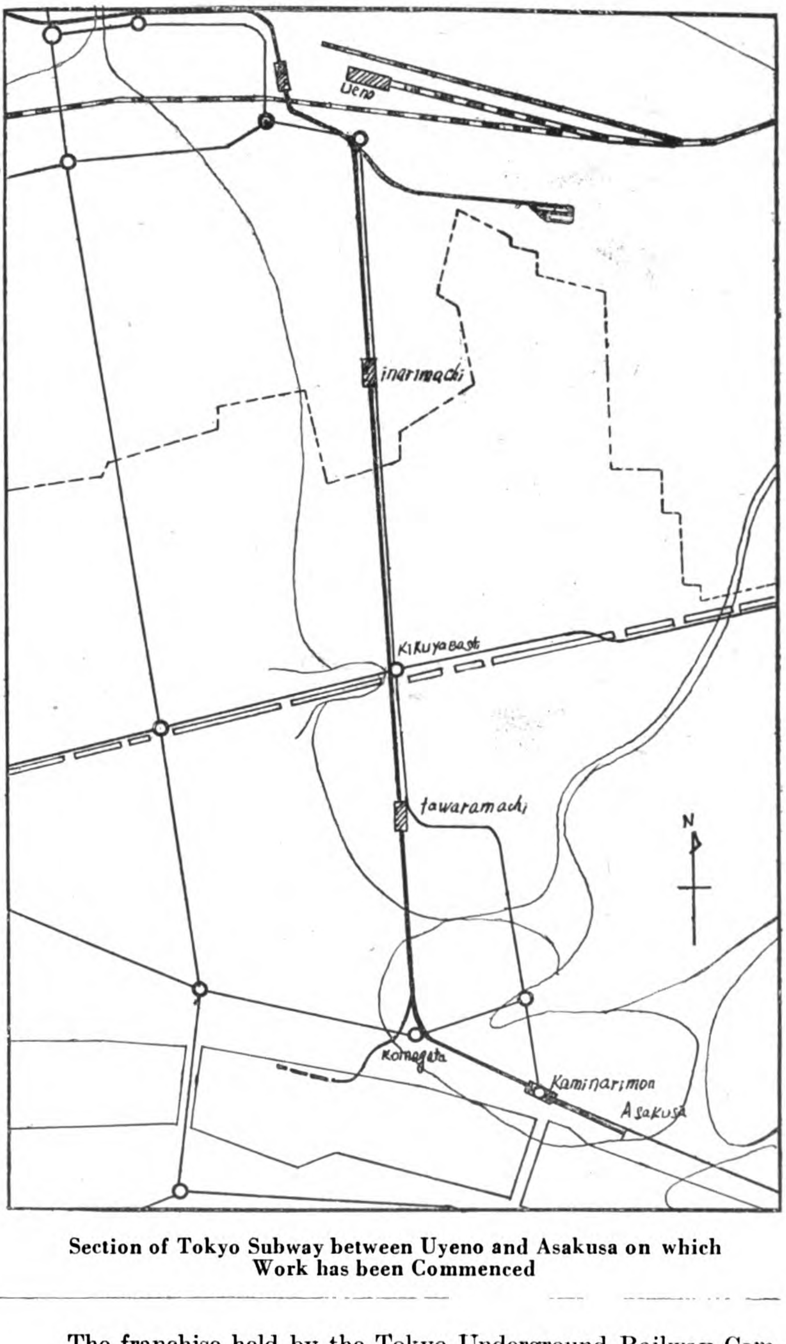
Breaking Ground for Tokyo's New Subway

Okura Engineering Company Starts Work on First Section of the Tokyo Underground Railway between Uyeno and Asakusa Park

THE first step in the construction of an adequate underground transportation system for the rapidly growing city of Tokyo was taken on May 1, when the Okura Engineering Company, Ltd., started work on the first section of the line held under charter from the city government by the Tokyo Underground Railway Company, Ltd. This company is one of four private concerns which obtained franchises during the boom days of the war to construct and operate subway lines in the city of Tokyo. The other three, failing to obtain the necessary capital to commence work within the time limit specified in their charters, automatically forfeited their rights and it began to look as though the franchise of the Tokyo Underground Railway Company would suffer the same fate. The continued depression in the home money market prohibited a further call on the shareholders and destroyed any possibility of issuing debentures. The future of the company was very gloomy, when in December last, the Okura interests agreed to furnish the capital necessary to construct the first section and save the franchise from lapsing by starting work before the expiry of the time limit. The section selected for immediate construction is the one between Uyeno station extending eastwards for one and a half miles to the Azuma Bridge and terminating near the entrance to Asakusa Park, the playground of Tokyo's millions. The estimated cost of this initial section, (Y.6,000,000), is being advanced by the Okura Engineering Company and as construction proceeds, the subway company will pay for completed work in promissory notes bearing interest at the rate of 9 per cent.



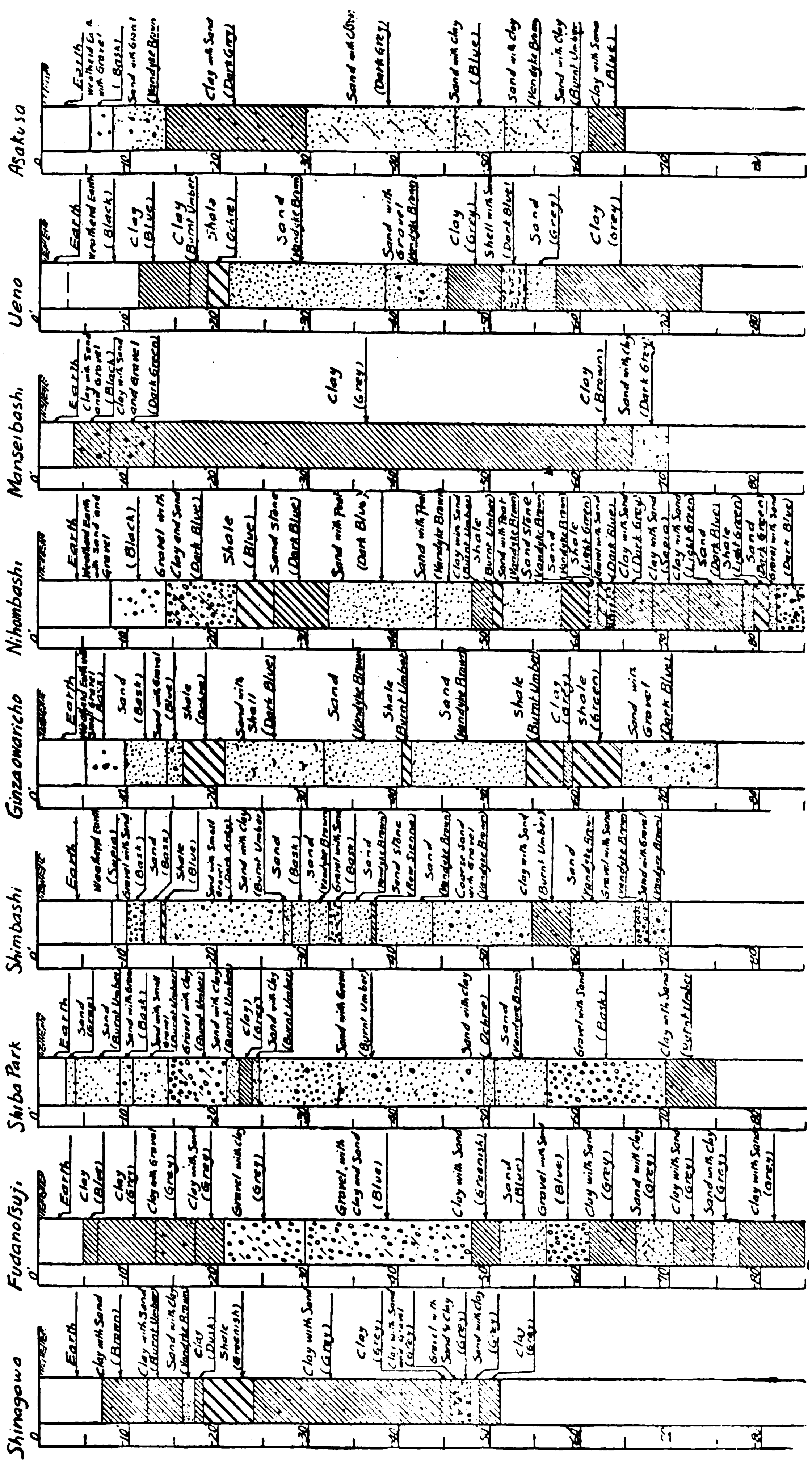
General Subway System of Tokyo: Showing Line of Tokyo Subway Co., Ltd.



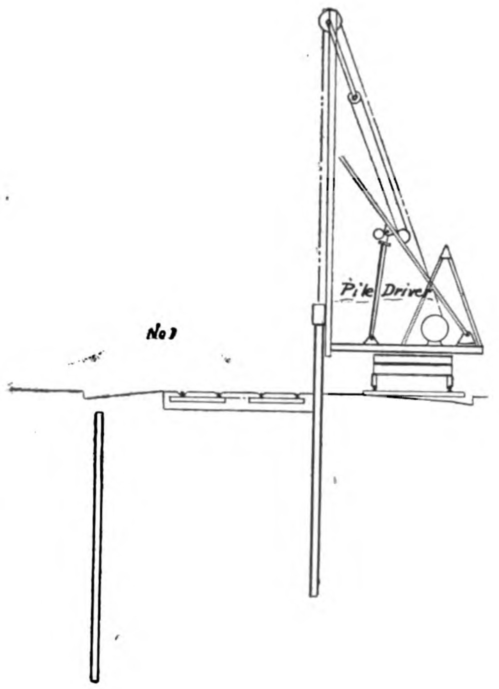
Section of Tokyo Subway between Uyeno and Asakusa on which Work has been Commenced

The franchise held by the Tokyo Underground Railway Company covers a line from Fudanotsuji to Asakusa passing through the very heart of the city, serving its most important business and shopping districts as well as its most popular parks and amusement centre. Undoubtedly, it will become the most profitable of all the transportation lines projected for the capital and for this reason the city authorities were anxious to include it in the general

RESULT OF BORINGS ALONG THE ROUTE OF THE TOKYO UNDERGROUND RAILWAY



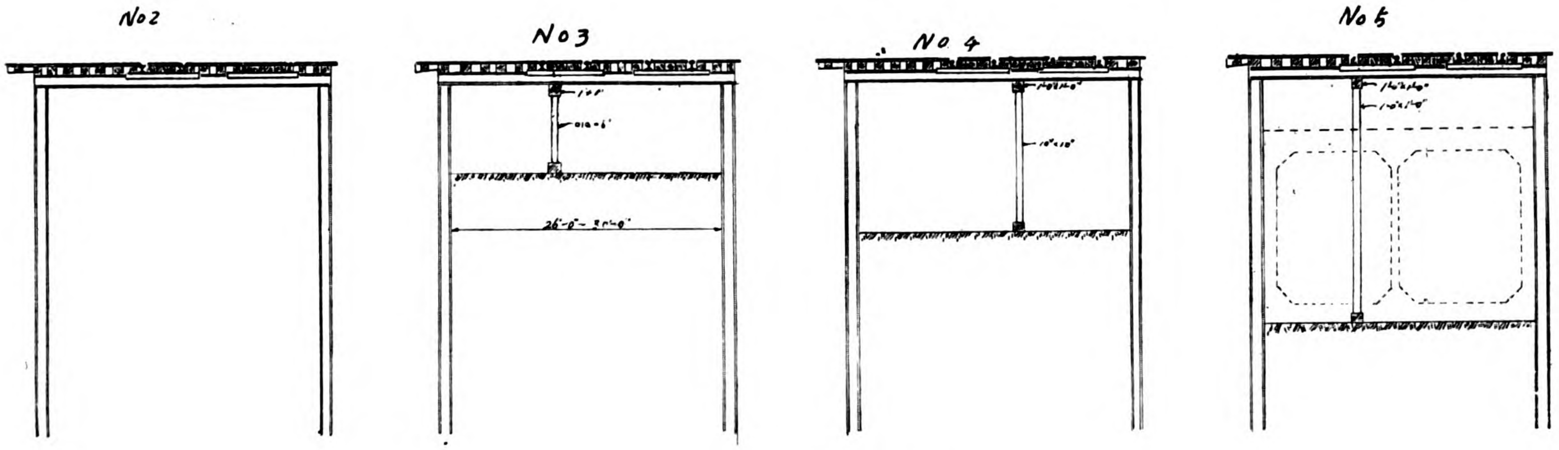
Nature of Soil along the Route of the Tokyo Subway Company's Line Between Shinagawa and Asakusa from Borings

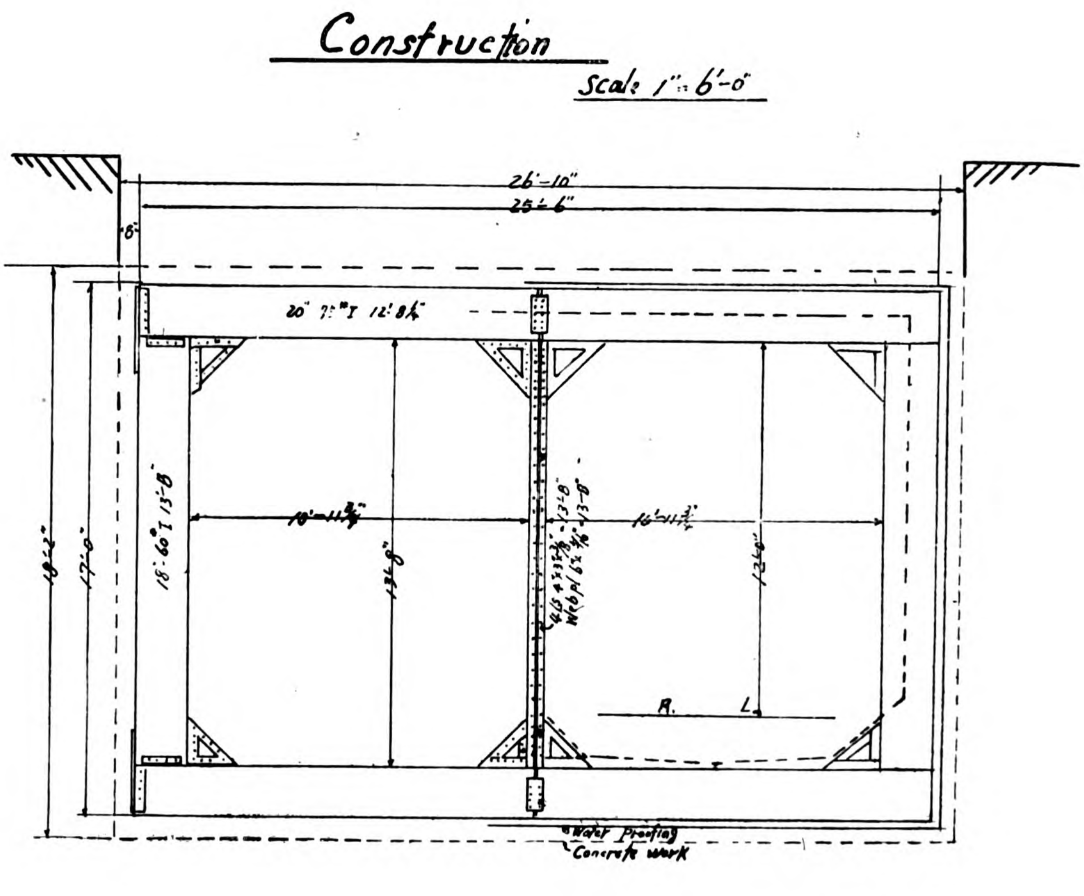


municipal rapid transit scheme. It is anticipated however, that as soon as the line is completed, negotiations will be started by the city government to purchase and operate it as part of the general municipal system.

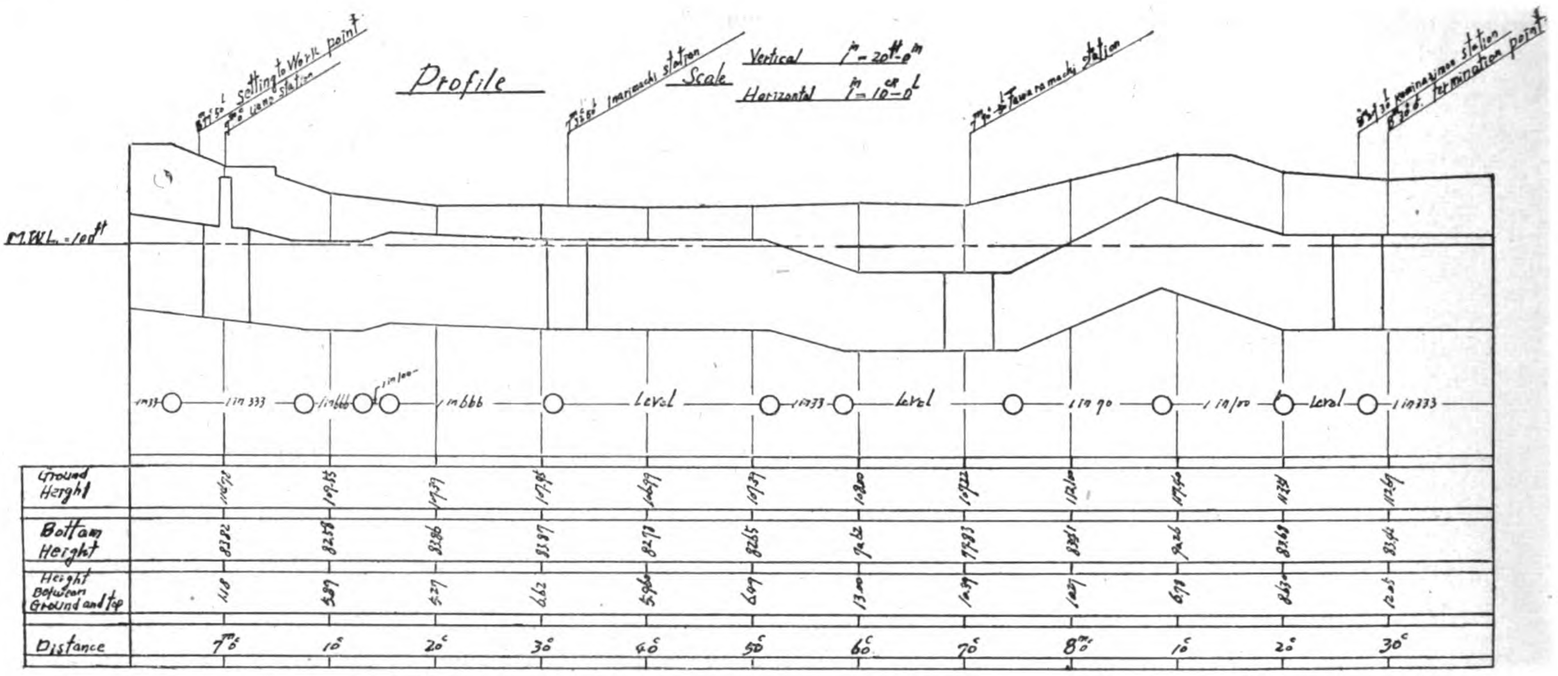
The section between Uyeno and Azumabashi will run underneath the streets on which surface cars are now operating, to Kikuyabashi, Tawara-bashi, Komagata and along the Sumida River to the Azumabashi near Asakusa Park. With the exception of that part of the line along the Sumida River this section will be constructed on a hard sand strata which will carry a load of two tons per square foot. Water is reached at a depth of five feet throughout the section, so that along the Sumida River it will be necessary to build a water-tight retaining wall covering a total of 15,000 square *tsubo*. The excavation is to be carried to an average depth of 29-ft. below the street level, with a tunnel height of 19-ft. and top filling of 10-ft. Exclusive of the stations, the tunnel will be of the box-type, double track system, 27-ft. wide and built throughout of reinforced concrete.

The method of construction, following the general lines employed in building the Berlin subways, provides for uninterrupted surface traffic during construction. " H " beams, 12-in. by 5-in. will be driven on both sides of the line, spaced 33-ft. apart and rails laid across these to support the refill and carry the street and surface traffic. The streets are to be maintained as free as possible from obstructions and incumbrances during construction to facilitate which, a railway track will be laid along the surface over which the dirt cars will be hauled by gasoline locomotives and discharged





Plans Showing Method of Constructing the first section, (Uyeno-Asakusa), of the Tokyo Subway Company's Line, now being carried out by the Okura Engineering & Contracting Company, also section of Completed Subway



Profile of Uyeno-Asakusa Subway Section

into barges at the river for dumping into the reclamation works along the foreshore of Tokyo Bay. At least 30,000 cubic *tsubo* of earth will be excavated, 6,000 cubic *tsubo* of concrete laid and 6,000 tons of steel required for the beams, pillars, rails and station supports.

Only Private Subway Franchise

The section under construction by the Okura Engineering Company will form a part of the only private line to be operated in Tokyo and because of its strategic key position in the general rapid transit scheme, it exerts a powerful influence on the program of the municipality. The city authorities have made several offers to take over the franchise and although these were declined, there is a close understanding and community of interests binding the two enterprises. The Tokyo Underground Railway Company was organized in August 1920 to carry out a franchise for constructing and operating a subway line from Shinagawa on the south to Minami-Senju on the north, passing through Shimbashi, Sudacho, Uyeno and Asakusa, a total distance of 9 miles 40 chains. An understanding was subsequently arrived at in which the terminal sections between Shinagawa and Fudanotsuji, and Asakusa-Minami Senju were surrendered to the city to be incorporated in the greater municipal rapid transit scheme.

Soil Conditions

One of the first steps on the part of the company after its organization was to investigate the soil conditions of Tokyo along the projected route of the subway. The result obtained from nearly 200 borings, varying in depth from 50 to 100-ft. showed that the sub-soil of Tokyo was fully strong enough to support the weight of such an undertaking. Borings along the route from Shinagawa to Mita showed that for 70 to 80-ft. below the surface the soil is a hard strata of mixed clay and sand seams having a high loading capacity. From Mita to Shimbashi the soil consists of sand, pebbles, mixed clay and sand seams of sufficient rigidity to bear the weight of subway construction. From Shimbashi to Uyeno, the soil is very good, for 40 to 50-ft. below the surface, being composed in the main of sand seams and further down of pebbles and hard clay mixed with sand, stones and shale. This section is crossed by rivers at Shimbashi, Kyobasi, Nihonbashi and Manseibashi and contrary to the general rule, the soil along their banks is hard. At Shimbashi, Kyobashi and Nihonbasi it is exceptionally hard consisting mostly of hard clay and sand stone, most suitable for subway construction. From Uyeno station to Asakusa Park the soil is largely composed of sand seams somewhat finer than those encountered along the Ginza section, while in part of the section between Kikuabashi to Umamichi, the strata is soft, but not to an extent as to make construction work unduly difficult. This is the only section of the entire line requiring the driving of piles to obtain a proper foundation for the subway.

Generally speaking, almost all the ground along the route from Fudanotsuji to Asakusa (except the five or six feet of top soil) consists of sand and gravel, compact and well bound together having ample sustaining power. This stratum contains sandwich layers of compact clay varying in depth from one to six feet at depths of ten to twenty feet, while at forty to fifty feet deep, coarse gravel or hard sandy clay stratum is reached. There are local areas along the route however, where the stratum consists of hard, sandy clay to a depth of 100-ft. the limit of the test borings. The general clayish composition of the sub-soil is such that little surface water is expected to flow into the excavation and such as does seep through can be readily handled by a small pumping plant. The results of the surveys carried out by the company's engineers, show that almost all sub-soil encountered is hardpan of compact sandy clay or compact sand and gravel, both having great sustaining power and little water, easy of excavation by pick and shovel. The rivers encountered along the route can be tunnelled under very easily by means of coffer-dams, the nature of the soil being such that pneumatic shields are not necessary. In fact, the only places in Tokyo where such construction methods will be essential, are the sections in the municipal scheme that carry the lines under the Sumida River to Honjo and Fukagawa wards.

Tunnel Dimensions

The main section of the line from Shimbashi to Uyeno, traversing the business and shopping district of the city, will run under the Ginza, with stations at Shimbashi, Owaricho, Minima-Denmacho-Nihonbashi, Honkokucho, Kandayekai-Maye, Sudacho, Hirokoji and Uyeno. The average roof of the subway tunnel in streets of 36 meters or more in width is to be 4-ft. below the street level, while in narrower streets the average depth as determined by the reconstruction authorities, is to be 11-ft. When passing under rivers the roof of the tunnel will be 3-ft. below the river beds. The space between the roof of the subway and the ground on the widest thoroughfares will be filled in with earth supporting the tramway rails only. In streets less than 33 meters wide where the distance between the roof of the subway and the ground level is to be 11-ft. provision is made for carrying the sewers, gas mains and part of the conduit for high tension electric wires. This arrangement is shown in the standard street plans appearing in the article on street construction in this number. It will be seen from this that the construction of the 27-ft. wide subway along the principal thoroughfare from Ginza to Uyeno (more than 90-ft. in width) will only affect about half the street obviating the heavy costs incidental

to constructing a subway without interfering with the many underground works which complicate similar construction in western cities.

The maximum gradient of the whole line is estimated at four percent. and the shortest radius of curve at 300-ft. Most of the radio of the curves will however be 500 to 1,000-ft. The original plans of the company called for a double track box-type reinforced concrete tunnel, 22-ft. in width and 12-ft. in height in accordance with the regulations drawn up by the Department of Railways. Certain modifications have since been made in these arbitrary dimensions and in the Uyeno-Akasuka section the tunnel height will be 19-ft. and 27-ft. wide. The gauge for the entire underground system will be standard. The cars are to be all steel of the bogie type, measuring 8-ft. in width and 35 to 50-ft. in length. A speed of 35 miles per hour will be maintained with stops of 30 seconds at ordinary stations and one minute at the principal stations, the trains to be equipped to develop high speed at starting. The average speed, inclusive of stops is estimated at about 20 miles, enabing a train to make the 8 mile run between Shinagawa and Asakusa Park (with some 18 stops) in 25 minutes. All the cars will be equipped with automatic brakes and the entire line with an automatic block signal system.

Cost of Construction

The cost of construction inclusive of all equipment, passenger stations, sub-stations, automatic safety devices etc., is estimated at Y.4,000,000 a mile of double track tunnel and line. In comparison with the costs of similar work in Europe and America, this is considered as a maximum figure which will be considerably scaled down in actual construction. The original estimated cost of the entire line before the two terminal sections were surrendered to the city is as follows:

Akasuka along the Ginza and Sudacho, paralleling the proposed subway route. This assumption is based on the fact that the carrying capacity of the municipal tramway line is incapable of further expansion and therefore with its better facilities for handling the traffic, the subway will not only relieve the congestion but attract the surplus and all the long haul traffic.

The estimated number of passengers and receipts from fares for the first ten years is as follows:

Year	Rate of increase	Number of Passengers	Average fare	Receipts from fares
	%		Yen	Yen
1926		56,938,397	.120	6,832,608
1927	18	67,187,308	.120	8,062,477
1928	20	80,624,770	.120	9,674,972
1929	18	95,137,229	.120	11,416,467
1930	15	109,407,813	.120	13,128,938
1931	10	120,348,594	.120	14,441,831
1932	10	132,383,453	.120	15,886,014
1933	7	141,650,295	.120	16,998,035
1934	7	151,565,815	.120	18,187,898
1935	7	162,175,422	.120	19,461,051

The rather low rate of increase in traffic is based on the figures of the Tokyo Electric Tramways of 1921, which show an eight per cent. annual increase, but on the other hand the rate of increase for the Toyko high-speed electric suburban lines of the government railways, is from 22 to 40 per cent. annually. On the opening of the subway in Madrid (a city of 652,000 population) the number of passengers carried the second year was 14,627,466. The Tokyo Underground Railway Company's estimate of the number of passengers per mile is nearly ten per cent. less than the Madrid line with its extension of 2.4 miles. In Europe and America the number of passengers carried by the subways is 2½ to 14½ times greater than those carried by the surface lines, so even if the number of passengers carried by the Tokyo subway reaches the lowest proportion in Europe and America, it should realize a revenue amounting to Y. 17,000,000 and pay a dividend of 20 to 30 per cent. per annum. These comparisons are valuable in inviting attention to the rather modest estimates of traffic prepared by the Tokyo subway company for the purpose of interesting capital in the enterprise.

The fares are to be levied according to the distance travelled, with a maximum of twenty sen for long and a minimum of five

Estimated Cost of Construction

(Length, 9 Miles, 40 Chains)

Items	Details	Magnitude or Quantity	Cost per unit	Cost	Total	Remarks
Survey and Supervising					Y. 400,000	
Ground					1,845,000	
	Station ground	200 *tsubo*	Y. 1,000	Y. 200,000		Station entrance and Exit.
	Electric substation ground	300 ,,	400	120,000		
	Car sheed and shop ground	3,200 ,,	200	640,000		
	Compensation for the use of underground	1,700 ,,	450	765,000		
	Miscellaneous compensation			120,000		
Tunnel-excavating					26,334,840	
	Portions for building stations	5,250 *feet*	790	4,147,500		
	Portions for laying lines	44,910 ,,	474	21,287,340		
	For disposal of buried objects			900,000		
Line-constructing					1,120,000	
	Rails	20 *miles*	40,000	800,000		
	Switches and frogs	40 *sets*	1,000	40,000		
	Signal devices			280,000		
Stations		21	70,000	1,470,000	1,470,000	
Rolling stocks					3,125,000	
	Motor cars	50 *cars*	45,000	2,250,000		
	Trailers	35 ,,	25,000	875,000		
Electric lines					1,289,500	
	Third rails	20 *miles*	33,500	670,000		
	Lighting			72,000		
	Feeders	9.5 *miles*	25,000	235,500		
	Transmission	10 ,,	30,000	300,000		
	Communication			10,000		
Electric sub-stations					350,000	
Apparatus					200,000	
Shop appliances					220,000	
Buildings					290,000	
	Electric sub-stations	240 *tsubo*	300	72,000		
	Car sheds	600 ,,	280	168,000		
	Shop buildings	200 ,,	250	50,000		
General expenses					500,000	
Total					37,144,340	
	Per mile				3,909,931	

(2) *Tsubo* is equal to about 36 square feet.

The above estimate is based on the par value of the yen and prices and wages prevailing in 1921, and therefore subject to the fluctuation of exchange and the prices of materials.

Revenues

In estimating the subway revenues it as assumed that it will attract one third of the number of passengers riding on the main line of the Tokyo Municipal Tramway running from Shimbashi to

sen for short hauls, or an average of twelve sen per passenger. An additional source of revenue to be derived from the sale of advertising space on the station platforms and cars, is placed at the conservative figure of Y. 120,000. It is also intended to operate a night freight service and as the line traverses the commercial and industrial center of the city, considerable revenue is expected from this source. The company, however, has not included this anticipated revenue in its estimate of receipts.

Expenditures

The estimated expenditures over a period of ten years is calculated as follows:

The estimates have been carried down to the most minute detail and based on actual wages and salaries. In estimating charges for the purchase of electric power, the Municipal Electric Bureau puts the cuurrent used for one car-mile at 1.21 to 1.28 k.w.h. and the Government Railway Department puts it at 2.7 k.w.h. for the interurban electric service between Tokyo and Yokohama. The subway company puts it a 4 k.w.h. with the expenses as follows:

Details of Motive Power Expenses

Use for	Quantity of current sent from	Quantity of current received by sub-plants	Cost of current received	
	K.W.H.	*K.W.H.*	Yen	
Electric car ...	13,910,880	15,120,522	453,615.660	Car-operated mile, 3,477,720 per-car mile 4.0 K.W.H.
Lighting and motive power	824,506	916,118	27,483.540	Computed number of 16-C.P. light, 4,000
Electric Signaling ...	346,750	388,360	11,650.800	For 72 signal devices
Total	15,082,136	16,425,000	492,750.000	Quantity of current received per day at sub-plants, 4,500 K.W.H. (e. g. 3 sen per K.W.H.)

The estimated revenue and expenditure for the first ten years following the opening of the line to traffic is as follows:

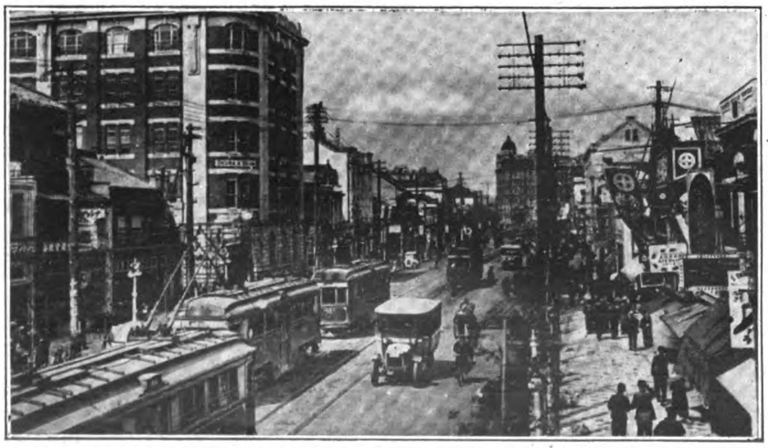
Year	Revenue: Passenger Fares	Revenue: From advertisements on station premises and the like sources	Revenue: Total	Expenditure	Net Profit	Percentage on Capital
	Yen	Yen	Yen	Yen	Yen	%
1926 ...	6,832,608	120,000	6,952,608	2,147,932	4,804,676	12.0
1927 ...	8,062,477	120,000	8,182,477	2,394,486	5,787,991	14.5
1928 ...	9,674,972	120,000	9,794,972	2,754,409	7,040,653	17.6
1929 ...	11,416,467	120,000	11,536,467	3,184,054	8,352,413	20.9
1930 ...	13,128,938	120,000	13,248,938	4,174,066	9,074,872	22.7
1931 ...	14,441,831	120,000	14,561,831	4,466,160	10,095,671	25.2
1932 ...	15,886,014	120,000	16,006,014	4,972,715	11,033,299	27.6
1933 ...	16,998,035	120,000	17,118,035	5,335,213	11,782,822	29.5
1934 ...	18,187,898	120,000	18,307,898	5,766,688	12,541,215	31.4
1935 ...	19,461,051	120,000	19,581,051	6,225,445	13,355,606	33.4

The future prospects of the company as set forth in the above estimate shows that at the end of five years the profit will be over 20 per cent. Comparison with the estimates for the construction of the Municipal Subway system and the normal rate of increase in the number of passengers that must be handled with the growth and expansion of the city, indicates that the figures given in this survey are most conservative. If we estimate that by the end of 1930, the total number of passengers that the Tokyo transportation system must be prepared to handle will exceed 700,000,000 and 900,000,000 by 1935, it would seem that the subway company is extremely modest in estimating that the key line of the new rapid transit system will carry 57,000,000 people the first year of operation.

Estimated Expenditure for Ten Years Following the Opening of the Lines to Traffic

Year	Office Expenses: Percentage of increase	Office Expenses: Amount	Operating Cost: Percentage of increase	Operating Cost: Amount	Motive Power: Percentage of increase	Motive Power: Amount	Electric Sub-station Expenses: Percentage of increase	Electric Sub-station Expenses: Amount	Vehicles: Percentage of increase	Vehicles: Amount	Maintenance of way: Percentage of increase	Maintenance of way: Amount	Electric Lines: Percentage of increase	Electric Lines: Amount	Building Repairing: Percentage of increase	Building Repairing: Amount	Taxes: Percentage of increase	Taxes: Amount	Miscellaneous: Percentage of increase	Miscellaneous: Amount	Total
		Yen		Yen		Yen		Yen		Yen		Yen		Yen		Yen		Yen		Yen	Yen
1926 (first year)		193,000		818,724		492,750		18,100		77,250		41,800		15,880		15,000		325,428		150,000	2,147,932
1927	5	202,650	10	900,596	08	532,170	06	19,186	10	84,975	10	45,980	10	17,468	10	16,500	27	414,461	7	160,500	2,394,486
1928	5	212,783	12	1,008,668	10	585,387	06	20,337	12	95,172	11	51,038	10	19,215	10	18,150	28	571,924	7	171,735	2,754,409
1929	5	223,422	10	1,109,535	08	632,218	06	21,557	13	107,544	12	57,163	10	21,137	10	19,965	41	807,757	7	183,756	3,184,054
1930	5	234,593	07	1,187,202	06	670,151	06	22,850	15	123,676	12	64,023	10	23,251	10	21,962	102	1,631,577	6	194,781	4,174,066
1931	5	246,322	06	1,258,434	05	703,659	07	24,450	17	144,701	12	71,706	12	26,041	12	24,597	08	1,759,782	6	206,468	4,466,160
1932	5	258,638	06	1,333,940	05	738,842	07	26,162	19	172,194	13	81,028	12	29,166	12	27,549	19	2,086,340	6	218,856	4,972,715
1933	5	271,570	05	1,400,637	04	768,396	07	27,993	20	206,633	13	91,562	12	32,666	12	30,855	09	2,275,102	5	299,799	5,335,213
1934	5	285,149	05	1,470,669	04	799,132	07	29,953	21	250,026	15	105,296	12	36,586	13	34,866	10	2,513,717	5	241,289	5,766,683
1935	5	299,406	05	1,544,202	04	831,097	07	32,050	22	305,032	15	121,090	13	41,342	13	39,399	10	2,758,474	5	253,353	6,225,445

Note : The figures representing " Percentage of increase " indicate the rate of increase of expenditure of each year over the preceeding one.



A Section of Ginza Street Looking North towards Nihonbashi: The Head Office Building of Okura & Company on the Left. The New Subway will run under this main thoroughfare

A part of "Pleasure Land" at Asakusa Park, Tokyo's Popular Amusement Resort, Served by the New Subway

Tokyo's Municipal Subway Project

THE city of Tokyo is to have a double-track, standard guage subway system of five lines, four to be built by the Municipality and one private line by the Tokyo City Subway Company, Ltd. The four lines in the municipal scheme as finally approved by the City Assembly and the Railway Ministry, aggregating 41.56 miles in length, are estimated to cost Y.4,500,000 per mile, or a total of Y.187,020,000.

The funds for this purpose will be raised in a series of external loans ranging from Y.12,000,000 to Y.22,000,000, spread over a period of thirteen years. Construction progress is estimated at from 2½ to 5 miles a year, and the loan installments will be issued in such amounts as will guarantee continuous progress until completion. It will be noted in the article on the Reconstruction Budget, published in this number, that the Imperial Diet has restricted the external borrowing powers of the city of Tokyo for the five-year reconstruction period ending 1929 to Y.100,000,000, and furthermore, the city will operate under a deficit until the expiration of that period, after which it will pile up a surplus large enough to permit it to meet all ordinary expenses.

Under the present system of taxation it is difficult to dissociate the central and prefectural governments from any loan which might be issued for the benefit of Tokyo, as in these matters the jurisdiction of the three authorities so overlap as to make them all more or less responsible for any debt incurred by the city, although such guarantee be not expressly stipulated in the bond. As a matter of fact, almost ninety per cent. of the municipal revenues from taxation are derived from surtaxes imposed on national and prefectural taxes laid on the city.

In connection with the construction and financing of the subway system it is expected that the rate of progress will bring enough mileage under operation by the end of the third year to assure a certain amount of revenue from fares collected. The full earning capacity of the system will not be reached until its completion, and in the meantime the loss in revenues will be met from the proceeds of temporary loans secured on the surplus profits of the lines after the eleventh year. In fact, full and detailed plans for financing, based on a most thorough survey of present and future traffic conditions and the municipal resources, have been carefully drawn up by experts and submitted to the searching scrutiny of the Ministry of Finance and the Municipal Assembly.

The five subway lines which were approved by the Municipal Assembly on December 24, 1924, and by the Railway Ministry in May, are as follows :

1st Line: (Reserved for the Tokyo Underground Railway Co.)

2nd Line: Commencing at Meguro, running to Osaki, Tengenji Roppongi, Iigura, Sakuradamon, Kajibashi, Nihonbashiku, Honkoku Cho, Asakusa Bashi, and Morita Cho to Minami Senju : 10.5 miles.

3rd Line: Commencing at Shibuya, running to Akasaka Mitsuke, Toranomon, Kyobashi-ku, Hiyoshi Cho, Sukiya Bashi, Eiraku Cho, Shohei Bashi, Hongo San Chome, Hongo-ku, Sabana Machi, to Sugamo : 9.9 miles.

4th Line: Commencing at Yodobashi, running to Hanzomon, Sakuradamon, Sukiya Bashi, Tsukiji, Nihonbashiku, Hama Cho, Yokoyama Cho, Mikura Bashi, Uyeno Hirokoji, Hongo-ku, Masago Cho, Otsuka, to Nakano Machi : 12.5 miles.

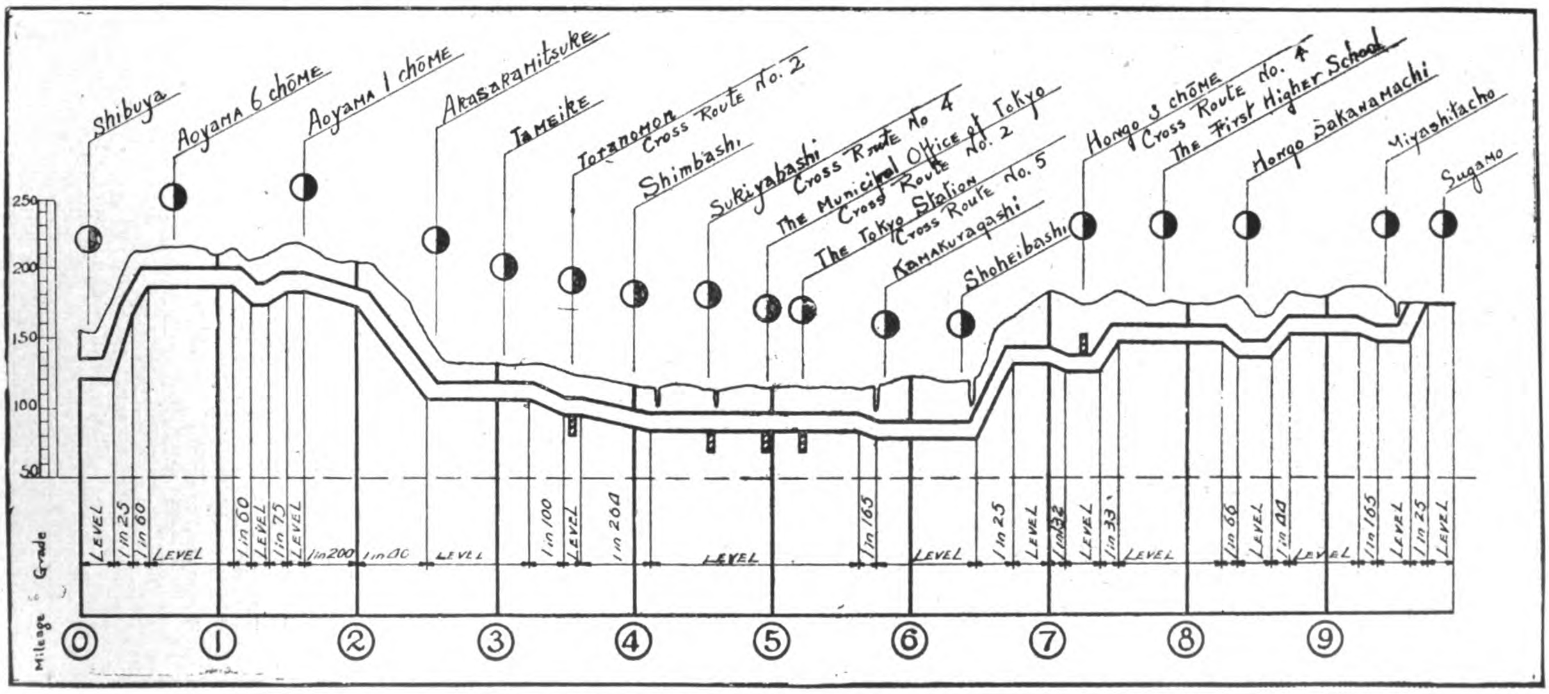
5th Line: Commencing at Nishi Sugamo Machi, running to Ushigome-ku, Kikui Cho, Iida Bashi, Hitotsu Totsuka Bashi, Eiraku Cho, Nakabashi Hirokoji, Eitai Bashi, to Fukagawa and Nishi Hirai Bashi : 8.66 miles.

Total 41.56 miles.

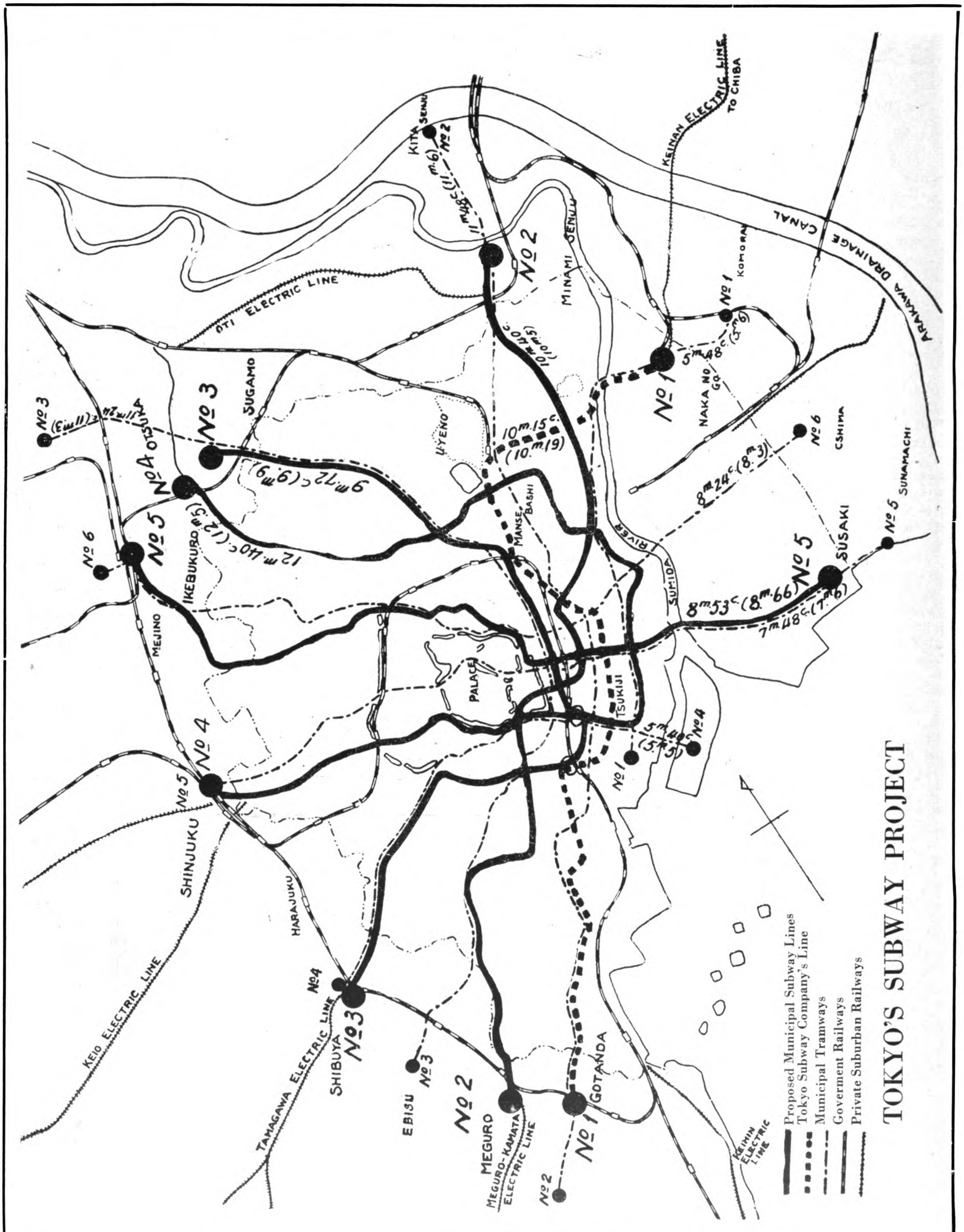
Estimated Costs of Construction :

Mileage : 41 miles 45 chains.

Items	Units	Unit Cost Yen	Total Cost Yen
Design and Inspection ...	41.56 miles	80,000 p.m.	3,324,800
Land	35,315 tsubo	200 per tsubo	7,063,800
Excavating	8,448 feet	40 per foot	337,920
Bridges	13,860 feet	375 per foot	5,197,500
Tunnels	197,142 feet	625 per foot	123,248,598
Track	91.4 miles	57,000 per mile	5,209,800
Stations	67 places	101,791 each	6,820,100
Cars	500	40,000 each	20,000,000
Various Buildings			83,100
Communication Lines ...	41.56 miles	1,000 per mile	41,560
Power Lines	41.56 miles	120,000 per mile	4,987,200
Transformer Stations ...	19,000 k.w.	120 per k.w.	2,280,000
Car Buildings...	41.56 miles	10,000 per mile	415,600
Equipment for construction	... ...	... ...	1,245,500
Right of Way Boundary Marks	... ...	... ...	20,780
Office Expenses	... ...	... ...	4,156,522
Preliminary Expenses ...	... ...	... ...	2,588,000
Total	... ...	... ...	Y.186,820,780
Average Cost per Mile	... ...	... ...	4,500,000



Profile of Subway Route No. 3; From Shibuya to Sugamo


TOKYO'S SUBWAY PROJECT
Proposed Municipal Subway Lines
Tokyo Subway Company's Line
Municipal Tramways
Goverment Railways
Private Suburban Railways
KEINAN ELECTRIC LINE TO CHIBA
ARAKAWA DRAINAGE CANAL
OTI ELECTRIC LINE
KEIO ELECTRIC LINE
TAMAGAWA ELECTRIC LINE
MEGURO-KAMATA ELECTRIC LINE
KEIHIN ELECTRIC LINE
SUMIDA RIVER
KITA SENJU
MINAMI SENJU
KOMORA
NAKA NO GO
OSHIMA
SUNAMACHI
SUSAKI
TSUKIJI
PALACE
MANSE BASHI
UYENO
SUGAMO
OTSUKA
IKEBUKURO
MEJINO
SHINJUKU
HARAJUKU
SHIBUYA
EBISU
MEGURO
GOTANDA

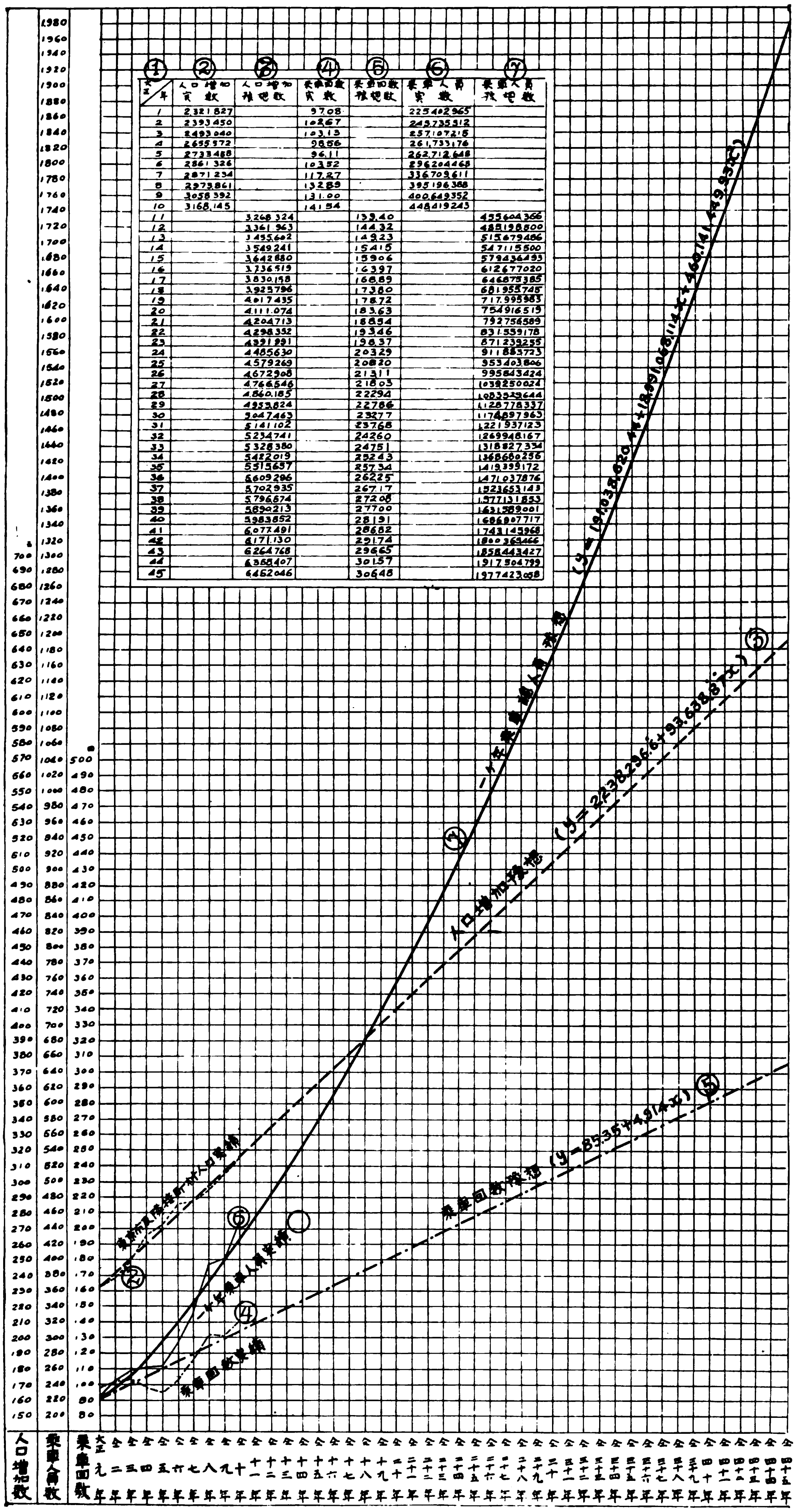


Diagram Showing Line of Tokyo's Traffic Increase and Frequency of Rides per Passenger.

A, Increase of Population. 2, No. of Passengers Using Trams. 3, Frequency of Rides. 1, Years Taisho Era (1912-1956) : 2, Actual Increase of Population ; 3, Estimated Increase of Population ; 4, Actual Number of Car Rides ; 5, Estimated No. of Car Rides ; 6, Actual No. of Passengers ; 7, Estimated No. of Passengers.

Distance between Stations :

Number of Line	Length, miles	Number of Stations	Average Distance between Stations, Miles
2	10.5	8	0.80
3	9.9	17	0.65
4	12.5	18	0.73
5	8.66	15	0.61
	—	—	—
Total	41.56 miles	67	0.653 miles, average.

Speed of Trains and Headway :

Length of Stop at Stations, Seconds.	Miles per hour	Time between trains, seconds. 3 car trains	4 car trains	5 car trains	8 car trains	10 car trains
15	15.8	78	80	81	85	87
30	17.6	93	95	96	100	102
45	15.8	108	110	111	115	117
60	14.5	123	125	126	130	132

Taking the number of passenger per car, 125, as n, and the time between cars as P, the transportation efficiency of the system per hour is expressed by $\frac{450,000\ n.}{P}$

Length of Stop at Stations. Seconds.	Passengers carried, in thousands. 3 car trains	4 car trains	5 car trains	8 car trains	10 car trains
15	17.3	22.5	27.8	41.4	51.7
30	14.5	20.0	23.4	36.0	44.1
45	12.5	16.4	20.3	31.3	38.5
60	11.0	14.4	17.9	27.7	34.1

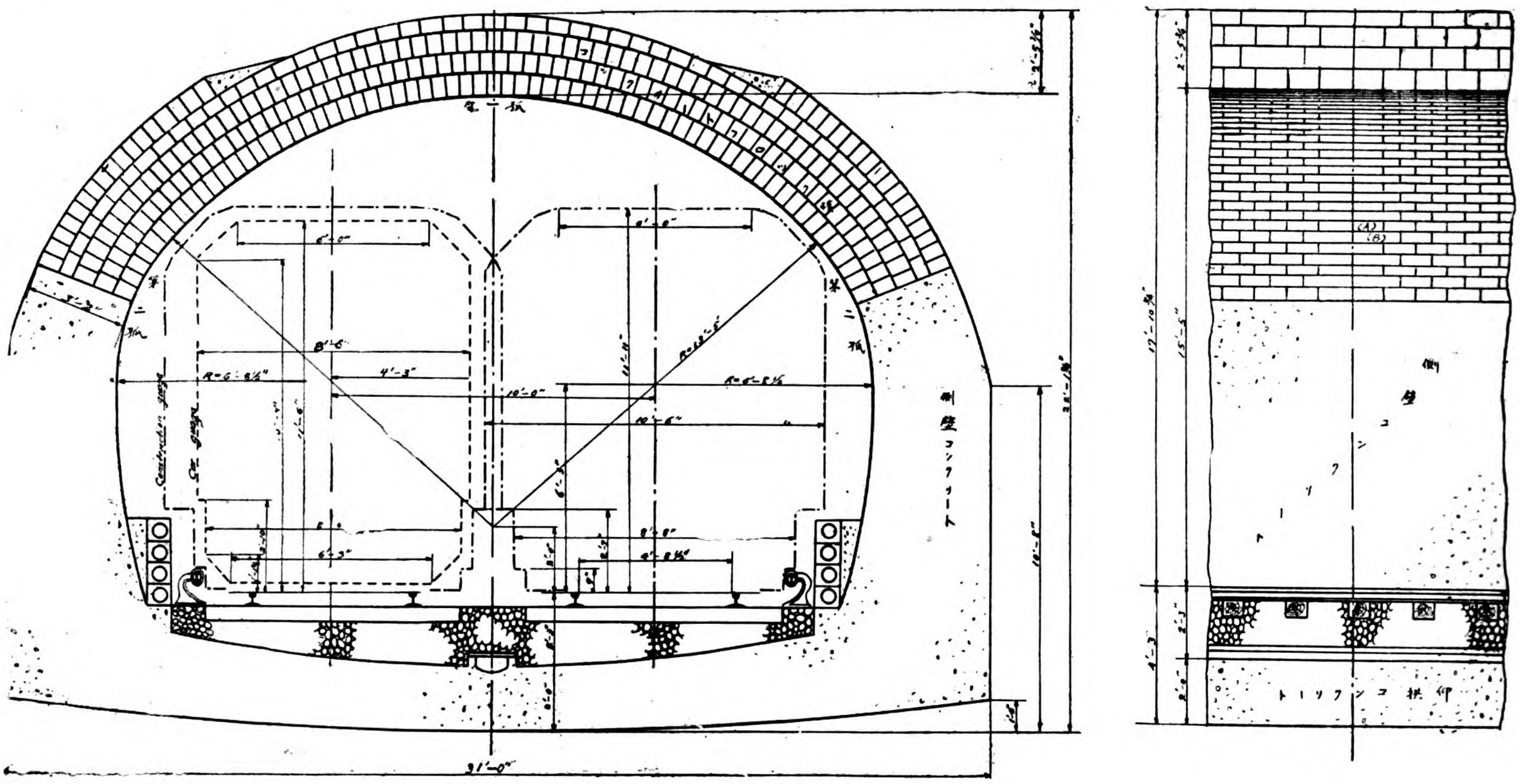
It is estimated that the 49.9 miles of double track on which trains are run for 19.5 hours in every 24 hours at a speed of 16 miles, stopping at stations 45 sec., each car of each train carrying 40 per cent. of capacity, 125 persons, and each passenger riding 4 miles, the number of passengers the system can carry annually will be as follows :

Number of Cars per Train	Time between Trains	Annual Passenger Number.
3	108	735,000,000
4	110	1,149,000,000
5	111	1,196,000,000
8	115	1,847,000,000
10	117	2,252,000,000

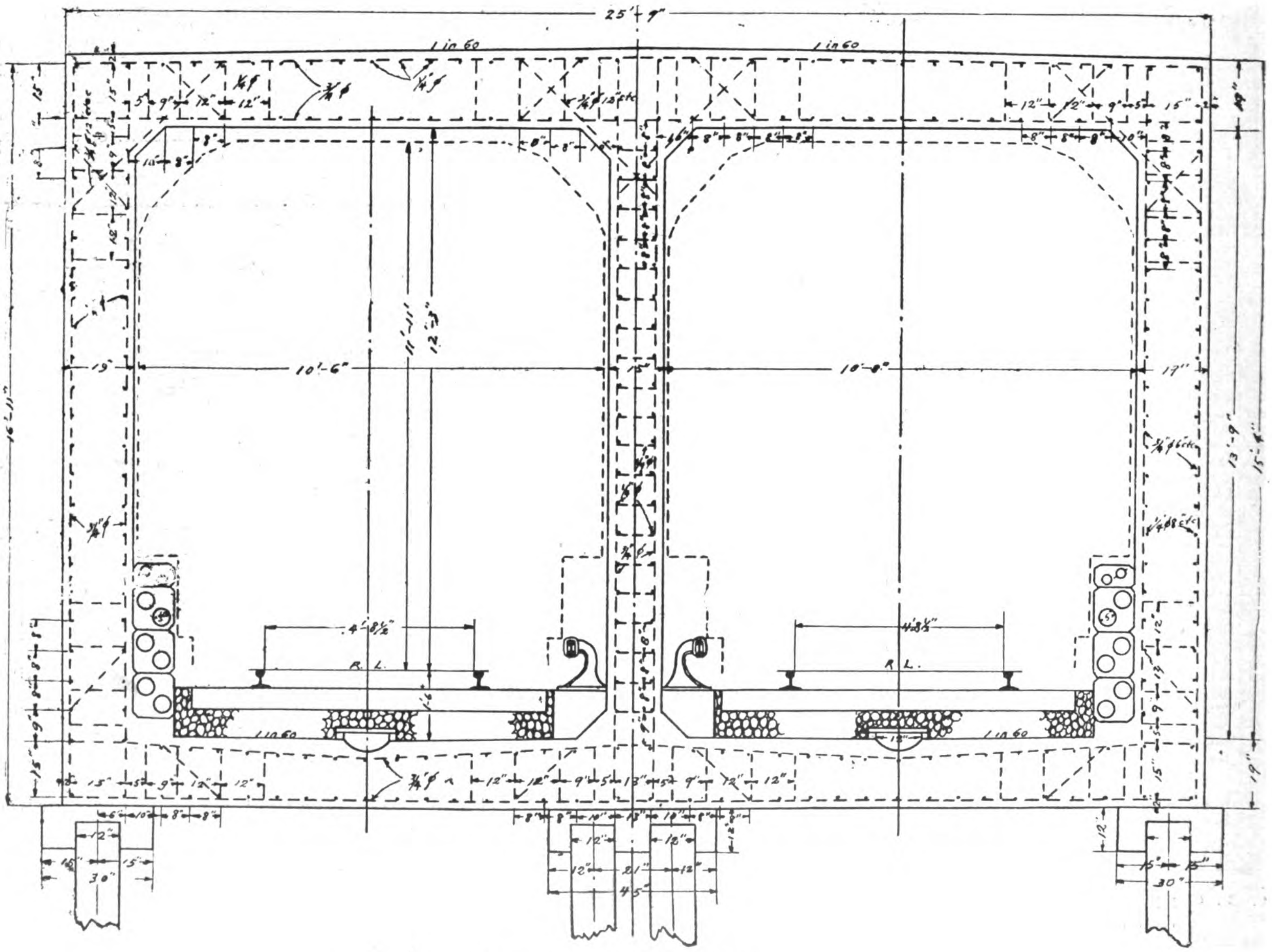
Each train running 45 minutes apart can handle 38,000 passengers per hour at any one station on the line.

Before committing the city to the construction of the subways, the authorities conducted a most thorough and searching investigation into the traffic needs of the metropolitan district for the next twenty years, basing their estimates on the experience of other large cities in Europe and America. These figures have been checked, and only after receiving the approval of the financial and railway experts did the Municipal authorities decide to proceed with the work.

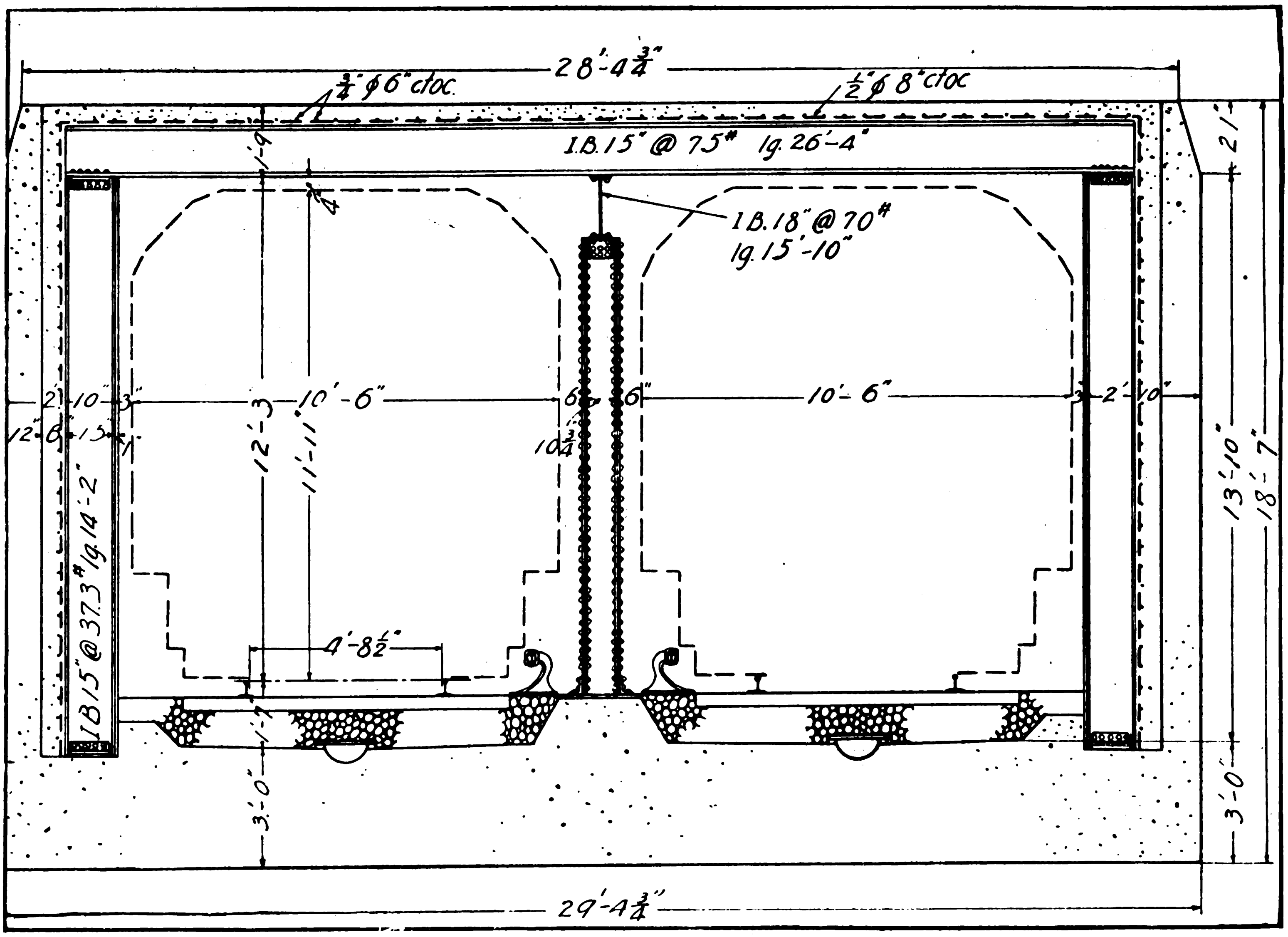
The growing city of Tokyo is now served by 195 miles of surface tramways operated by the municipality. This is exclusive of the high-speed overhead electric railway service encircling the city operated by the Imperial Railway Department (see article on "Electrification of Railways") and the several private and municipal motor-bus lines. In the last fiscal year ending March 31, 1925, the total number of passengers carried by the surface lines was 480,000,000, and it is estimated that this will increase to 530,000,000 during the current year. Owing to the restrictions placed on the extension



Arched Section of New Subway.



Rectangular Section of Subway.



RECTANGULAR SECTION OF SUBWAY.

Table of Materials: Concrete, 24,374 lbs, 174.1 cv. ft; I Beams, 1817 lbs, 3.79 cv. ft; Mild Steel, 158.3 lbs, 0.33 cv. ft.; Conveying of Remaining Earth, 53,762 lbs., 537 624 cv. ft. (2.489 cv. tsubo)

of the surface lines by the street plans of the Reconstruction Bureau, only 372 miles, or about twice the present mileage, can be operated within the city limits. Even with this mileage it will be impossible for the surface lines to adequately handle the rapidly increasing traffic from the fast growing suburban districts whose development is proceeding at a pace out of all proportion to the transportation facilities. This is specially true since the earthquake of 1923, which compelled thousands of homeless people to settle in the outlying districts who now decline to return to the overcrowded city. So great indeed has been the growth of the suburbs that, comparing it with similar conditions in Europe and America, it is estimated that by 1930 the Tokyo surface tramways will be called upon to handle over 700,000,000 passengers a year, increasing to 900,000,000 in 1935 and to more than 1,300,000,000 in 1945.

The traffic limit of the Tokyo surface lines is placed at 600,000,000 annually, so the only solution to the transportation problem lies in the immediate construction of subways to handle the long-haul traffic from the suburbs now pouring into the city through the many private railways serving these sections and transferring at the city limits to the surface and overhead electric lines. The great bulk of this traffic is destined for the business and shopping center of the city, which for all practical purposes may be taken as the Tokyo Central Railway Station. In estimating the number of passengers that would be diverted to the subways, the traffic experts arrive at the following very conservative figures for the No. 3 Subway Line, starting at the Shibuya terminal and ending at the Tokyo Central Station and then taking the other half of the same line from Sugamo into the Central Station. The table gives the number of passengers per mile per day based on the traffic results for the fiscal year 1923. In arriving at the percentage of passengers diverted to the subway, the calculations are based on the returns of the present surface tramway, motor bus and overhead electric services.

NO. 3 SUBWAY LINE—SHIBUYA TO TOKYO CENTRAL STATION

	Section	Passengers	Subway %	Estimated Passengers	Miles Carried	Passengers per mm. per day
	By Surface Tram Lines :					
From	Shibuya Terminal ...	25.940	70	18,158	4.6	83,527
,,	Aoyama 4-chome ...	20,060	65	13,039	4.0	52,156
,,	Kasumi-cho	18,760	50	9,380	3.5	32,380
,,	Sakurada, Hongo-cho, to Tokyo Central Station	12,950	30	3,885	1.3	5,051
	Total	77,710	57.2	44,462	3.9	173,564
	By Motor Bus					
,,	Shibuya	4,500	65	2,925	4.2	12,285
,,	Sakurada, Hongo-cho, to Tokyo Central Station	900	30	270	1.3	351
	Total	5,400	59.2	3,195	3.95	12,636
	By Gov't. Electric Line :					
,,	Shibuya and Harakujo...	3,690	70	2,583	4.6	11,882
,,	Ebisu and Meguro ...	6,560	70	4,592	4.6	21,123
	Grand Total ...	93,360	58.7	54,832	3.99	219,205
	SUGAMO TO TOKYO CENTRAL					
	By Surface Tram Lines :					
,,	Sugamo Line	35,780	65	23,257	4.0	93,028
,,	Otsuka Terminal ...	36,930	65	24,005	4.3	103,222
,,	Kumagome Terminal ...	27,900	65	18,135	4.3	77,981

NO. 3 SUBWAY LINE—SHIBUYA TO TOKYO CENTRAL STATION

Section	Passengers	Subway %	Estimated Passengers	Miles Carried	Passengers per mm. per day
By Surface Tram Lines (Continued).					
From					
„ Sudacho to Tokyo Cent.	24,570	30	7,401	1.3	9,621
„ Increase en route ...	15,800	50	7,900	3.5	27,650
Total	141,080	57.2	80,698	3,86	311,502
By Motor Bus :					
„ Sugamo Line	1,800	65	1,170	4.0	4,680
„ Gokokuji Line	720	30	216	1.5	324
„ Sudacho to Tokyo Cent.	504	30	151	1.3	197
Total	3,024	50.8	1,537	3.4	5,201
By Gov't. Electric Line :					
„ Otsuka, Sugamo and Kumagome	440	65	286	4.3	1,230
„ Meijiro and Ikebukuro ...	3,080	65	2,002	4.3	8,609
Total	3,520	57.3	84,523	3.86	326,542

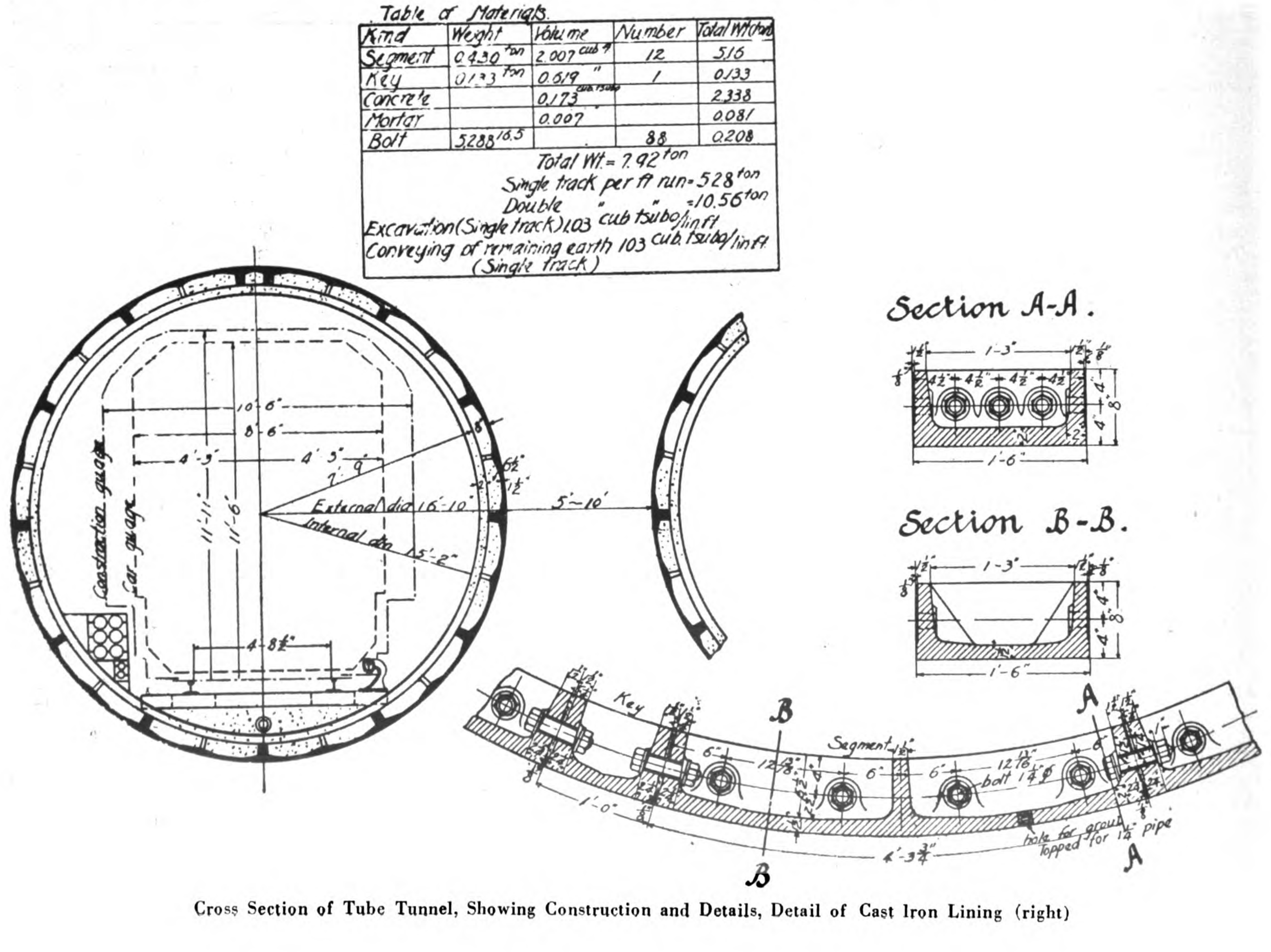
Aoyama Section ...	219,205—3.99	54,938 passengers.
Sugamo „ ...	326,542—3.86	84,596 „
	545,747—7.86	69,521 passengers

It will be seen from this extremely conservative estimate based on the traffic returns of the surface, overhead electric and motor bus services for 1923, that No. 3 Subway Line may fairly expect to get 69,521 passengers per day, or, say, 25,000,000 in one year. At an average fare of 10 sen this gives a revenue of Y.2,500,000. This line is 10 miles in length and will cost about Y.45,000,000 to build and equip. At eight per cent. to cover the service on the construction loan, or Y.3,600,000, the deficit must be made up from other sources, or, as is contemplated, by temporary loans secured on the excess profits after the line is meeting its obligations. Within ten years, at the present rate of increase, this line will be handling over 50,000,000 passengers per year, producing a revenue of Y.5,000,000.

Reference to the map of the proposed subway routes will show that the other three Municipal lines all connect with important suburban railways, and converge in the heart of the city at the Tokyo Central Railway Station. Careful estimates of the probable subway traffic for these other lines, showing equally satisfactory results, have also been worked out by the experts.

The tendency to make Tokyo an industrial city as well as the financial and political capital is responsible for its rather abnormal increase of population as compared with other parts of the empire. People are flowing into the metropolitan district from the country districts at such a rate that the urban population is increasing four times as rapidly as other Japanese cities, and this tendency is bound to continue rather than diminish owing to the annual increase of population in Japan of over 700,000. The limited opportunities for gaining a livelihood in the country are forcing these people into the cities, with the result that the industrial districts of Tokyo and the new manufacturing centers in nearby towns will continue to absorb a large part of this surplus. Traffic in Tokyo will grow in geometric progression along the same lines as other great cities, and the attached diagram showing the line of traffic increase based on the law of the least square and the frequency of rides per person shows that by 1945 Tokyo's transportation system will be called upon to handle nearly 2,000,000,000 passengers per annum.

The concentration of business and shopping in a restricted area of less than a mile square is responsible for the usual rush hour traffic, which in Tokyo is already beyond the capacity of the surface lines to cope with. Eighty per cent. of the traffic during these morning and evening rush hours is bound in and out of the central district. Some idea of the increase of population in Tokyo and its 27 suburban towns and villages is seen in the figures for the eight-year period 1912-1920. During this time the urban population increased from 2,009,980 to 2,377,884, or only 18 per cent., while the 27 suburbs increased from 342,401 to 732,709, or 114 per cent. Since 1922 the rate of increase in the suburbs has been much greater, and it may be estimated that at this time they have grown to over 1,000,000.



Cross Section of Tube Tunnel, Showing Construction and Details, Detail of Cast Iron Lining (right)

Restoration of Communications System

By SANNOSUKE INADA

Chief Engineer of Technical Section, Department of Communications, Japan

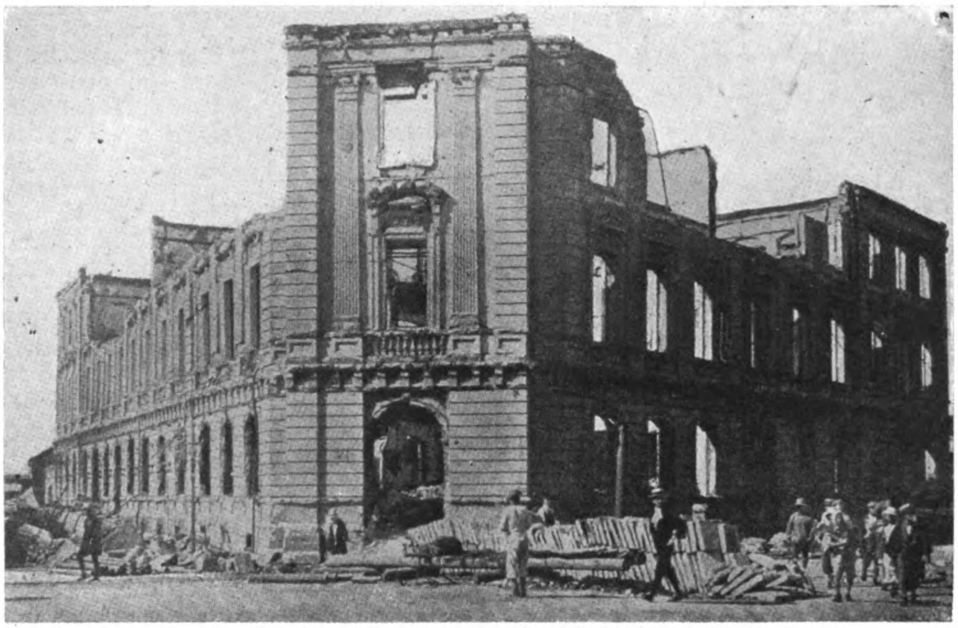
(Reprinted from "The Far Eastern Review," March, 1925)

THE Tokyo earthquake caused severe damage to the telegraph and telephone installations in Tokyo, Yokohama and their vicinities ; and a majority of the office buildings, equipments, and line plants in these localities was reduced to ashes by the conflagrations which spread immediately after the quake. Damages to these installations were so serious that they can never be fully stated in detail, but it is intended that general descriptions concerning them shall be given.

Damages to Installations

The number of the first and second-class offices damaged is given below :

District	No. of Offices	Burnt or Wrecked
Tokyo and its suburbs	23	13
Province of Kanagawa	8	7



General View of Tokyo Telegraph Office after Fire

The line plants connecting and terminating at the above offices were wiped out by conflagrations. The damages to the Tokyo central telegraph office caused not only an interruption of the entire central service of telegraphic function in Japan, but also of her international communications.

As soon as the quake occurred the 350 telegraph circuits which terminate at the Tokyo central telegraph office came to faults of contacts and earth ; and the electrical source for the telegraph was shut down by the tumbling down of the secondary batteries. Thus all the circuits were interrupted, and at the same time all employees, rushing outdoors, barely escaped being crushed by the destruction of walls on the third floor. As this building was very old, a new central office in the centre of the city was in course of construction, reinforced concrete being used throughout. In spite of all efforts of the employees, all installations were reduced to ashes by fire on the evening of the first day, the principal equipment lost being as follows:

Equipment	*Number Lost*
Wheatstone automatic transmitter and receiver	126
Quadruplex and simultaneous A.C. and D.C. duplex	Sets for 19 Ccts.and spare
Duplex and combined Dx-Sx. ...	Sets for 65 Ccts.and spare
Simplex	Sets for138Ccts.and spare
Syphon recorder duplex (for Bonin and Guam cable)	1 complete set
High frequency simplex	1 complete set
Western electric quadruple-duplex printer	1 complete set
Western electric start-stop printer ...	1 complete set
Teletype	2 sets
Kleinschmidt keyboard perforator ...	17 sets
Telegraph switchboard	2 sets
Monitoring set	5 sets
Pneumatic tube equipment ...	14 sets
Ticker	126 sets
Testing equipment	Complete set

The underground cable between Tokyo and Yokohama was burnt or crushed in Yokohama and near the river Rokugo, and totally damaged near the river Banyu, where the cables were suspended by arms attached to the piers of the railway bridge. Disaster in the vicinity of Hakone was so serious that no pole line remained on account of the cracks and failures in the ground. One may easily gauge the magnitude of the disaster by referring to Figure 1, which shows the damage done to a pole line in Yokohama.

As a result of the first quake, the Guam cable, the only cable which connects Japan with the United States of America, went down to fault and was interrupted. For urgent repairs the *Okinawa Maru* was ordered to steam hastily from Nagasaki, and after strenuous endeavors, co-operating with two other cable ships, *Ogasawara Maru* and *Nanyo Maru*, faults were cleared on October 27. The latter cable ship, being then anchored at Yokohama, supplied cables and other materials needed for the repair to the *Okinawa Maru*, and the former made hasty trips to supply the necessary cables, carrying them from the cable tank at Nagasaki. The faults of this cable were grappled at 16 points along the route, at distances from 44 to 75 knots from Etchujima cable house, where this cable is landed, operating both inside and outside of Tokyo bay at depths of sea measuring from 300 to 1,160 fathoms. Locations of these faults were as follows :

Fault	*Distance along Cable from Etchujima*
Point No. 1.	About 44.5 knots (about 5 knots off Kachiyama, westward)
Point No. 2.	About 45.5 knots
Point No. 3.	About 46.1 knots
Point No. 4.	About 46.6 knots
Point No. 5.	About 66.6 knots
Point No. 6.	About 74.1 knots (about 10 knots off Habu harbor in Oshima, westward)

According to investigations, it seems that these faults were due to sudden shocks which were caused by the earthquake. The faults were breaks and grounding, and from an inspection of the faulty parts of this cable it was noted that it was broken with no elongation of armor steel, but as if a tremendous stress had been applied suddenly. By the fact that at some points the cable seems entangled forcibly, it can be imagined that these faults might have occurred at points where some part of the cable was buried under the sea bed according to its sudden change.

It may be added, in passing, that the condition of damage on the Sakurajima submarine cable, which connected Kagoshima and Sakurajima island, and which was affected by the eruption of Sakurajima island of January 1914, was nearly the same as that of the Guam cable above mentioned. At one or two feet from the end of the cable break the inner serving of the former cable was snapped at quite numerous points.

The underground portion of the Guam cable from cable house to Tokyo central telegraph office, which is of four cores of I.R. cables, was also burnt at several bridges on its route, but was repaired before communication between Tokyo and Guam was restored.

Figure 1.—Cracks in Ground near a River in Yokohama. Telephone Pole near Centre of Picture

Emergency Measures

As a consequence of the entire breakdown of the Tokyo central telegraph office system, it was planned on the afternoon of the very day of the disaster to open a temporary telegraph office in the building of the Communications officers' training institution in Shiba park, but that plan fell through completely, as the building was burnt in the early morning of the second day. Thereupon it was decided, first of all, to connect Tokyo with other important cities at some point in the suburbs of Tokyo. For this purpose Senju office, which is situated in a part north-east of Tokyo, was chosen from the standpoint of routing. Communication concerning relief business was successfully opened with Osaka, Nagoya and Sendai at 11 p.m. on the second day. As shown by the map (Figure 3), the central and the busiest portion, or nearly one-half of the area of the city of Tokyo, was burnt; it was a very difficult task to find an appropriate site for the central office.

For convenience sake it was planned to open the temporary central telegraph office in the building of Tokyo central post office, which fortunately escaped the fire. After much effort instruments and materials were gathered from all districts. On the other hand, by jointing together underground cables of telegraph and telephone, which remained undamaged in the city, it was possible to open communication from the centre of the capital to the cities of Osaka, Nagoya, Nagasaki, Kobe, Sapporo and Nagano one after another in the period from the fifth to eighth day. At the same time a temporary circuit between the central office and the radio station in the telegraph corps at Nakano, a suburb of Tokyo, which served to connect other radio stations and the central office, was constructed by a force from the telegraph corps.

On the 14th the temporary Tokyo central telegraph office was removed to the fourth floor of Eiraku building, where emergency circuits terminating at Senju Kameido and other places were cut over together. Thus the organization of the plant of the Tokyo central telegraph office was consolidated, which had been rather disorganized since the day of the disaster. Later, the number of circuits which terminated at this office were gradually increased, making a total of 65 on November 11, and they afforded efficient service to all quarters of Japan.

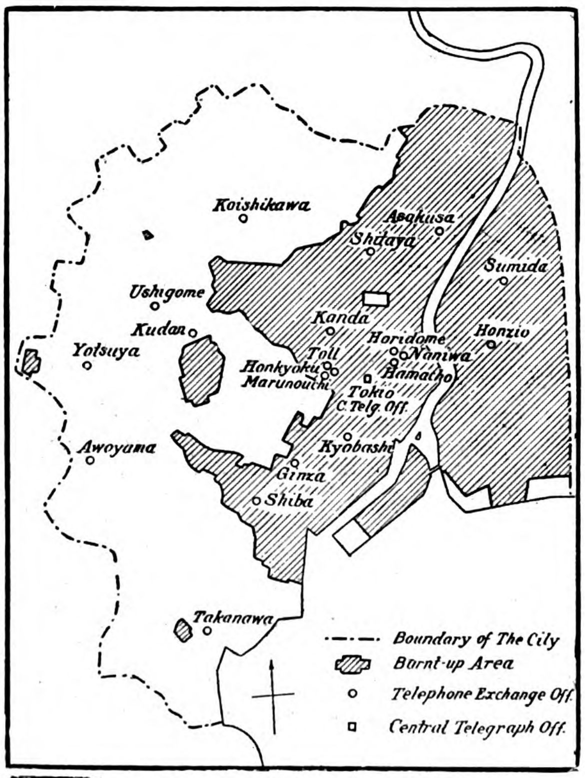


Figure 3.—Map of Burnt Area in the City of Tokyo

At Yokohama, as the damages done to that city were so serious that many of our employees were killed and injured, any sort of planning of emergency measures was very difficult. As nothing could be done in the centre of the city a temporary office was established at Kanagawa station of the inter-urban electric railway between Tokyo and Yokohama. On September 12 a telegraph service was offered to the public, but with some restrictions, serving relief messages only as in Tokyo. Communication from Yokohama to Kamakura and Yokosuka was commenced on the 17th. On October 24, after removal of the temporary office to the barracks at Sakuragi-cho, communication with Osaka, Shizuoka, Maebashi, Kyoto, Sannomiya and other places was re-opened.

Traffic in the districts outside the affected area increased extraordinarily, especially at Osaka, where it came up to over twice the daily service before the disaster, amounting to something over 188,000 messages on September 5. At Sannomiya foreign messages dispatched during the first ten days of September increased by 80 per cent. in the number of messages and 250 per cent. in the number of words in daily average. As temporary measures for this extraordinary condition circuits as direct as possible from Tokyo to the cities in Chugoku, Kyushu and north-east districts were chosen, making use of circuits which were interrupted. Although unexpected, owing to the make-up of the temporary circuits involved, satisfactory results were obtained by putting the duplex Western Electric type printer in use for foreign messages between Osaka and Nagasaki.

Damages to the Telephone

I. Damages to the Office Buildings

Number of centrals and the extent of damages sustained from the earthquake calamity are given in a table elsewhere in this article.

In Yokohama the central Honkyoku was, as shown in Figure 5, wrecked entirely and many employees were killed or injured there. In Tokyo, the central Kyobashi was, as shown in Figure 6, destroyed at its corner, and several employees here also were killed or injured, the building afterwards burning to ashes. The centrals Shiba, Kanda, Naniwa, Shitaya and Honkyoku, being of brick construction, were damaged seriously and burnt to ashes afterwards. The central Kudan was damaged so seriously that it cannot be used again, owing to the cracks in the walls or unrepairable damages to the main structures. As for the remaining centrals such as Sumida, Ginza, Hamacho, Horidome and Asakusa, damages were comparatively slight, and these might be used again by simple repairs. By the conflagrations which spread immediately after the quake all these centrals lost all the equipments, furniture, etc., the main structures of reinforced concrete alone being saved.

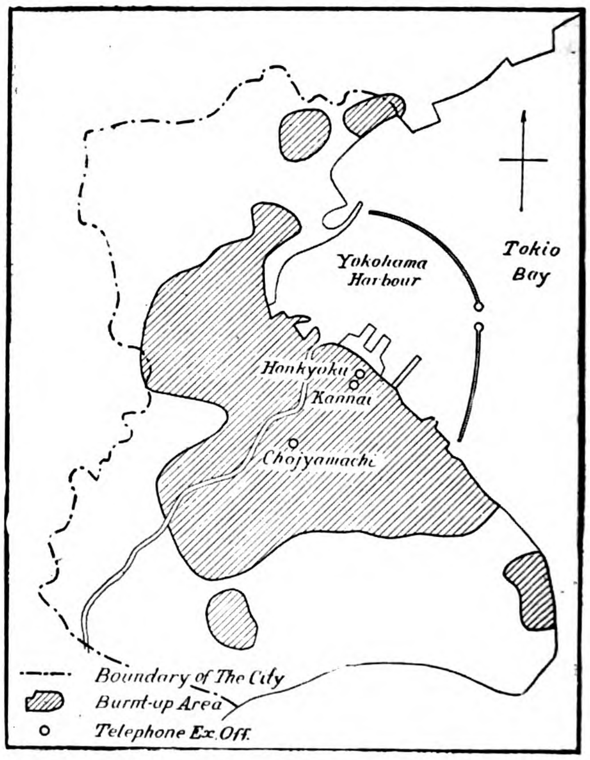


Figure 4.—Map of Burnt Area in the City of Yokohama

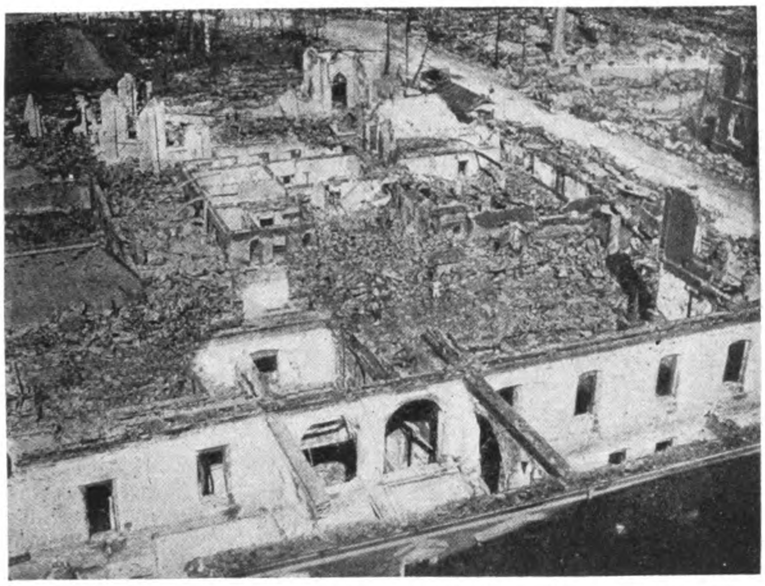


Figure 5.—General View of Ruins of Telephone Central Honkyoku, Yokohama

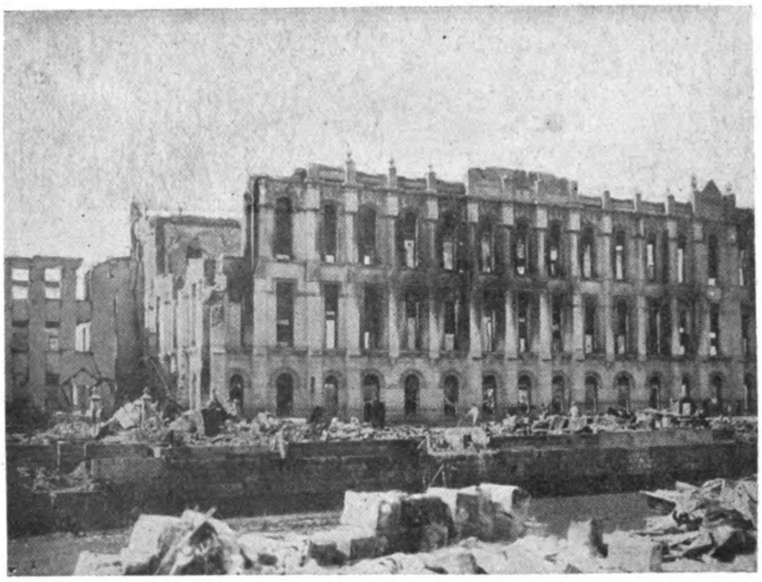


Figure 6.—Outside View of Telephone Central, Kyobashi, Tokyo, After Fire

Thus all the centrals in Yokohama were shut down. In Tokyo two centrals, Kudan and Yotsuya, were not burnt, but became unavailable; 14 of them burnt completely with their equipments; and only four remaining were capable of being opened to renew their service, namely Koishikawa, Ushigome, Awoyama and Takanawa.

City	Extent of Damage	Number of Offices	Type of Building Construction	
	Damaged beyond repair	8	Stone work	1
			Reinforced concrete	7
Tokyo	Structure only saved — equipments, furniture, fittings, etc., burnt—available by repair and re-equipment	7	Reinforced concrete	
	Available by reinforcing, though seriously damaged — equipments not burnt	1	Reinforced concrete	
	Available by repairing—equipments not burnt	4	Reinforced concrete	
Yokohama	wrecked almost completely and burnt	1	Brick work	
	Structure only saved — equipments, furniture, fittings, etc., burnt—available by repairing...	1	Reinforced concrete	
	Available by repairing—structure only saved	1	Reinforced concrete	

II. Damages to Office Equipments.

At the instant of the severe shock some of the switchboards rocked backwards and forwards, cable runways dropped, M.D.F. and I.D.F. deformed in a corrugated way, becoming wavy, relay racks inclined, and meter batteries tumbled down. While these damaged parts were being investigated and restored as soon as possible in order to resume the service the fires started at nearly every part of the city, and spread out at a tremendous rate. While it was impossible at the time to investigate fully the extent of damages done to the equipments in each office, the six surviving centrals were investigated more fully. It should be remembered that the extent of the damage was different in each case, some so slight as loosened bolts, disorder of relay adjustment and running over of electrolyte of storage batteries. These slight damages were present even in the cases denoted as " right " in table on following page showing the condition of damages in six surviving centrals.

A description is given here of the condition of the batteries which is applicable to all the centrals, and which is of interest in connection with improvement of setting in telephone offices. Damages to other kinds of equipment will be described later.

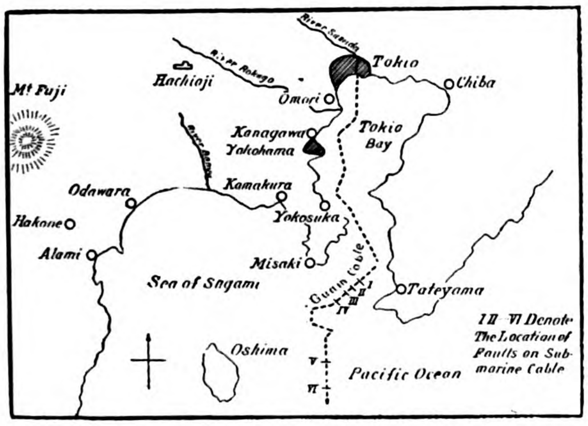


Figure 2.—Map of the Quake Area on September 1, 1923

Electrolyte in cells ran over more or less in all the centrals. The glass type cells for register use (40v) were arranged on two wooden frame shelves, upper and lower, and some of the cells on upper shelf fell down and were broken.

None of the cells of the common battery (24v), which were in lead-lined wooden tanks, tumbled, as they were set on the floor and were, therefore, stable. Among damages done to the common batteries in the centrals, Yotsuya, Ushigome and Awoyama, the following may be mentioned. Ears of the active plates were melted as a consequence of short circuit, due to breaking of the supporting side glasses, although they were of a standard size of secondary cell maker. In the case of two cells in Awoyama buckling of plates, which was occasioned by the falling of active materials, caused short circuit of the plates, thereby introducing a small hole in the lining of the tank, which led to running out of electrolyte. This hole, so small as not to be visible, seems to have been caused by sparks at a point where the active materials made a partial contact with the lead-lining. While the above batteries were of the G.S. type made in Japan, those in the centrals Takanawa and Koishikawa were of the Tudor type, and in the latter case there happened no such damage as mentioned above. The difference in the condition of both instances above cited is probably due to the difference in the thickness of the supporting side glasses.

The generating equipments in all centrals were undamaged owing to the good foundations; especially so was this the case in Sumida central. As fire was not so serious there, 10 among 11 cells of common battery of that office

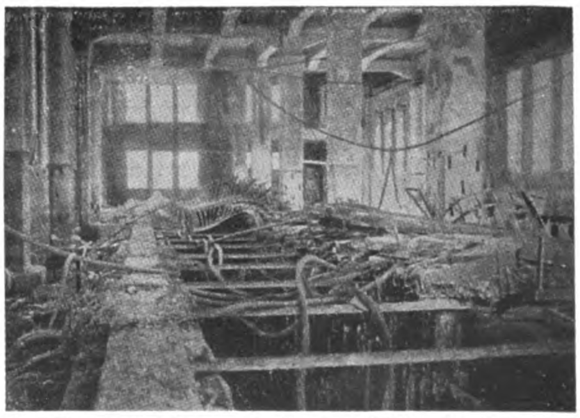


Figure 9.—Ruins of M.D.F. and Office Manhole after fire in Telephone Central, Ginza, Tokyo

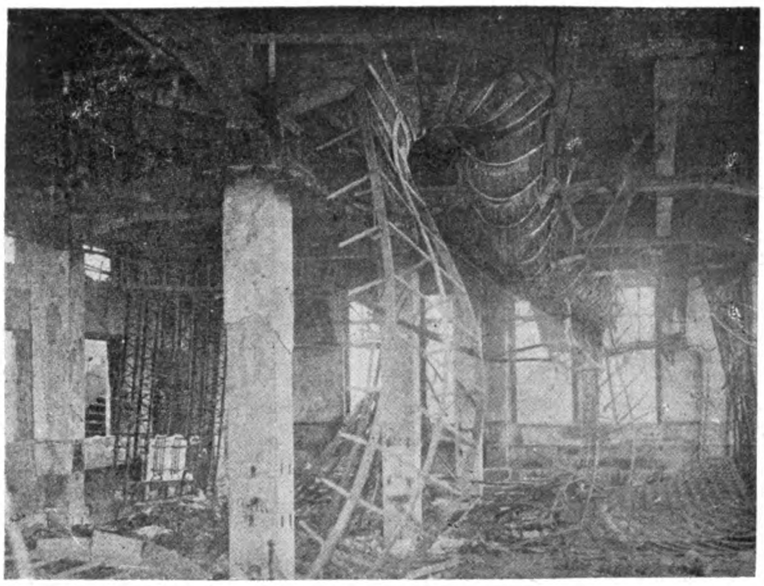


Figure 7.—Ruins of Cable Room after Fire in Telephone Central, Horidome, Tokyo

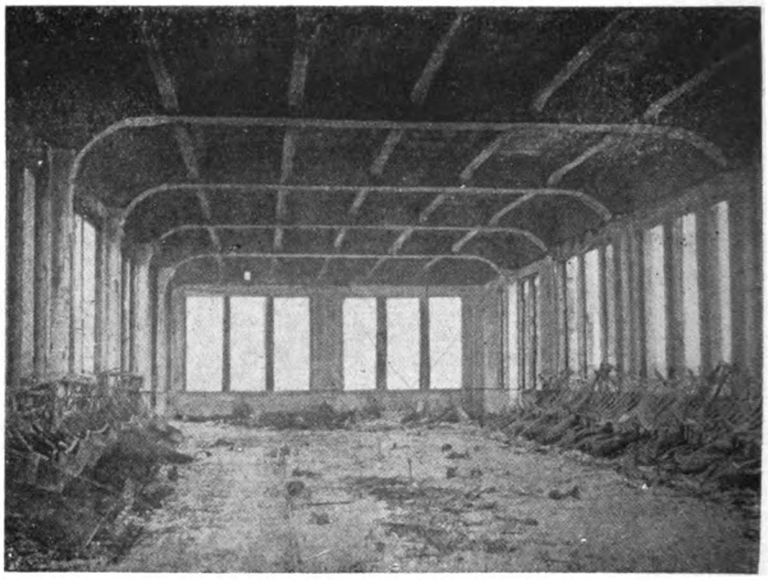


Figure 8.—Ruins of Switching Room after Fire in Telephone Central, Horidome, Tokyo

were utilized again in another central by replacing some of the plates.

III. Damages to the Subscribers' Stations and Line Plants.

TOKYO

Facilities	*Number before Disaster*	*Burnt or Demolished*	*% Damaged*
Subscribers' stations	82,766	50,265	60.8
Poles	58,521	26,598	45.0
Arms	198,622	82,251	41.0
Aerial cable (cable length) ...	28,543 miles	12,299 miles	43.0
Pot heads	4,897	2,927	60.0

YOKOHAMA

Facilities	*Number before Disaster*	*Burnt or Demolished*	*% Damaged*
Subscribers' stations	10,340	9,740	94.0
Poles	13,350	12,600	90.0
Arms	24,700	21,600	88.0
Aerial cable (cable length) ...	104 miles	75 miles	72.0

The preceding tables show numerically the damages done to the subscribers' stations and line plants in both Tokyo and Yokohama.

In both of the cities Tokyo and Yokohama, most of the manholes were so deluged that it prevented a full inspection of damages done to the underground cables, but the following table gives the figures for cables which were penetrated by water through damages to the lead sheaths in the Tokyo area :

Cable	*Cable Length Unavailable. In Miles*	*Cable Length before Disaster. In Miles*
1,200 pr.	.33	1.00
800 „	.05	.09
600 „	17.30	52.00
400 „	50.00	150.00
200 „	101.00	302.00
100 „	24.00	120.00

As the result of inspection of cables, the following faults on the cables terminating in five centrals were found :

Cable	*Total No. of Ccts. Prepared for Subcs.*	*No. of Und. Gr. Cables Terminated*	*No. of Faults Location on Und. Gr. Cable*	*No. of Faults Location on Aerial Cable*
Koishikawa...	9,000	27	0	50 pr.—15
Ushigome	7,400	12	200 pr.—1 400 pr.—1	50 pr.— 7
Awoyama	4,800	11	0	0
Takanawa	6,200	18	400 pr.—1	50 pr.— 8
Yotsuya	3,600	6	600 pr.—1	0

As the description has been of a general character heretofore, a more detailed summary will be given below :

Toll Lines : Among the damages done to the toll lines, it may be mentioned that the underground toll cable between Tokyo and Yokohama was so seriously damaged that it can hardly be repaired. This cable was installed in 1922 by the latest practice of engineering method. It is of the quadded type, medium heavy loaded, and was manufactured by the Western Electric Company in the United States of America, minute care being taken to minimize capacity unbalances not only between conductors of the pairs, but also between pair and pair. On its installation cores were chosen and spliced, so as to minimize the capacity unbalances between each circuit, at seven points in each loading section. While this cable was installed with such extreme caution as above stated, it sustained from disaster such damages as the crushing of the cast-iron conduit, sinking and shifting at the river Rokugo and other places along the route. Such painstaking labors during the cable laying was of no account, and a more minute investigation and electrical measurements will be necessary before it will again be available for the restoration of the service. The balancing at those faulty points will be more difficult than in the case of initial installation, because sufficient points cannot be obtained to make the balance.

Kind of Damage	*Amount Damaged. Miles*	*Remarks*
Cable length burnt	2.5	Total cable length before disaster was 42 miles.
No. of points of punctured or break ...	21	
No. of cables punctured or broken ...	82	
No. of locations water penetrated ...	273	
No. of cable pieces water penetrated...	420	

It is to be regretted that the scheme of replacing the present aerial toll lines between Tokyo and Okayama (nearly 500 miles) by such quadded and loaded cables, with repeater stations *en route*, will have to be postponed ; as a part of this scheme the cable working between Tokyo and Odawara was in course of construction. The cable drums had been distributed along the route, so that they sustained heavy damages ; while the loading coils were burnt completely, for they were in course of testing in Yokohama. But it is desired to perform the above scheme as soon as the financial condition of the Government admits.

Cables Routed on Bridges : Figures 12 and 13 show examples of the damages done to the cables routed on public bridges in Tokyo, which were found at a point crossing the Government railway where underground cables were installed in conduits laid under the road. By the destruction of the embankments at both sides all conduits at points indicated by A and B in the figure and the lower layers of conduits at point C were broken ; consequently cables kept their continuity merely by cores, lead sheath being peeled off as shown in Figure 15. This is caused by the shearing force on conduits, caused by the relative displacement between

the embankment and concrete wall. Such shearing or crushing occurred at places where soil and structures of different solidity meet together, for the wave motions in both were different.

Generally, in cases where cables were laid over public bridges or on special telephone cable bridges, it is a matter of course that these cables were burnt where the bridges were burnt, and even in case where the bridge itself escaped the fire, a majority of the cables were burnt by the conflagration of boats which crowded under the bridge for the purpose of getting shelter and escaping from the pouring flames and burnt ashes. In the case of concrete or stone bridges and special telephone cable bridges, which were far from the general public or not crowded by boats, cables were safe.

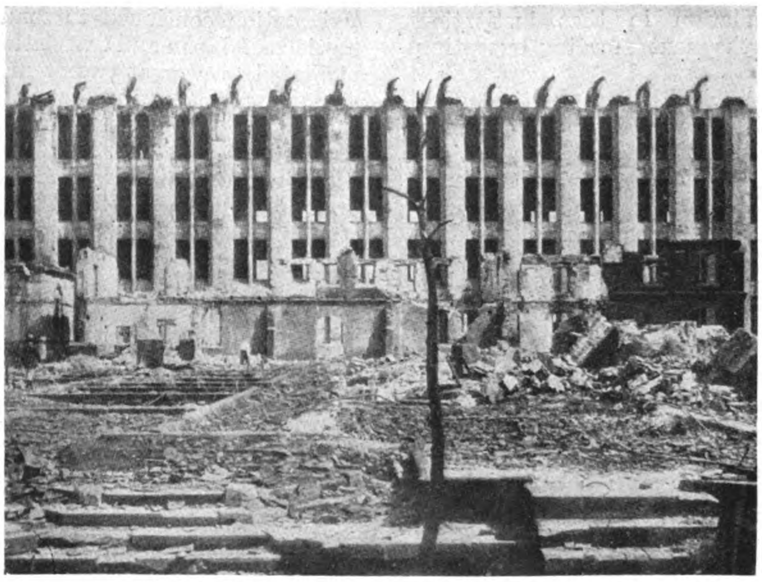


Figure 11.—New Tokyo Central Telegraph Office after Fire. In Course of Construction

Office Manholes : The office manholes were safe in centrals which escaped the fire, while in burnt centrals lead sheaths of cables were peeled off, leaving mere cores as entangled ropes. A majority of manholes placed in front of centrals were undamaged in appearance.

Cables in Lateral Tubes : In the burnt portion of the city a majority of cables in laterals were burnt and melted lead sheaths were stuck in the tube up to near the ground surface.

Manholes : In Tokyo the majority of the damages in manholes were cracks in its walls due to horizontal quake. In Yokohama there were many cases where only a part of the manhole body itself was shifted horizontally, leaving the cover case projecting above the ground surface by one foot or so owing to sinking of the surrounding earth ; the entrance arch was damaged and cast-iron conduit projected by three feet or so towards inside of manholes. It is remarkable that there were no manholes which sank below the ground surface, and this is probably due to the fact that the foundation was somewhat better than the surrounding earth.

Underground Conduits Near Riverside : In the case of roads along the river bank the parts near the river became disturbed ; consequently underground conduits and manholes became exposed and cables damaged.

Equipment	Koishikawa (*Centrals*)	Takanawa	Ushigome
Switchboard	Right	Slightly shifted	Right
M.D.F. and I.D.F. ...	Slightly inclined	Slightly inclined	Right
Rack	Inclined	Slightly inclined	Right
Register rack	Right	Slightly inclined	Right
Battery—24 volt ...	Right	Right	2 cells damaged
Battery—40 volt ...	Right	I cell broken	Some on upper shelf broken
Generating equipment ...	Right	Right	Right

Equipment	Yotsuya (*Centrals*)	Kudan	Awoyama
Switchboard	Line of surface shifted	Nearly the same as other Centrals—All equipments here were dismantled and added to other Centrals	Right
M.D.F. and I.D.F. ...	Slightly inclined		Right
Rack	Slightly bent		Right
Register rack	Right		Right
Battery—24 volt ...	3 cells damaged		2 cells damaged
Battery—40 volt ...	Some on upper shelf broken		Some on upper shelf broken
Generating equipment ...	Right		Right

Open Wires : Generally it seems that the damages done to the poles and open wires were most serious where the direction of the pole line coincided with that of the quake propagation.

Damages on toll lines were nearly the same as those of telegraph lines ; the number of circuits damaged amounted to 303 terminating in Tokyo, and 111 terminating in Yokohama.

Emergency Measures: The following are the measures performed concerning telephones in consequence of the disaster :

(*a*) Local exchanges : In Tokyo, for Government offices pertaining to the temporary relief work and for other important subscribers, the service was opened by means of standard magneto switchboards, each of 100 subscribers' capacity, installed in a room in the Tokyo central post office, which escaped the fire as referred to above ; as a next step newspaper offices, banks and other subscribers having close relation with public interest were added as soon as the line plant, instruments and materials admitted. In Yokohama, since no building belonging to the Department of Communications had survived, a standard magneto switchboard, with a capacity for 50 subscribers, was installed in the branch office of public works of the Department for Home Affairs ; thus service was restored to governmental offices and important subscribers just as in Tokyo. Later this equipment was removed to the barracks in front of Sakuragicho railway station.

(*b*) Toll Lines : On September 3 the toll circuits to Sendai and Utsunomiya were opened at Senju like telegraph lines, and these were then cut over to the standard magneto switchboards for the toll line purposes, which were installed in the Tokyo central post office at the same time the circuits to Nagoya, Osaka and other important cities were restored. As, owing to the inherent function of the [standard magneto switchboard, the toll service could not be given to the subscribers belonging to common battery offices, several pay stations were installed in the Tokyo central post office for the purpose of this service. Later, as the number of circuits increased, restriction for toll service was removed. Owing to shortage of the number of toll circuits, at first the toll service was afforded to messages relating to the relief business. On November 10 the total number of working circuits amounted to 74. Prior to this some modifications were given in order to give toll service to all subscribers in common battery offices.

In Yokohama, at first, the toll as well as telegraph service to Tokyo was opened in the waiting room of the Kanagawa station of the inter-urban electric railway between Tokyo and Yokohama, later removing it to the barracks above mentioned. The number of circuits to Osaka, Kobe, Nagoya and other important cities was nearly ten on November 11. As restoration of Yokohama was very slow, such number of circuits was sufficient for the toll service.

Damages Done to Radio Stations

The number of radio offices within the area of the disaster is given in the table below, 6 among 20 stations being damaged most seriously :

Administration	*Public*	*Private*	*Experimental*	*Total*
Dept. of Communications ...	0	0	3 (3)	3 (3)
Naval Department	2		1 (1)	3 (1)
Department of War	0	1	1	2
Department of Railways ...	0	0	1	1
Factory	0	0	4	4
School	0	0	4 (1)	4 (1)
Others	0	0	3 (1)	3 (1)
Grand Total				20 (6)

Figures in brackets denote totally damaged.

As seen in this table no station for public service was within the area of the disaster, but by means of installations in the military office and a few equipments which survived in the communication officers' training institution, immediate emergency measures were performed even before the severe shock hardly

slackened. Unfortunately the installation in that institution was reduced to ashes by fire early the next morning excepting two iron towers.

The burnt-out important offices which have relation with radio engineering are the electrical laboratory, Communication officers' training institution and naval technologic research section. As these possessed the most important laboratories and research equipments in Japan, the loss which our empire encountered is very great; for we have lost important research results, documents, reports, etc., together with equipments which were very important for the development of radio engineering, and also preparations for the coming conference on international radio communications.

It is reported that on September 1, in the Communication officers' training institution, only a few minutes before the great quake, the resonance condition of the receiving apparatus was exceedingly deranged, when some measurements for the radio communication from North China were being investigated by the operator. Immediately after he had noticed this extraordinary phenomenon he felt the quake. Such a phenomenon might be caused sometimes by the swinging of the antenna, but the antenna in that institution was so tightly stretched that in ordinary heavy storms such a condition was never observed before. It is improbable that the operator was too earnest in inspection not to take notice of the first shock of the quake, because he felt the quake at the same time the others did. The quake in far distance might probably be mentioned as a cause for the above phenomenon, but the exact interval of time which elapsed between the first quake and the feeling of that phenomenon was not observed; so this phenomenon is cited as an instance toward solving the question to be met in the future. It may be added here that in that institution after the quake listening was continued till early next morning, when that building was burnt.

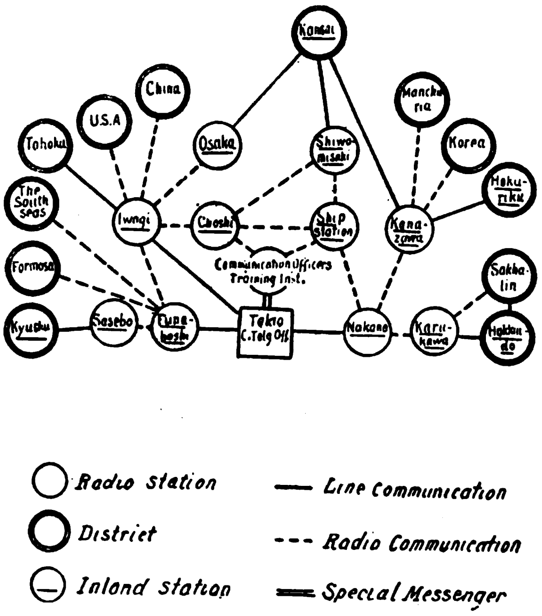


Figure 10.—Schematic Radio Communications After the Disaster

Soon after the fire a temporary circuit between the temporary Tokyo central telegraph office and the telegraph corps at Nakano was established; so that by means of the radio installation at the latter place, communication was begun to all coast stations from Tokyo. It is said that in this performance in the telegraph corps portable radio apparatus proved a great success.

After September 2, as communication between warships, which were anchored at Yokohama or Shibaura (in Tokyo), and land stations increased, their interference in Tokyo bay became fairly strong. Beside the above, Funabashi station was successfully used for service. The new work of radio communications for the public after the disaster is shown in Figure 19 schematically.

While the above is a general description of the measures which were taken in the environs of the Tokyo central telegraph office, many of the radio stations in local districts took an active part in the communication service. The news of the great disaster of September 1 was received in Hongkong and Manila on that day via Osezaki, which was sent from Choshi and Iwagi, and on the other hand reports were sent from Iwagi direct to the United States of America and Hawaii, so that all the ships at sea listened in to these messages. Furthermore, the Iwagi station continued to send reports to America telling the conditions of Japan and translating news successively. This station contributed to a great extent in arousing in America and Europe profound sympathy for Japan; it is especially rejoicing to note that the master and the officers of Iwagi station were publicly recognized in America. It must be mentioned here that the ship station on board the *Korea Maru* and *Mishi Maru*, which lay anchored at Yokohama, served to communicate with every quarter of the empire, day and night, on and after September 1; also all the coast stations endeavored to serve in a state of sleepless and unresting condition for a fortnight. It is also reported that the Ohi factory, belonging to the Department of Railways, and being one of the experimental stations, served to communicate with ferry-boats that ran between Tokyo and Shimizu.

The great difficulty encountered in connection with radio communication was confusion, as stated above, but this was restricted to the Tokyo bay, and by order it was practically overcome by means of proper adjustment of the wave lengths.

Other Damage Done

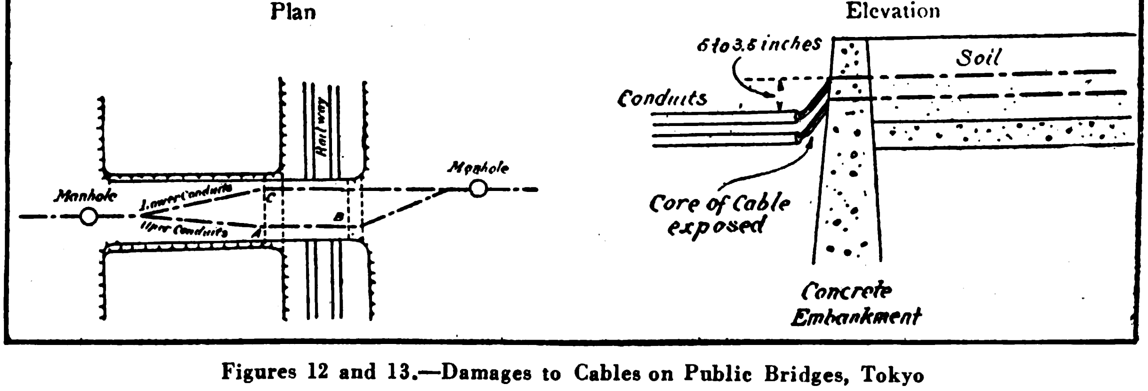
Material or immaterial losses beside those previously mentioned were sustained from damages occasioned to the buildings of the Department of Communications, electrical laboratory and technical section of the Tokyo administrative office, as well as store-houses which were completely burnt. In these three offices above mentioned were located very important laboratory installations, containing therein reports of research, documents and materials for investigations relating to wired and wireless telegraphy and telephony in Japan which had been prepared by many engineers, who spent many years, some in foreign countries, gathering valuable reports and papers, and others at home working most painstakingly at their chosen profession. It is to be greatly regretted that these precious documents and installations were reduced to ashes and that nothing can compensate for the loss, which cannot be estimated in terms of monetary value.

The disaster caused not only much inconvenience in the preparation of papers for the technical committee on international radio communications, but also it introduced great obstructions for the telegraph and telephone extension plants to be performed in future, which are being proceeded with upon a plan laid out for a number of consecutive years.

While much stock material was in store for emergency purposes, much of it was lost by the conflagration, causing great obstructions to emergency measures. On the other hand, much difficulty was encountered as the more important business and factory quarters of the city were wiped out.

A few instances regarding information about telegraph and telephone installations will be added below, as such results of investigation of the damages caused are of some value toward preventing such disasters in future.

Office Buildings: It would be very important as well as interesting to architects to investigate the condition of buildings which escaped the damages of the quake and came comparatively unharmed through the fire. Quake and fire-proof structures are to be recommended for houses in all



Figures 12 and 13.—Damages to Cables on Public Bridges, Tokyo

Ushigome Telephone Exchange Building in Tokyo which was not destroyed by the quake or fire and is one of the Most Modern Central Offices in the Capital

the important parts of the city, especially for telegraph and telephone offices. Telegraph and telephone installations are urgently required in times of such disasters, and much thought should be given to selection of proper types to be adopted for these buildings. While most of the brick structures became dangerously shaken by the earthquake, reinforced concrete buildings were immune to both the earthquake and fire. In Tokyo, for instance, the building of the toll and two local exchanges at Marunouchi was destroyed by the fire with all the contents except mere structures, so that the building is being refitted for the purposes of establishing a temporary toll exchange, and housing the Tokyo central telegraph office and one of the local exchanges. Beside this, the buildings of the centrals Ginza, Asakusa, Hamacho, Horidome and Sumida may also be utilized again by simply repairing the inside fittings. From the above it is evident that reinforced concrete building should be adopted in all cases in future.

By the first shock of the quake all water mains were interrupted, so that fires at almost every part of Tokyo and also of Yokohama got immediate headway at their will and nearly all important parts of Tokyo and the whole of Yokohama were turned into ashes. Temperature of the burning areas reached such high degree that window and other glass and some metal parts melted as if in hearths, and it is also to be noted that metal fire-shutters in all the buildings worked ineffectively. In future much precaution must be taken in fireproofing windows, which seem to be the weakest point of buildings. Strong cyclones and high winds were caused by local temperature differences during the fires. Some people were blown upwards and carried to places some distance away. It is difficult to say what unexpected events happened during those few days. It is needless to say that all such questions must be taken into consideration by engineers who are to shoulder the responsible work of reconstruction and all measures for fire and quake proofing should undoubtedly be provided for.

Construction of Lines : In the burnt up areas the overhead telephone lines were completely destroyed by fire, though a majority of them were replaced by underground system long since. These overhead lines being for distribution purpose for subscribers, it is desirable to replace them by an underground system, if financial conditions will permit this to be done in the near future. As given in a table previously referred to, damages to the underground cables were rather slight, much less when compared with aerial lines, even in the cases where manholes became flooded by water, or cast-iron conduits projected into the manholes due to destruction of road and crushing of conduit. From the point of view of beauty, and also for reasons of frequent faults in aerial lines, it would be advisable to put the whole system underground in both Tokyo and Yokohama.

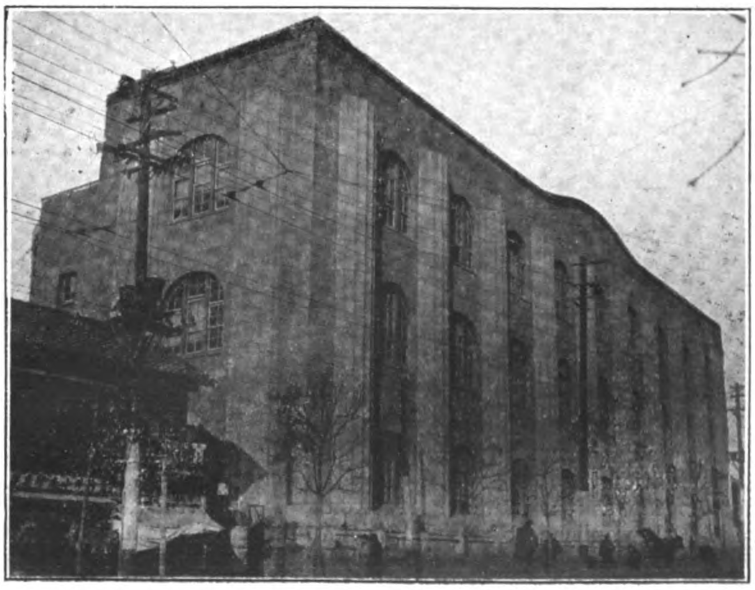
Construction of Underground Lines : A majority of manholes were flooded by drains due to loosened connections and breakages of conduits. In future special attention should be paid to workmanship of jointing the conduits and uniformity of foundation beds along the entire underground construction.

River Crossing : For routing cables over public bridges it is safer to choose bridges of fireproof construction, such as concrete or stone work, and to wrap them with some fireproof material. It is preferable to wrap cables with fireproof substance even where special telephone cable bridges are used, or to install them under the river bed. In the late disaster some cables, which were otherwise undamaged, were damaged at river crossings, which caused delay in re-opening the telephone service to some extent. It would be very interesting as well as instructive to investigate methods of river crossing of cables.

Supply of Equipments and Materials : The most difficult problem encountered in making arrangements for emergency measures was the requisition of instruments and materials. Stocks of instruments and materials, which were lost by the disaster, amounted to an enormous quantity, and because many of the factories were also damaged, their supply was obtained partly from local makers, while some was imported.

Adoption of Automatic Telephone System : It is true that civilization tends to replace the manual power by the mechanical.

Shiba Telephone Exchange, One of Four Central Offices in Tokyo spared by the earthquake and fire



Aoyama Telephone Exchange in Tokyo, one of four surviving the quake and fire

Though it is also clear that, in case of telephone service, to use a great many operators is both uneconomical and inconvenient, owing to financial reasons the adoption of the machine switching system has not yet been realized. It is firmly believed that this is the best opportunity to replace the former inconvenient telephone by a more up-to-date and convenient automatic system, as both Tokyo and Yokohama are now deprived of the telephone service almost entirely.

Installation of Radio Telegraph and Telephone: At the time of the late disaster there were no public radio stations in the burnt-up area which catered to the public service, and consequently no radio station was damaged; but if there had existed an undamaged one we can easily imagine its possible activity. It would have been a foregone requirement that an uninterrupted supply of electric power and a continuous communication between it and the central office were firmly established.

It is to be noted that in the last disaster the entire system of the electric power supply and lighting were interrupted for some time. From these observations it is evident that such installations should be made fire and quake proof, and that inter-connections between power houses and transformer stations, between these points and consumers, etc., should be of the underground system.

Broadcasting of radio telegraph served admirably in reporting the disaster to foreign countries as well as to ships at sea. It is firmly believed that telephone broadcasting would have played an efficient part if it had existed, a good reason for its realization.

Store-houses: It is believed that store-houses in future should be not only as rigid in construction as other buildings (or rather more so), but also fireproof, as much difficulty was experienced in executing emergency measures at this time. It is safer not to centralize store-houses, but to distribute them in many quarters of the city, in spite of some inconveniences to be felt in ordinary days from the point of view of storing, shipment and supervision. In the late disaster, for instance, the storehouse at Shibaura remained undamaged, while that in the enclosure of the Department of Communications was burnt. It is worth while to consider this problem.

Outline of the Program of Reconstruction Executed and Otherwise (March 1, 1924)

Telegraph

Tokyo: As a consequence of the removal of restrictions for messages, as above mentioned, the volume of traffic increased tremendously. The number of circuits was increased to 76 in Eiraku building, which was the full capacity of that temporary office. On November 23 this temporary office was removed to the repaired building in which the local telephone exchange Marunouchi was located. At that time some suburban circuits were added. The traffic-carrying capacity of the circuits has been restored since December 12 to that of as nearly as before the disaster, being increased by 160; while some circuits for city branch offices could not be restored owing to the delay in reconstruction of buildings. At the end of the year 1923 circuits were classified as follows:

System	*Number of Circuits*
Automatic duplex	24
Sounder duplex	58
Sounder simplex	144
Morse duplex	3
Morse simplex	14
Siphon recorder simplex	1
Telephone	1
Total	245

With the addition of 11 circuits in January 1924 nearly all circuits were restored to their former capacity with the exception of local circuits in the city. These city circuits will be opened as soon as switchboard and other equipments as well as office accommodations are ready.

As far as the number of circuits is concerned, restoration will be accomplished by April 1924,* while complete reconstruction will be finished early in the year 1925. At that time the Tokyo central telegraph office will be removed to its new building, which was in course of construction before the disaster.

The pneumatic tubes in Tokyo had been installed between the Tokyo central telegraph office and eight branch offices with a route mileage of nearly 6. But all the terminals were destroyed by fire and the underground tubes damaged also. The present scheme of reconstruction is to connect the first four branch offices with the central when the permanent office is opened, making a route mileage of 3.5 Successively for 13 branch offices a mileage of 20 in the year 1925, and for four branch offices a mileage of 8.5 in the year 1926, will be added, connecting with the central office respectively.

Yokohama: As previously described, 19 circuits were restored by the emergency measures in the temporary office at Sakuragicho, while at the end of November these were increased to 26. 39 circuits were totally restored in the first part of January 1924, the office being removed to the new building. These circuits may be classified as follows:

System	*Number of Circuits*
Automatic duplex	1
Sounder duplex	8
Sounder simplex	28
Morse simplex	2
Total	39

Complete restoration will be accomplished in April 1924.

Telephone

Tokyo. (*a*) Exchange: Prior to the disaster, in Tokyo there were one toll and 19 local exchanges, serving about 83,000 telephone stations. Among them the toll, 15 local exchanges and nearly 52,000 stations were burnt or wrecked by the disaster. An area of 13.5 square miles in the city of Tokyo was burnt to the ground, 30.5 square miles being the total area. The remaining centrals were re-opened on September 29, after urgent repairs to office equipment and line plant. The number of stations in those four centrals are given below:

NUMBER OF STATIONS

Central	*Before Disaster*	*Burnt or Wrecked*	*Opened on Sept. 29*
Awoyama	2,416	0	2,416
Koishikawa	6,836	699	6,137
Ushigome	4,172	0	4,172
Takanawa	4,473	125	4,348
Total	17,897	824	17,073

Since the localities which are covered by the above centrals are situated on more or less hard bed ground, damages to them were comparatively slight.

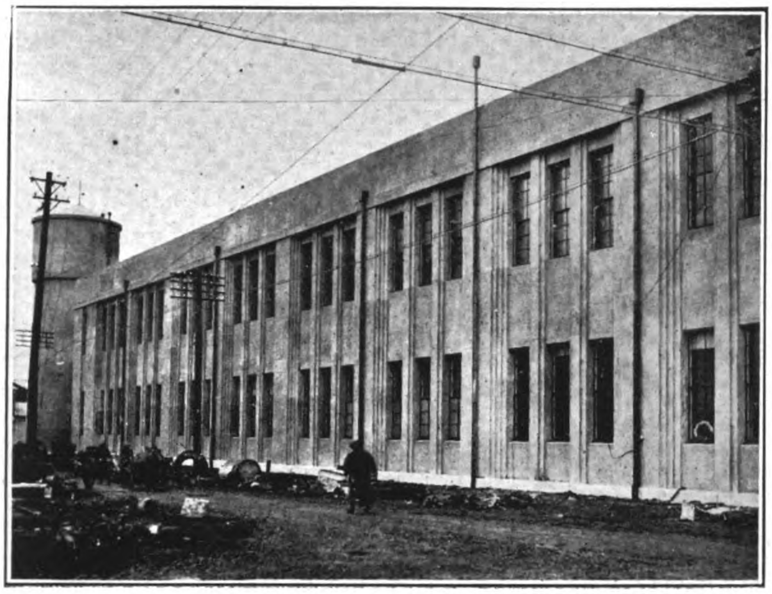
It is of interest to give a brief description about the traffic data on telephone service during the first three days after re-opening the four centrals. The average number of calls per station per day was 2.5, while 8.5 was the average during last August, just before the disaster.

Immediately after the above centrals were re-opened efforts were make to connect those subscribers who were most urgently in need of telephone service and who were scattered over all quarters of the city, to any one of the above four centrals according to their locations, by the aid of inter-office trunk lines. Thus a total of 20,743 stations were restored by the end of the year 1923. The temporary local exchange Ote was opened with a capacity of 4,000 in the burnt building of central Marunouchi. By the end of March the central Yotsuya will be re-opened, after repairs to that building are accomplished. Thus a total of 30,000 stations will be restored. By the extension of the switchboards in the above six offices, 9,000 stations will be added by the end of August.

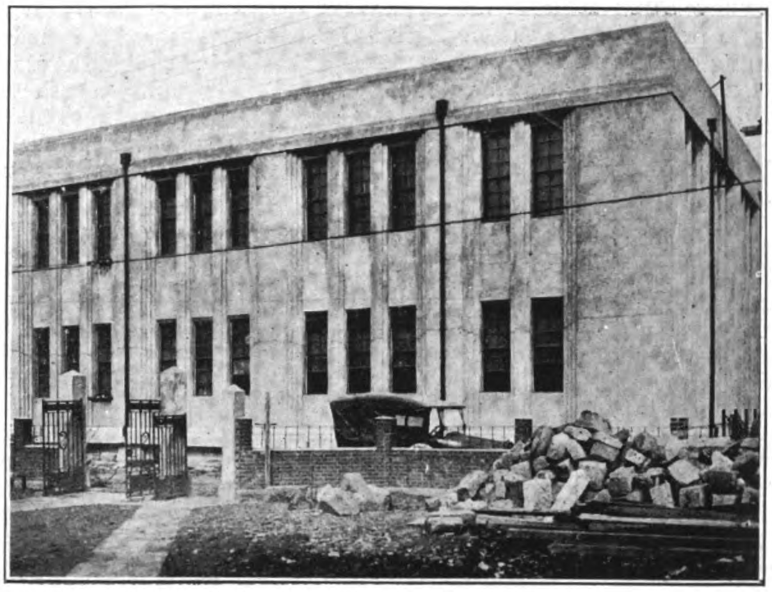
Two of the four burnt offices, the buildings of which are in course of repair, will be re-opened in the fall of 1924, and the other two by February 1925, the common battery system being employed. By March 1925 the total sum of stations restored will be enumerated by 64,100, there being 83,000 before the disaster.

Besides the total of ten exchanges, thus restored, four and five automatic exchanges will be opened by the end of the fiscal year 1924

*Dates appearing in this article are published without change. Attention is called to the fact that the program of reconstruction is dated March 1, 1924.



Kyobashi Automatic Telephone Station, Showing Adosole Tower



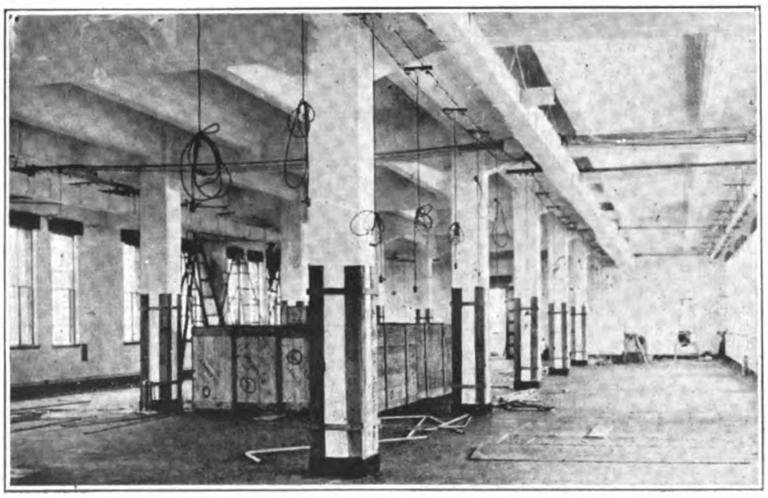
Honjo Automatic Telephone Station

and 1925 respectively, one of them being planned to supplant the temporary common battery office Ote. Restoring of the remaining 19,000 stations in Tokyo will be accomplished at the same time.

The program of measures for telephone reconstruction is expected to extend for a period of 2½ years, rather longer than usually accepted. In justification to the length of the reconstruction period it might be mentioned as follows. It is, of course, true that restoration of telephone service should be done as quickly as possible, as it is one of the most essential for the reconstruction of Tokyo. On the other hand, it may easily be justified that the work of reconstruction of the multi-office telephone area, which has stations numbering more than 80,000, cannot be treated as simply as the case of several independent telephone areas of moderate capacity. For the preparation of switchboards, first of all, a great difficulty is encountered. As several of the factories for telephone industry were damaged it must be expected that a rather longer delivery for home made is inevitable. Many foreign makers also offered earnest suggestions for the restoration of the telephone system, but they could not supply switchboards of the specified type at the specified time of delivery. To adopt many different systems of switchboards in the present case in Tokyo must be carefully considered, from the point of view of inconvenience and want of economy in operation and maintenance.

On the other hand, security of service cannot be expected if telephone offices were installed in imperfect buildings like barracks. Moreover, owing to probable alterations in the street contours, as a consequence of the city's reconstruction planning, construction of permanent buildings is not allowed before that plan is settled. To build offices with risk of removal within two or three years cannot be thought of. It is thought not unlikely that a tot l of 30,000 stations can be restored by March 1924, and 64,000 by March 1925. With this number it is expected that a restoration of service to all subscribers, at least one substitution for each subscriber, and also a fairly ample service may be given in Tokyo, the condition of general business being depressed to some extent compared with that before the disaster. A careful investigation regarding every point leads to the conclusion to adopt the program of telephone reconstruction outlined as above.

(*b*) Toll Line: After the emergency measures, as previously mentioned, were taken on December 1, 1923, the temporary toll office was removed to the repaired building of the old Marunouchi, where equipments were provided for 164 circuits. The number of toll lines will be increased to 277 by the end of March 1924, and it will not be so long before all circuits, 317, will be restored; while in the fall of 1925 the permanent toll exchange will be opened.



Interior of Kyobashi Automatic Telephone Station

Yokohama. (*a*) Local Exchange: While there were in Yokohama one toll and two local exchanges, serving 10,600 stations, the whole was practically destroyed. On September 29, 1923, 30 subscribers were restored, and this increased to 450 by the end of that year. It is planned to restore 2,000 stations in the new temporary office by March 1924, the switchboard being of the magneto parallel multiple type removed from a central which was recently closed in Tokyo; by June 1924 the sum of stations will increase to 3,700. In the fall of 1925 two automatic exchanges will be opened, where all the subscribers will be cut over and all the remaining stations will be restored at the same time.

(*b*) Toll Line: The number of toll lines in Yokohama before the disaster was 111. Gradually increasing the number of lines restored, a total of 35 were completed at the end of the year 1923. The sum of restored lines will become 73 by the end of 1924 and 111 by 1925, thus making all restored.

It must be added that when the automatic system supplants the manual local exchange the permanent toll office will be opened.

Restoration of Telephone Services in Tokyo and Yokohama.

In consequence of the earthquake disaster on September 1, 1923, the telephone plants in both cities were so badly wrecked that service to the 84,000 subscribers in Tokyo, 10,600 in Yokohama, and toll service on 429 circuits were shut down.

Emergency repairs were started immediately on the central office equipment and line plant of the four offices not destroyed in Tokyo, namely, Aoyama, Takanawa, Koishikawa, and Ushigome. This work was completed as soon after the disaster as September 29, and the four offices reopened on that date. Subscribers were restored day by day, so that, by the end of the year, the total number reached 20,743.

Common battery switchboards were installed on an emergency basis in the badly-

damaged Marunouchi and Yotsuya centrals. These two offices were put in service shortly after the first of the year, the former being opened under the new name of Ote. This permitted a total of about 30,000 subscribers to be restored in Tokyo by March 1, 1924.

In Yokohama, temporary central office equipment was installed in the repeater station which was under construction at the time of the earthquake, and service restored to 2,000 subscribers.

Temporary service toll switchboards were installed in the Ote office, Tokyo, and a standard toll board in the temporary station in Yokohama, with the result that toll service was resumed over 164 circuits.

The restoration work proceeded under the plan adopted of restoring all remaining subscribers during the two fiscal years 1924 and 1925 and of completing during 1925 such rearrangements as will be necessary to bring the two exchanges to a permanent basis that will assure satisfactory and economical service. By the end of March 1925 the following results were obtained:

A—Tokyo

Centrals	*No. of restored Subscribers*
Koishikawa	7,267
Aoyama	6,598
Ushigome	6,249
Yotsuya	6,187
Takanawa	7,176
Ote	6,420
Asakusa	7,613
Ginza	7,233
Naniwa	6,384
Sumida	5,459
Total	66,586

B—Yokohama.

No. of restored subscribers, 4,260.

C—Toll Lines.

Total number of restored circuits in Tokyo and Yokohama—351.

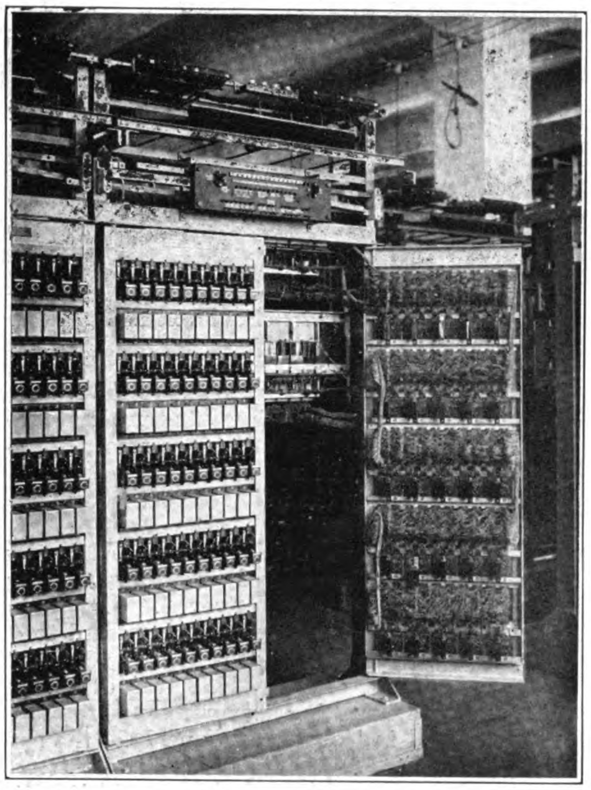
From the above it is seen that at the end of the fiscal year 1924 the damaged telephone plant had been restored to a point where the number of subscribers in service was in Tokyo 80 per cent. and in Yokohama 40 per cent. of the number before the disaster, and that 82 per cent. of the toll lines were restored.

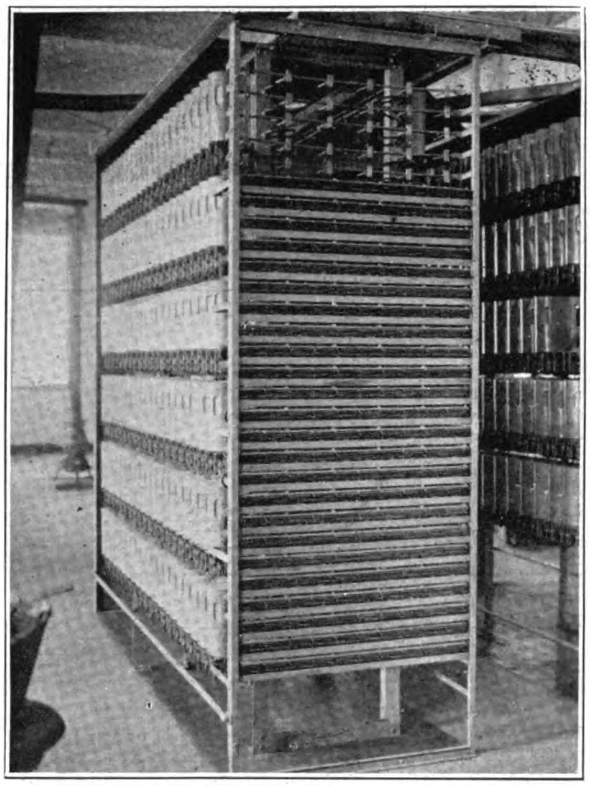
Programme for Restoration is the Next Step.

The plan for further telephone restoration is as follows:

A. Tokyo.—During the fiscal year 1925 the five centrals, Kyobashi, Kanda, Honjo, Shitaya and Kayabacho, will be re-opened with A.T.M. Co.'s Automatic equipment. The completion of these offices will permit the remaining 16,500 subscribers to be restored to service, and in addition a total of 12,274 subscribers located temporarily in manual offices will be cut over to the automatic offices. The greater part of the switchboards for the new offices have arrived; the new buildings will be completed in the near future, and it is expected that they can be opened in accordance with the following schedule:

Centrals	*Date*
Kyobashi	Jan. 1926
Honjo	,, ,,
Kayabacho	Feb. ,,
Shitaya	March ,,
Kanda	,, ,,





Honjo Automatic Telephone Station

Front View of Line Switch Board **Side View of the Selector Board**

It is further planned that during the fiscal year 1926 four other central offices, Kudan, Nihonbashi, Marunouchi and Shiba, all equipped with automatic apparatus, will be opened, and a total of 12,162 existing subscribers located temporarily in other centrals will then be cut over to them. All of the subscribers served from the temporary Ote office will be included in those transferred to the automatic offices and Ote will be closed. As a final result of the restoration the figures will accordingly be: Nine manual exchanges serving a total of 46,737 subscribers; nine auto-exchanges serving a total of 37,263 subscribers. It is expected that the number of subscribers served by each automatic office at the end of the fiscal years 1925 and 1926 will be as follows:

Fiscal year 1925.

Centrals	*No. of Subscribers*
Kyobashi	6,068
Honjo	5,676
Kayabacho	2,919
Shitaya	5,832
Kudan	3,499
Total	25,101

Fiscal year 1926.

Centrals	*No. of Subscribers.*
Kudan	3,515
Shiba	2,524
Marunouchi	2,373
Nihonbashi	3,631
Total	12,162

B. Yokohama.—It is expected that two offices, Honkyoku and Chojamachi, will be opened in March 1926 with Siemens and Halske automatic equipment. The completion of these offices will provide for restoring service to 6,340 subscribers, and in addition the 4,260 subscribers which have been served from the temporary office will be cut over to these new offices, the temporary office being closed.

C. Toll Lines.—In Tokyo the 40 remaining toll lines will be restored to service during 1925. It is expected that a new B.C. toll board will be completed during 1926 and all toll lines will be cut over to it.

In Yokohama a new common battery toll board will be opened during the fiscal year 1925. All operating toll lines will be cut over to it and service will also be restored on the 38 lines remaining out of service until that time.

Extension of Cable Plant.

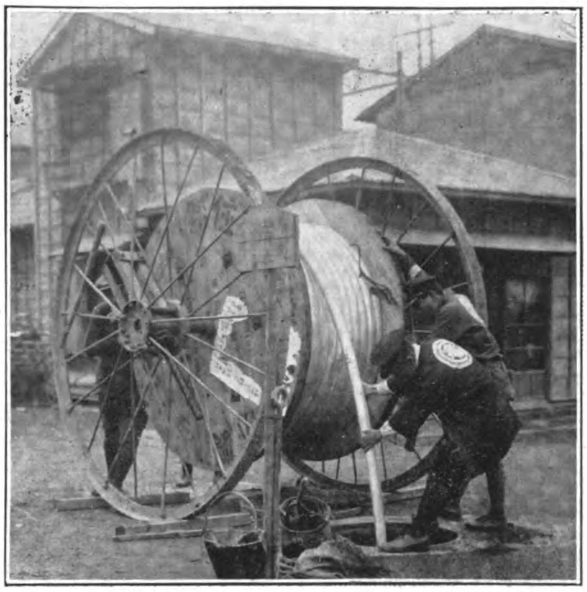
Before the earthquake the area of the streets in the cities of Tokyo and Yokohama was only about 12 per cent. of the total area as compared with 20 per cent. in many of the cities of other countries. For years the necessity of widening the streets has been considered most urgent. The reconstruction of the cities at this time offers a chance to care for this necessity by changing the street contours and widening and improving the road surfaces. Such changes in streets will involve extensive changes in the Government-owned telephone and telegraph line plant.

In carrying out these changes it is essential that provision be made in the underground plant to care for future development as determined by fundamental plan studies. In this way the cost of the plant over a period of years is kept to a minimum, and also the repeated digging up of the streets, with the consequent blocking of traffic, is avoided as far as possible.

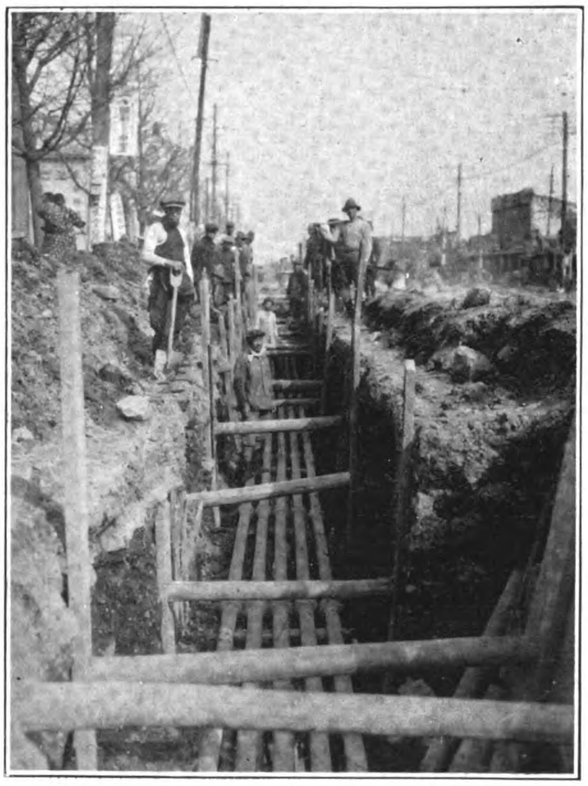
As a safeguard in the future against damages such as were experienced in the recent disaster it is planned to use, in the main parts of the cities, fire and earthquake-proof buildings which will greatly improve the cities' appearance. Consistent with these plans it will be desirable to abolish as far as possible the use of aerial wire distribution by placing the wires underground. For example, in a location such as the Marunouchi district the distributing plant should be entirely underground and aerial distribution completely done away with. Aerial toll entrance lines should be completely replaced by underground cable, thus avoiding interruptions to toll service which now frequently occur, due to the necessity of removing pole lines to care for the development of suburbs.

Adoption of Automatic Exchange System.

Technically and economically the automatic telephone system has proved itself successful. Before the disaster difficulty was being experienced in the larger cities in securing and training operators for the manual switchboards. In Tokyo it was estimated that about 10,000 operators would shortly be required, and it was expected that so large a force would be extremely difficult to maintain. The automatic system was being studied in Japan as a means of relieving this situation and as an improvement in telephone service. A small experimental installation was in operation in the Department of Communications.



Drawing Cable into Ducts



Laying Telephone Cable Ducts Under Street

Cable Laying Over Bridge

In a large multi-office exchange area such as Tokyo it would, of course, have been impracticable to replace all the manual offices with automatic equipment at one time, due to the extremely high first cost of the automatic equipment and the great loss involved in abandoning the manual switchboards before they neared the end of their useful life.

The principal objection to the introduction of automatic equipment, one office at a time, in such an area is the high cost of arranging all the manual switchboards for interchanging calls with the relatively few subscribers served from the automatic equipment.

In considering the type of equipment to be used for restoring the plant destroyed by the earthquake disaster the above objections to automatic equipment have disappeared, while all the advantages remained. There was, of course, no question but that it would be more economical to install automatic at once than to restore the plant on a manual basis and later replace it with automatic equipment in order to meet satisfactorily the public requirement for service improvement or because of economic necessity.

The quantity of telephone material required for the reconstruction work was so large that most of it could not be obtained in Japan, regardless of the type decided upon. In view of all these favorable factors it was decided to proceed with the permanent restoration on an automatic basis.

Trunking Scheme in Tokyo.

As stated above, nine manual offices will remain in service after the

completion of the restoration program, and it will accordingly be impracticable to place the entire Tokyo exchange on an automatic basis at once. Call indicator switchboards will be installed for completing calls originating in automatic offices for manual office subscribers. The method of operating these switchboards is considerably different from any now in service in this country, and careful attention must be given to the proper training of call indicator operators in order to insure high-grade service.

With the numbering scheme adopted, each subscriber's number will consist of six digits, the first two being used as an office name or designation, and the last four being the subscriber's number. The Tokyo exchange area is divided into seven districts. When the reconstruction work is finished there will be from two to four offices in each district. However, this number will, of course, increase as the exchange grows. The following table gives the details of the district and office numbering scheme.

District and Office Numbering Scheme.

Offices	*District Numbers*	*Office Numbers*
Marunouchi	—	3
Nihonbashi	2	4
Kanda	—	5
Kudan	—	3
Ushigome	—	4
Yotsuya	3	5
Aoyama	—	6
Shiba	—	3
Takanawa	4	4
Kyobashi	—	6
Ginza	5	7
Kayabacho	—	6
Naniwa	6	7
Honjo	—	3
Sumida	7	4
Shitaya	—	3
Asakusa	8	4
Koishikawa	—	5

The digit being omitted on account of liability of sending false impulse, the digits from 2 to 9 are applied for both district and office numbers. As the final capacity of an automatic exchange is 10,000 lines, it is not necessary to change this 6 digit system until subscriber lines increase up to about 800,000 in Tokyo.

Total Expenses for Restoration.

The total expenses required for restoration of telephone equipments amount to the enormous sum of 102 million yen, of which 12 million yen was invested in the emergency repairs just after the disaster and 90 million yen is divided for the years 1924, 1925 and 1926 as follows :

1924.	1925	1926	Total
thousand	yen	thousand	yen
34,101	36,652	19,247	90,000

The principal reason of such an extraordinarily large sum as shown in the above table is to have to restore many subscribers temporarily in other existing exchanges and afterwards to cut them over to their own exchanges opened with automatic system. And otherwise it is also due to the restoration scheme laid out not only for recovering into original state, but also for future development.

Conversion of P. B. X. from Manual to Automatic.

The adoption of automatic equipment for telephone exchanges in Tokyo and Yokohama, which is an epoch-making step in the development of the telephone service in Japan, has attracted the attention of large P.B.X. users to this type of equipment. In Tokyo and Yokohama, and also in Osaka and other large cities, many large firms are considering the adoption of automatic P.B.X.'s as a means of improving their service from the standpoint of speed, privacy and accuracy. In many instances it is also expected that, even though the initial cost is high, the installation of automatic P.B.X. equipment will prove economical.

Some of the larger P.B.X. users have already placed orders for automatic equipments to replace the manual boards now in use.

" Adosole " Dessicating Plants.

Automatic telephone equipment comprises many small and delicate parts, many of which must be electrically insulated from each other, and it is essential that this insulation be maintained at all times. Special attention must be given this point, particularly where high humidity conditions prevail as in this country.

" Adosole " dessicating plants, which are inventions of the Physical and Chemical Research Institute of Tokyo, will be installed at each automatic office in Tokyo. These plants are used not only to keep the air dry in the equipment rooms, but also for cooling or heating the building.

The principal elements of an " Adosole " plant are as follows :

" Adosole " tower holding ten tons of " Adosole " refresher, air blower, air cooler, air dryer, and dry air supply pipes. The plants are designed to give the following control in the building :

(*a*) With the temperature of the open air at 95°F, the temperature of the air in the test and switch rooms is kept below 85°F at a relative humidity between 60 and 70 per cent.

(*b*) With the open air at 20°F the temperature of the test and switch rooms will be maintained at 60°F.

(*c*) During the rainy season, with the relative humidity of open air at 90 per cent., the relative humidity of the test and switch rooms is kept between 60 and 70 per cent. by lowering the temperature.

Lessons Learned from the Disaster.

Most brick manholes were seriously damaged by the earthquake and it is believed that concrete construction should be adopted.

In localities where the soil bed is soft special attention should be given to providing suitable foundations for underground conduits.

Where possible, conduit routes should not be on riverside roads. Where conduits must be placed in such roads they should be located on the side of the road away from the river.

Since wood poles are liable to be burned, and because their life is relatively short, fabricated iron poles of simple triangular section will be adopted.

Radio Telephones for Japanese Ports

While radio broadcasting has been attracting such unprecedented attention in Tokyo, other parts of Japan have been making strides in the same direction, it is indicated by the announcement that the Port of Kobe is to facilitate communications between the harbor and vessels at sea by connecting the radio on board the ships with the telephone service in the port . The wireless telephone service will be used by Kobe residents to call up their friends at sea, or to broadcast programs to vessels in the harbor. In stormy weather the port of Kobe will inform ships at sea of their position and give other advice relating to the weather and the ocean currents.

The Department of Communications plans to establish a similar service at each of the large ports.

The original apparatus installed for this purpose at the port five years ago was a temporary machine and had a number of defects in operation. To make the service more satisfactory the Municipality has been constructing two towers, one on the roof of the Motocho office and the other in the compound of the central post-office. Better equipment is being installed to allow the service to expand.

The new plant will be in operation in August, when it is expected to be able to talk not only with vessels at sea, but with individuals in Akashi City to the west and those in Osaka and Kyoto in the east. The service will be expanded even to vessels passing through the Kwannon Straits and to those passing off the shore of Tosa, in the south-western province of Shikoku.

The primary function of the wireless service will be to determine the actual hour of the arrival of incoming vessels at port. The system was established at the request of the shipowners and business firms who have large importing and exporting transactions. The number of vessels who have entered into harmony with the organization of the new service now totals 1,215.

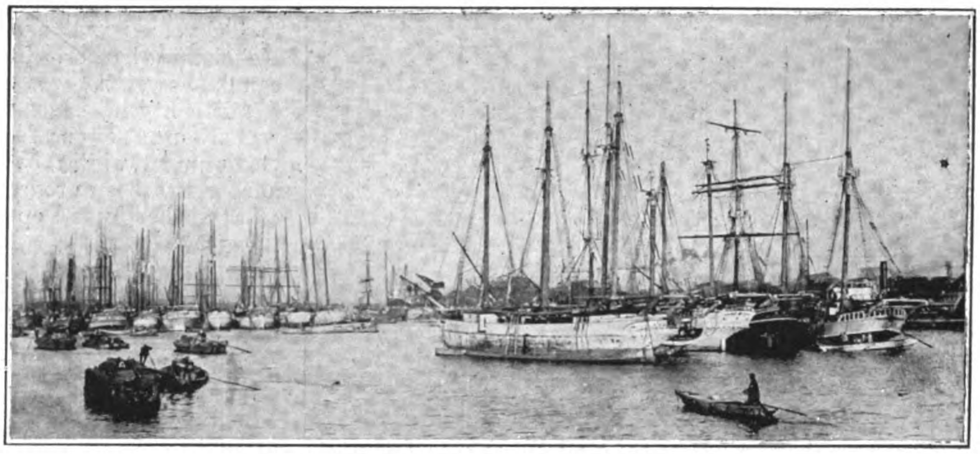
Befor the impending improvements the wireless communication service transmitted no less than 120,000 communications from shore to sea during the past year. Only 68 vessels had joined the service last June, and the number has grown steadily since. It is expected to exceed its present total as soon as the improved service, including radio transmission, becomes available.

The Key to Tokyo's Future Prosperity

The Harbor Extension and Tokyo-Yokohama Canal Plans

IN less than twenty-five years the entire Tokyo Bay foreshore from Yokohama to the Sumida, and from there to the mouth of the Arakawa Flood Prevention Canal, will be one continuous stretch of improved harbor. Docks, wharves, warehouses, factories and other improvements erected on reclaimed ground, protected by breakwaters and connected by deep-water canals, will as completely change the present aspect of the shore line as the opening of Yokohama to foreign trade has transformed in fifty years a salt-water marsh into the premier port of Japan. As we piece together the various schemes for the extension of Tokyo's harbor facilities and fit them in with the plans of the Tokyo Bay Reclamation Company at Tsurumi, where they merge with those of the Yokohama Harbor Board, it is not difficult to visualize the realization of the above picture. When we consider that the plans for building and expanding the present metropolis into a Greater Tokyo are based on an estimated population of seven millions, whose necessities of life must be brought from other parts of the empire by water, and that the costs of living will be largely determined by the cost of delivering these products at the water entrance to Tokyo, it requires no undue prescience to predict that the picture will come true.

It must come true, or the future expension of the capital will be checked and its prospects of developing into an industrial center effectively killed by exorbitant transportation, landing, lighterage, wharfage and warehouse charges on all necessities of life, merchandise and raw products. With a population increasing at the rate of 700,000 a year and pressing into the cities to seek a livelihood that is no longer possible to gain in the country, every facility must be provided by the authorities to meet this increasing demand for employment and keep down the costs of living. One of the greatest factors in this struggle for existence which confronts the people of Japan will be their ability to lower the present exorbitant scale of prices in the metropolitan district by reducing to a minimum the charges on all raw materials that will enable them in part to successfully compete with other nations in the markets of the world for the sale of their manufactured products. If this cannot be done, industry will move away from Tokyo and seek locations where these deep-water facilities are obtainable. This is just what is happening to-day in the Tsurumi and Kawasaki districts nearer to Yokohama.



THE SUMIDA RIVER AT TSUKISHIMA.
The Necessities of Life for the Metropolis are carried from all parts of the Empire on Small Coasting Vessels Discharging their Cargoes along the Sumida River Waterfront

That this truth is fully realized by those who direct the destinies of the city is seen in the many schemes put forward from time to time to improve and expand the harbor facilities. Like all other vast public improvements that interfere with or abolish ancient privileges and vested rights, every attempt so far to lighten the burden on the city of Tokyo has been met with the stubborn resistance of those interests which have waxed powerful and grown rich from the transportation tolls levied on practically every article entering the capital. The rise of Tokyo to the position of even a second-rate coastwise port permitting the entrance of 4,000 to 5,000-ton ships will deprive Yokohama of the large, fat and juicy squeeze now levied on all merchandise entering Tokyo from the sea and the still more handsome profits from lighterage charges which average more than the steamer freights from foreign countries. No city so situated can hope to escape from paying tribute unless drastic action be taken to free itself through the creation of modern harbor facilities, or in the event this is not immediately practicable, then all lighterage transportation should be taken over by the city and operated for the benefit of the people.

Tokyo to-day is by far the most expensive city in the world to live in. People pay more and get less for their money than in America, the land of high prices and standards of living. All this is traceable to the archaic conditions surrounding the transportation, landing, marketing and distributing system and the consequent heavy charges levied on all necessities of life. There may be a way to ameliorate this situation, but it would seem to the outsider that either the authorities must develop the harbor so that the largest coastwise steamers can warp alongside the piers, or nationalize or municipalize the lighterage business and operate it as a public utility in connection with the central markets, city canal system and motor delivery to the retail shops. Instead, however, of tackling the problem from this angle, the authorities seem to be reluctant to injure the lighterage business and the vested interests of Yokohama and are trying to compromise by starting immediate work on the construction of the much-talked-of Tokyo-Yokohama canal, which perpetuates the lighterage hold on the metropolis.

The plan for the canal was advocated years ago because of the constantly expanding traffic between the port and the capital and because transportation by water has been regarded as inadequate.

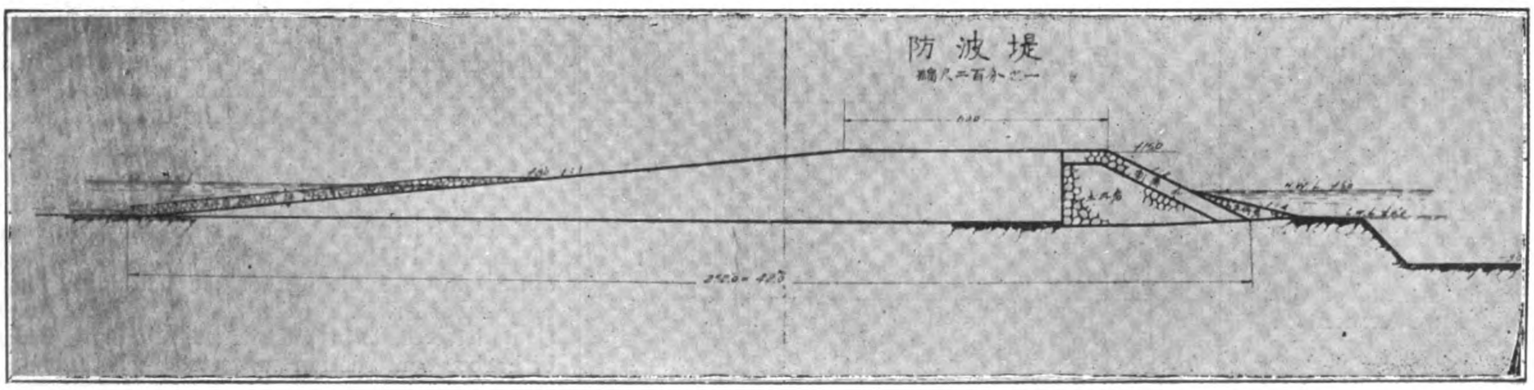
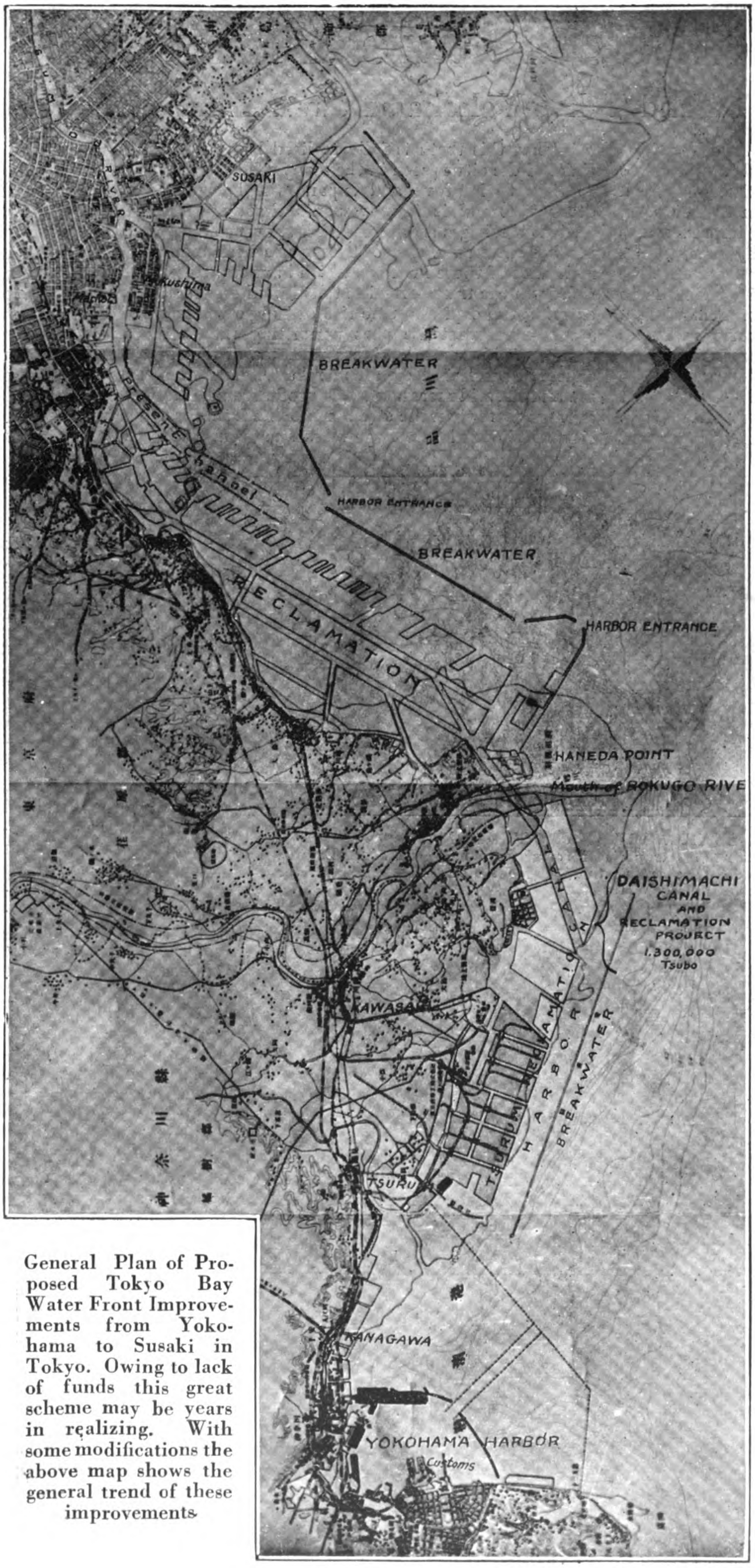


Fig. 1.—Type of Breakwater for Tokyo Harbor Construction



General Plan of Proposed Tokyo Bay Water Front Improvements from Yokohama to Susaki in Tokyo. Owing to lack of funds this great scheme may be years in realizing. With some modifications the above map shows the general trend of these improvements.

Approximately 80 per cent. of the merchandise landed at Yokohama from foreign and other Japanese ports must be trans-shipped for Tokyo, and about the same percentage consigned to Tokyo by train has to be forwarded to Yokohama. Of all the freight thus exchanged only 10 per cent. is transported by train.

Thousands of sailboats and lighters operate between the two points, but the constant delays and the damage frequently suffered in following the crowded water routes render the traffic unsatisfactory. Freight rates are out of proportion to the distance, and the costs of the commodities thus exchanged have been advanced accordingly.

A plan for the construction of the canal was proposed by the Reconstruction Board immediately after the great earthquake and fire, when building materials were urgently needed in Tokyo, at a time when 60 per cent. of the lighters engaged in this traffic were destroyed. In compliance with the Government policy for financial retrenchment the original plan was rejected. This program included the construction of a harbor in Tokyo, as well as the reconstruction of the Yokohama harbor. The part providing for the canal, however, was struck out. The Tokyo Municipality has since been engaged in rebuilding its harbor out of city funds and with the aid of the Government, while the reconstruction of Yokohama harbor has been progressing through the separate effort of the Home Department.

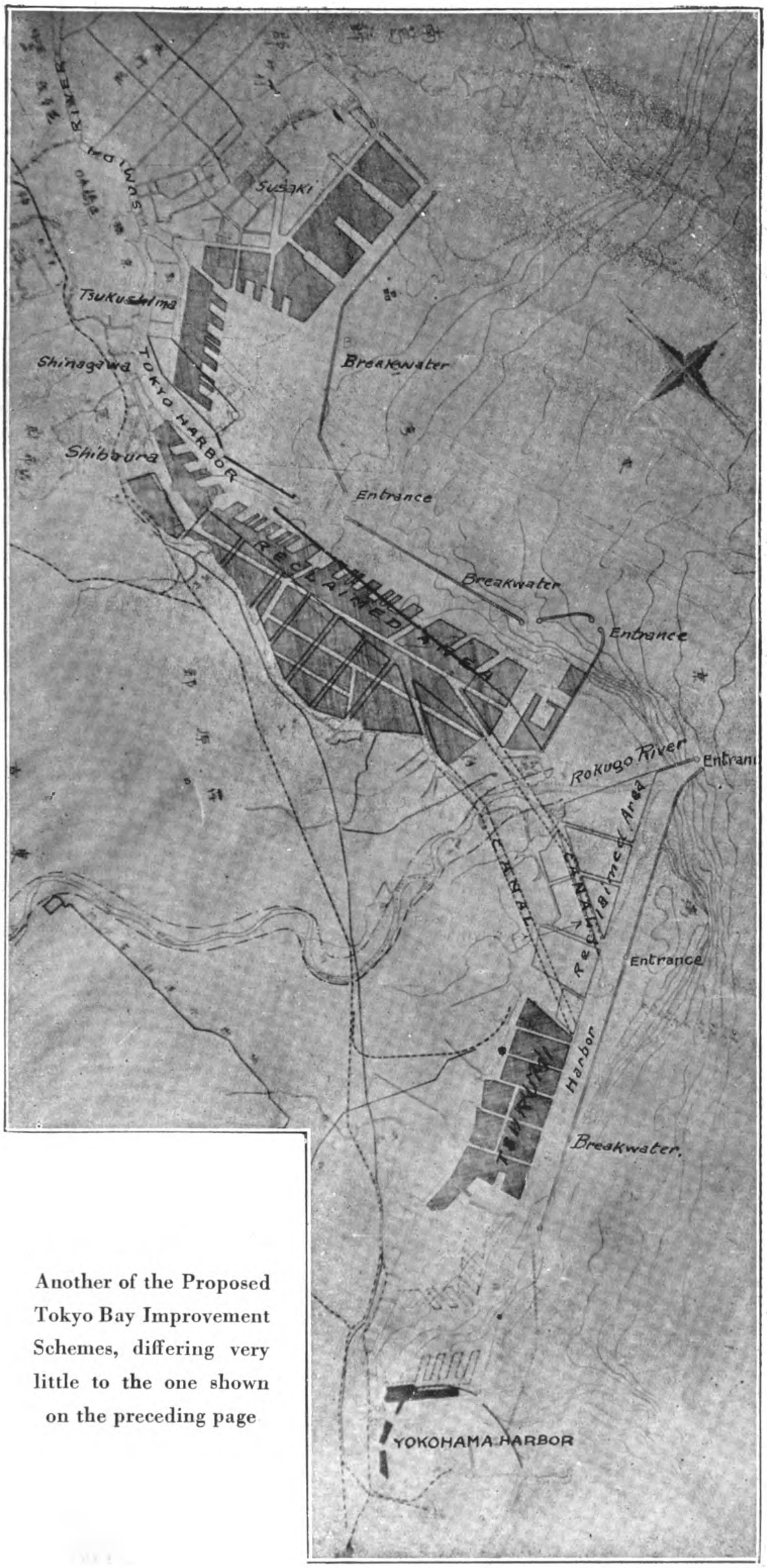
In view of the progress made in the construction of both harbors, the Government is now said to be inclined to favor the canal project in order to improve the freight transportation service.

In the earlier plan Y.17,000,000 had been estimated as the cost, but this is now increased to Y.20,000,000. The profit from the canal is estimated at Y.3,000,000 per annum in addition to the income to be derived from disposing of 560,000 *tsubo* of reclaimed land. If this can be sold at the low rate of Y.25 per *tsubo*, the total amount earned would aggregate Y.14,000,000.

The completion of the work would mean an end of the inconveniences to shippers occasioned by the unforeseen delays in the traffic. It is reported that twice during the past year water communication has been interrupted by storms, which take a heavy toll in lives and damage to the cargo. During the past two years 51 vessels carrying 5,100 tons of cargo were lost. Because of these adverse weather conditions, the lighters can make only 36 trips a year. The insurance rates, it is pointed out, would be lower, because of the comparative safety of the voyage.

Assured that the construction costs will be more than repaid from the sale of reclaimed land, and that the canal tolls would materially add to the revenues of the city, the Department of Home Affairs, having control over river and harbor improvements, has prepared a bill for presentation to the next session of the Diet asking for an appropriation of Y.20,000,000 to proceed with the scheme. It is estimated that construction will take four years, its completion synchronizing with the termination of the five-year general reconstruction program.

The project of a new harbor for Tokyo dates as far back as 1885, but owing to political reasons the approval of the Imperial Government was not obtained until 1911. In 1889, in accordance with a proposal of Dr. K. Furuichi, the City Improvement Committee made investigations concerning a plan of harbor construction suggested by M. Lenot, a



Another of the Proposed Tokyo Bay Improvement Schemes, differing very little to the one shown on the preceding page

French engineer; but as the improvement of the waterworks system was then under way and ought first to be completed, the plan was postponed.

Again in 1890 the then mayor of Tokyo, Mr. H. Matsuda, decided to meet the expense for harbor improvement from the city improvement fund with the consent of the Committee; and Dr. Furuichi and Dr. H. Nakayama were appointed to draft a plan for the work, which when completed was estimated to cost Y.41,000,000. The plan was passed by the City Council and received the approval of the City Improvement Committee. Accordingly a Harbor Works Investigation Committee was created and commissioners nominated to go thoroughly into the matter. In July of the same year the mayor asked the Minister of Home Affairs to advance Y.12,000,000 from the treasury by way of making a beginning. The petition, however, lay neglected for some years.

In 1896 the Committee decided to prepare its plans on a smaller scale, reducing the estimate to Y.35,700,000, and conferred with the governor of Tokyo prefecture with regard to the execution of the plans, but without any definite result. Prospects at once became more hopeful when Baron Sakatani became mayor of Tokyo, and in 1913 he presented a scheme designed by Dr. R. Naoki involving an estimate of Y.20,000,000, and in March the Committee voted the new plan.

There have been several schemes proposed from time to time since then for the improvement and expansion of Tokyo's harbor facilities, most of which have been discarded. We reproduce the plans of the two most important projects in order to show the ultimate scope of the work. One of these covers the comprehensive harbor scheme devised under Viscount Goto's term as mayor of Tokyo, calling for the huge expenditure of Y.350,000,000, spread over a period of thirty years. In this scheme the entrance to the harbor is off Haneda Point, where the Rokugogawa (Tama) empties into the sea. The breakwater was to extend for ten miles to a point near where the Nakagawa (now the Arakawa Flood Prevention Canal) empties into the bay. The Shibaura waterfront was to be improved for about 3½ miles, with warehouses and other facilities, transforming the district into a foreign trading quarter. The following details give a general idea of the scope of this scheme:

Total area of port	9,854,300 *tsubo* (approximately 8,200 acres)
Total dredged area	9,174,550 *tsubo* (approximately 7,600 acres)
Depth of anti-port ..	from 30 to 40 *shaku* (one *shaku* equals 11 inches)
Area of anti-port	419,200 *tsubo* (approximately 350 acres)
Depth of channel ..	from 12 to 36 *shaku*
Area of channel	3,959,250 *tsubo* (approximately 3,300 acres)
Depth of harbor ..	from 12 to 40 *shaku*
Area of harbor	2,894,900 *tsubo* (approximately 2,400 acres)
Depth of lighter harbor ..	8 *shaku*
Area of harbor	166,500 *tsubo* (approximately 138 acres)
Depth of canals connecting reclaimed lands	6 *shaku*
Area of the above canals ..	932,500 *tsubo* (approximately 770 acres)
Total area of reclaimed land ..	8,574,400 *tsubo* (approximately 7,100 acres)
Length of breakwater ..	8,230 *ken* (approximately 51,850 feet)
Total length of piers	12,944 *ken* (approximately 814,500 feet)

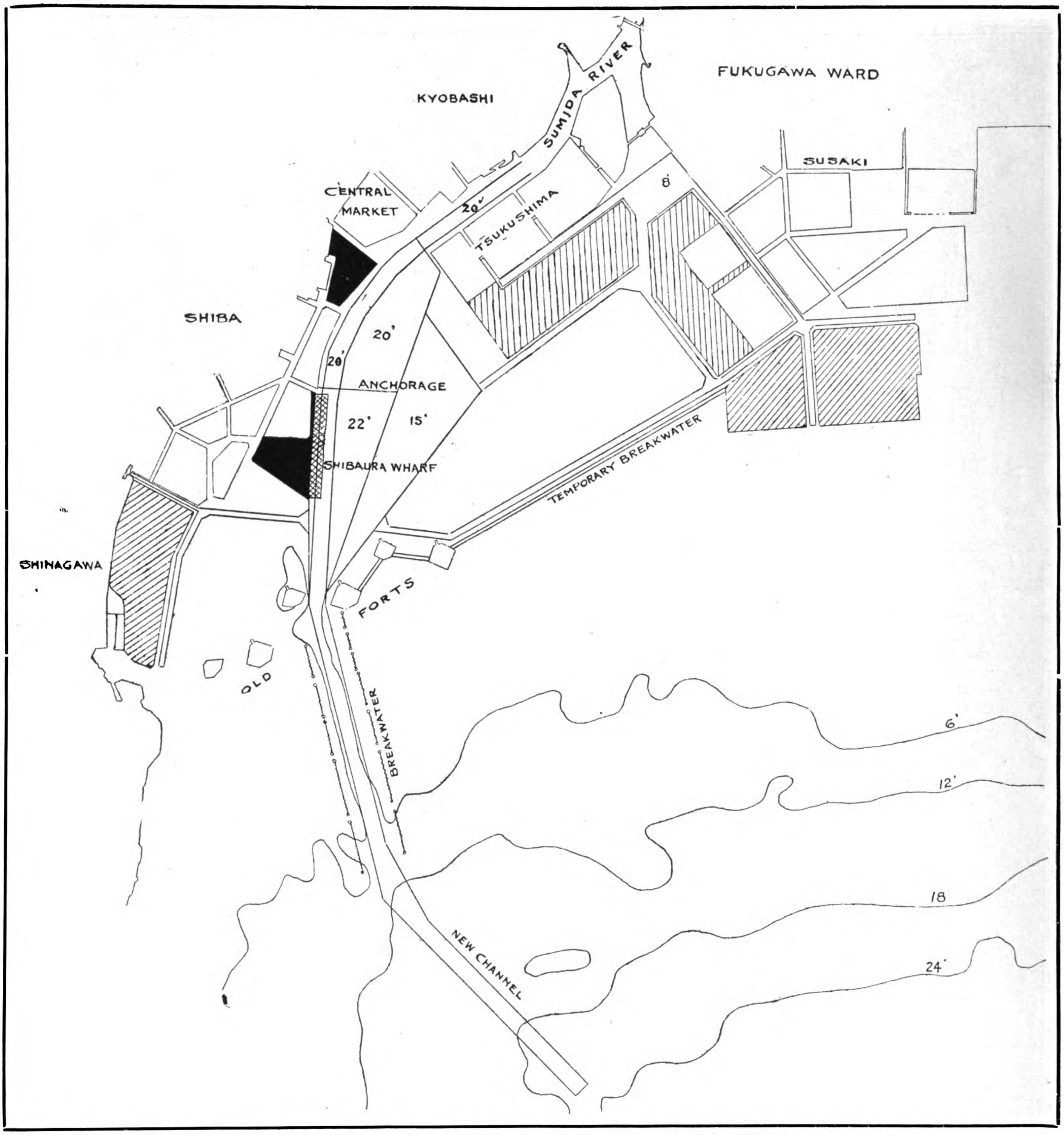


Fig. 3.—PRESENT CONDITION OF TOKYO'S HARBOR SCHEME

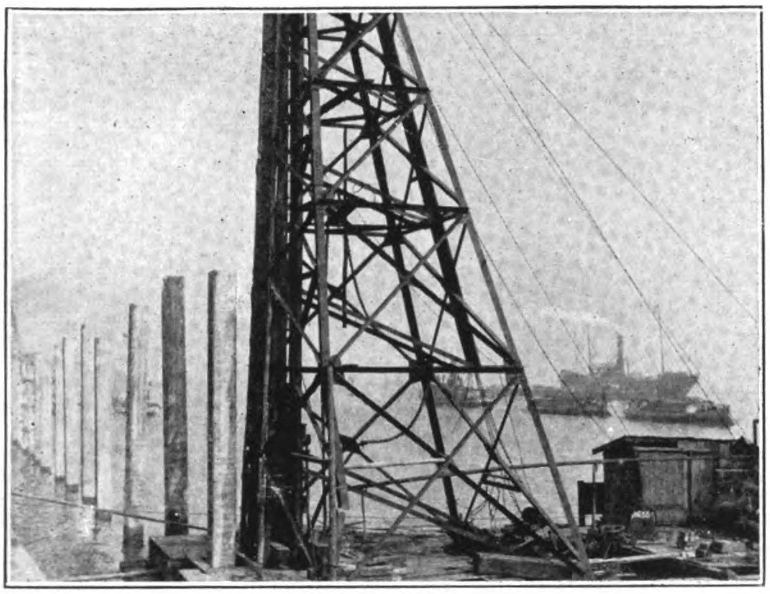
Black: Completed Reclamation; Shaded Parts: Reclaimed Areas one-half completed: Anchorage and New Channel, Dredging now going on

Effective length of piers .. .. 10,197 *ken* (approximately 641,000 feet)

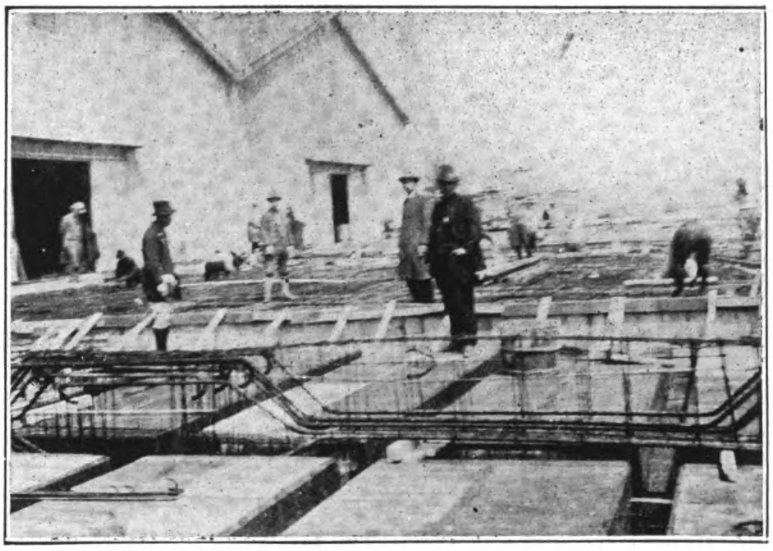
Total length of cargo loading and discharging wharfs .. .. 14,294 *ken* (approximately 900,500 feet)

At the mouth of the Sumidagawa piers for passenger boats will be constructed. Somewhere in the Tsukishima or the Etchujima districts a railway station to handle freight from the north-eastern parts of the mainland will be erected. The reclaimed land, between Nakagawa and Nakajima, is to be used for ship-building yards and factories. The rent on these lands is calculated by the Tokyo municipal authorities as an important source of revenue with which the cost of constructing the harbor will be met.

This elaborate scheme fell through for lack of funds, and the demand on the treasury for other urgent reconstruction work has compelled its abandonment. Nevertheless, this plan may be accepted as the basis for future harbor expansion, a guide to be followed as far as the funds will permit. A new and less pretentious plan has since been drawn, eliminating the pier construction and shifting the harbor mouth to a point off the Omori foreshore, as shown on the



Shibaura Harbor



Large Sheds on Quay at Shibaura

map. Even this plan is too costly for the city to undertake with its present limited finances, so a much smaller program is now actually being executed with the funds available.

For this purpose the sum of Y.6,800,000 was appropriated in 1922 to deepen the mouth of the Sumida river. The demands on the harbor facilities following the earthquake impressed the authorities with the inadequacy of this step to meet the demands of the shipping, and a further Y.12,200,000 (a total of Y.19,000,000) was appropriated last year to cover further improvements up to 1931. On these limited funds the city is now carrying forward the harbor work as outlined in Figure 3.

The plans provide for dredging a 22-feet channel from the Shibaura wharves out between the third and fourth forts into the bay for a distance of 13,500 feet, following the present channel for 10,320 feet, and from there on a new channel will be dredged for the remainder of the distance. This will enable a limited number of 5,000 to 6,000-ton vessels to come alongside the Shibaura wharves. Inside the breakwater an anchorage of varying depth is to be dredged. From the fifth fort north to Tsukishima, as shown in the plan, an area of 745,300 *tsubo* will be dredged, 287,800 *tsubo* of which will have a depth of 15 feet in order to accommodate 40 vessels of 500 to 1,000 tons. Another adjoining section will be sub-divided; the first, covering 225,400 *tsubo*, will be dredged to 20 feet, and the other, covering 207,000 *tsubo*, to 22 feet. This anchorage will accommodate 29 vessels of 1,000 to 3,000 tons. At Shibaura the depth will be 25 feet, permitting six 5,000 to 6,000-ton ships to moor alongside the wharf, which is to be 3,000 feet long. The harbor will be protected by a temporary breakwater of the type shown on Fig. 1, extending from the fourth fort to a point on the reclaimed land off Susaki.

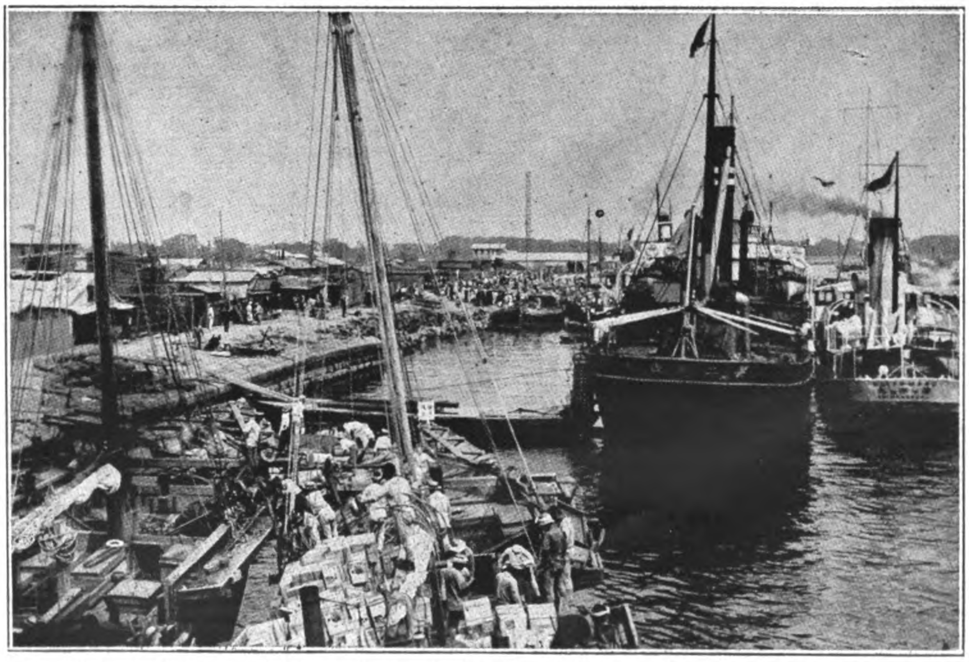
It is estimated that the soil dredged from the channel and anchorage will provide 2,549,877 cubic *tsubo* for reclaiming the seven sections shown on the plan, Fig. 3. The new land will be twelve feet above datum and protected with heavy piling and bulkheads. The 1st area is 41,460 *tsubo*; 2nd area 57,700; 3rd, 181,723 *tsubo*; 4th, 143,612 *tsubo*; 5th, 326,708 *tsubo*; 6th, 277,634 *tsubo*; and 7th, 123,200 *tsubo*, a total of 1,062,037 *tsubo* that will be sold at a minimum of Y.25 per *tsubo*, providing a revenue of over Y.40,000,000.

It will be seen from this brief outline of these plans that a very small part of the more important scheme is being carried forward. There is still a vast amount of valuable reclamation work in straightening out the shore line from Shibaura to Haneda Point, and still another equally important addition from there south to the limits of the Tsurumi Reclamation. The Keihin or Tokyo-Yokohama canal is in reality a waterway protected behind the breakwaters except for that part where it crosses the mouth of the Rokugo river.

Present Program

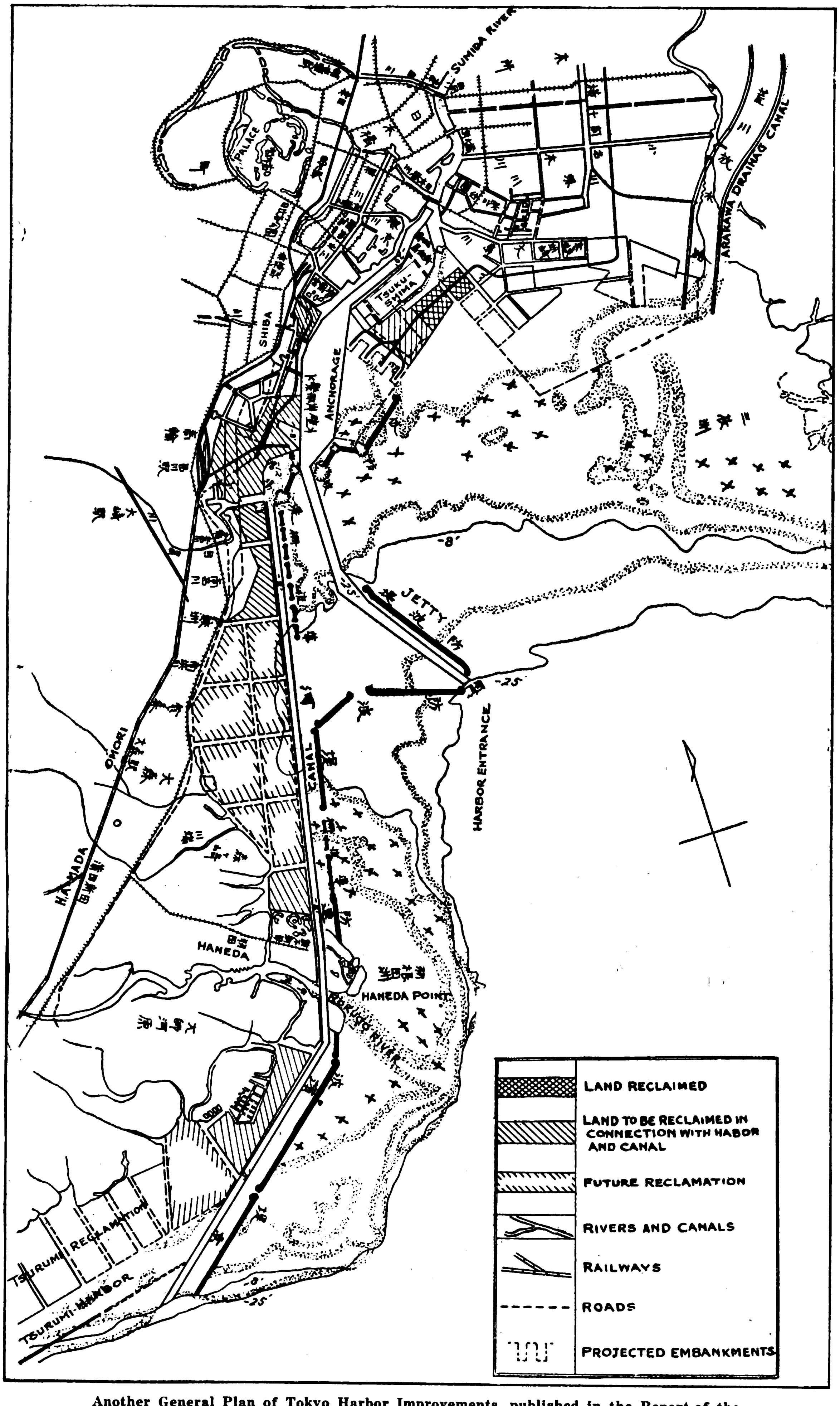
The Japan Advertiser of June 19 says that an additional appropriation amounting to Y.12,210,000 for the construction of a harbor for Tokyo capable of docking ocean-going liners has been decided upon by the Municipal Assembly in order to carry out the program on a larger scale, with the aim of completing the harbor in 1932. The original sum set aside for the purpose was only Y. 6,800,000.

Investigation has revealed that the Municipal treasury alone, being already burdened with the work of rebuilding the city of Tokyo, will be unable to meet the entire appropriation. Consequently the city is expecting to receive a subsidy from the Government and Mr. Tanuma, one of the deputy mayors of Tokyo, has already opened negotiations to that end with the Government authorities. The request from the Municipality is said to have received a warm welcome from the officials of the Department of Home Affairs, who are planning to make an investigation of the new harbor scheme before rendering a formal decision as to the granting of the funds.



Tokyo's Antiquated Water Front. Unloading Relief Supplies at Shibaura Wharf immediately after the Disaster. Since then New Wharves and Warehouses have been built

The authorities of the Department are reported to be inclined



Another General Plan of Tokyo Harbor Improvements, published in the Report of the Reconstruction Bureau

to give a subsidy of several million Yen to support the project. Even prior to the announcement of the plan by the city authorities federal officials had discussed plans for the construction of a harbor for Tokyo in connection with the proposed digging of a canal between Tokyo and Yokohama. The Government, however, abandoned its original intentions when it saw the plans conflict with the project of the Municipality.

The reclamation work so far carried out has cost about Y.7,000,000, and the area of the reclaimed land is estimated at about 80,000 *tsubo*. There are still about 210,000 *tsubo* of land to be reclaimed along the shore south of Shinagawa station and near the site of the Shiba Imperial detached palace. The Municipality is planning to dispose of all land reclaimed in the course of the construction of the harbor at an average price of about Y.50 per *tsubo* in order to raise funds to carry on the work. The Government authorities consider the price expected by the Municipality to be a little too high, but a more thorough investigation will be made immediately, so that the Government may act intelligently in the matter at the end of next month, when the national budget for the next fiscal year is composed.

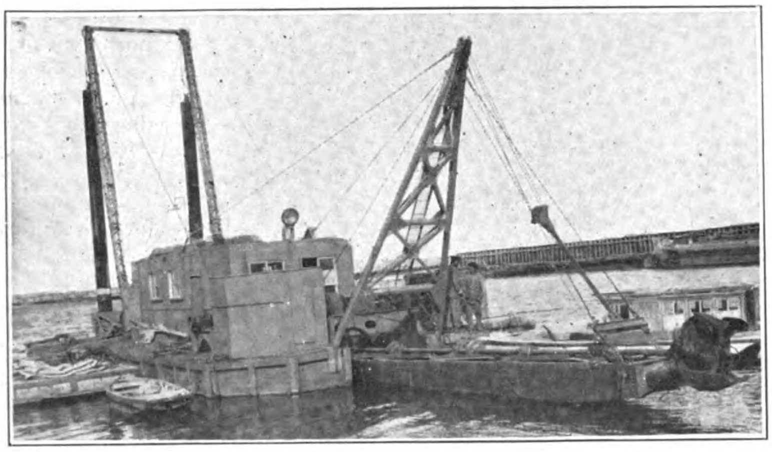
Shibaura Wharf

Tokyo will have a new pier at Shibaura by the end of June as a starter on the construction of the greater harbor plans here, according to a recent announcement by the authorities in charge of the work of building the new dock.

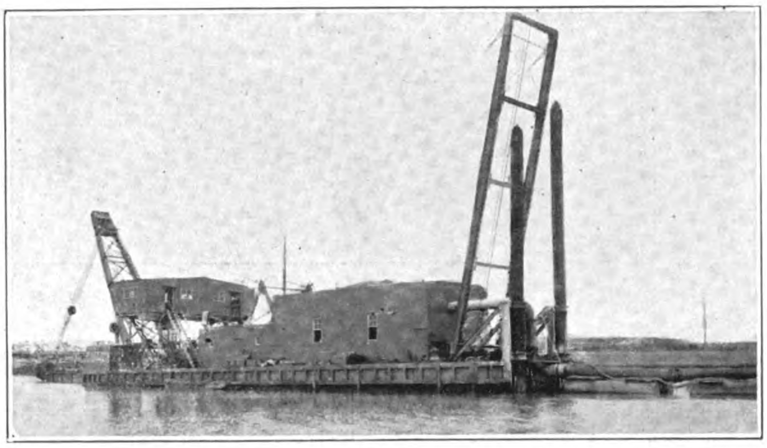
The length of the pier is 310 *ken*, and it is 7½ *ken* wide. When it is finished at least six vessels, each displacing about 3,000 tons, will have room alongside at the same time. A celebration marking its completion is planned by the Municipal authorities.

In the meantime the site for more land that is to be reclaimed in accordance with the harbor plans at the mouth of the Sumida river has been designated and has been submitted to the Department of Home Affairs for approval. The plan was revised at a recent committee meeting on harbor construction in the Municipal Assembly. It calls for the reclamation of 1,062,037 *tsubo* of land.

(Continued on page 432).



No. 4 Hydraulic Dredge



Hydraulic Dredge, "Suehiro Maru"

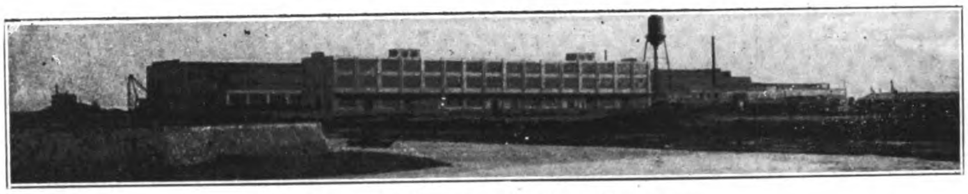
TSURUMI

Transforming a Swamp into a Modern Industrial Center

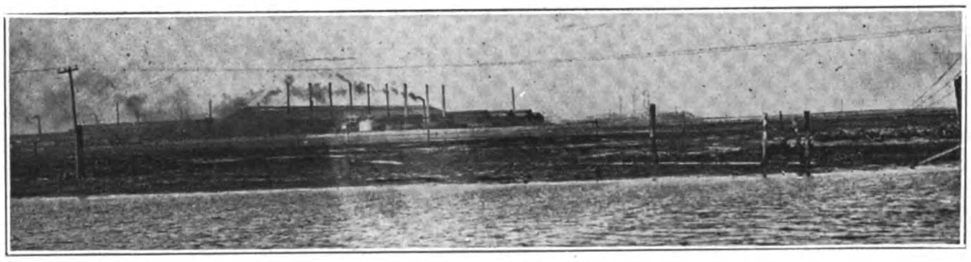
The Work of The Tokyo Bay Reclamation Company

THE delay on the part of Tokyo's Municipal authorities to provide adequate harbor facilities for promoting the industrial growth of the city has created a movement that is diverting the erection of new manufacturing plants to localities along the bay front with access to deep water where they will be freed from exorbitant unloading, lighterage and warehouse charges. Tokyo's unstrategic commercial location, unless rectified by huge harbor improvements, will be capitalized by Yokohama and Kanagawa. The future commercial greatness of Tokyo is so bound up in its harbor that unless up-to-date facilities are provided that will lower the charges on raw materials and essential food supplies the business men of Japan will meet the situation by developing a new deep-water industrial center in the vicinity of Yokohama.

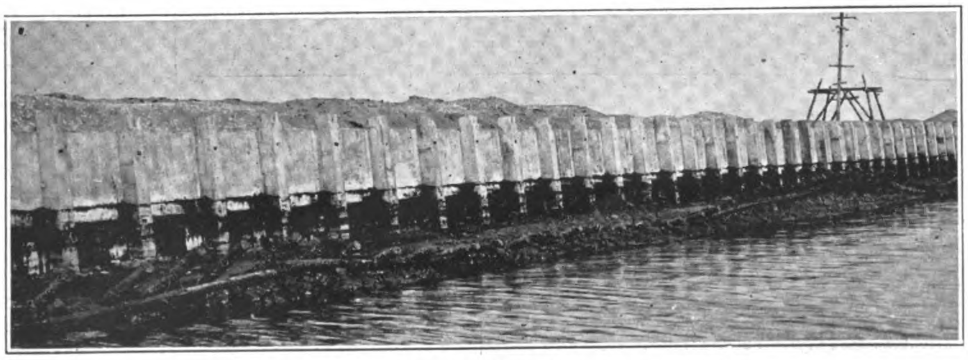
This idea was evidently in the mind of Mr. Soichiro Asano, the veteran shipping magnate of Japan, when he organized in 1912 the Tsurumi Reclamation Association for the purpose of reclaiming and improving the low-lying land at the mouth of the Tama river, near Tsurumi, converting it into an industrial district with deep-water shipping facilities. A million and a half *tsubo* was reclaimed by this Association before its work was taken over by a company organized for this purpose, called the Maichiku Kabushiki Kaisha. This company carried on until 1920, when it merged with the Tokyo Bay Reclamation Company, Ltd., which has continued the operations to date.



Shibaura Engineering Works at Tsurumi



Site Before Reclamation



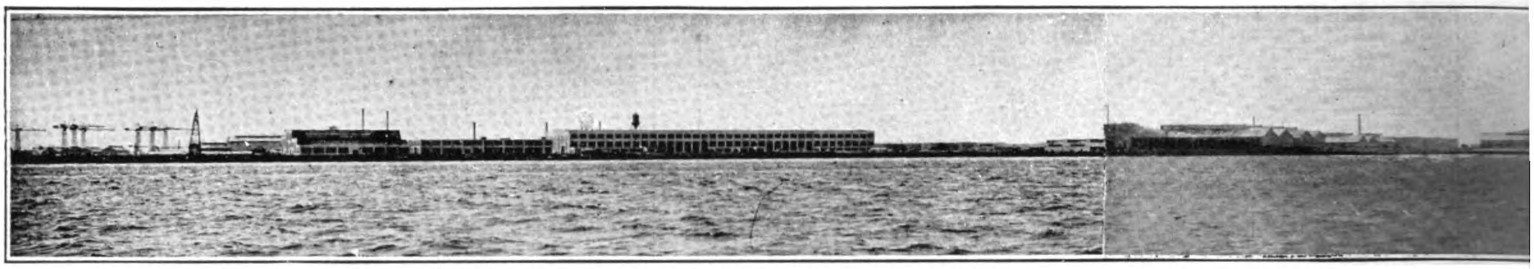
Reinforced Concrete Sea Wall Nearly Completed

On the sea side of this reclaimed area a protected harbor 1,500-ft. wide is being dredged to a depth of 30-ft. in order to provide anchorage for 10,000-ton steamers. To facilitate water transportation with all parts of the reclaimed area canals are being dug of sufficient width and depth to allow lighters and launches to come alongside the foreshore of the various industrial establishments erected in the new district to take advantage of this great saving in their cost of production.

The harbor itself will be 1,500-ft. wide and 13,560-ft. long, with a water surface of 600,000 *tsubo*. Up to within 180-ft. of the shore line the harbor will be dredged to a depth of 30-ft. at low tide, and an entrance channel of the same depth will be dredged for a distance of 5,060-ft. to the outer deep-water harbor at Yokohama.

The harbor will be protected on the bay side by a breakwater 13,560-ft. long, at a distance of 1,956-ft. from the shore line. The breakwater is being constructed (as shown in the accompanying plans) of concrete blocks laid on a rock foundation varying in form according to the depth of the water and carried to one foot above the highest tide recorded in Tokyo Bay.

The several reclaimed sections are to be cut by canals, as shown on the map, having a top width of 240-ft. sloping to



Asano Shipyards: Asano Steel Works: Shibaura Engineering Works: Standard Oil Co.:

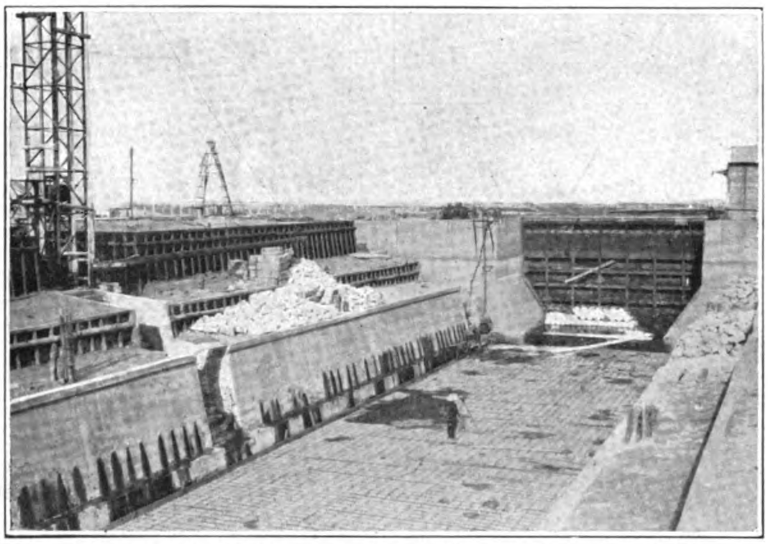
THE NEW TO

162-ft. at the bottom, with a depth of 10-ft. at low tide. These main canals will have a total length of 25,380-ft. The main canal leads into one that has been dug by the Keihin Electric Tramway Company for its own use. These canals are to be protected, as shown in the drawings, by employing a two-step bulkhead inthe 1st district, and in the others a concrete sea-wall type.

The reclaimed area is divided into nine districts. Districts 1 to 3 are not yet sufficiently advanced for erecting heavy buildings, but on No. 4 is found the splendid new plant of the Nisshin Flour Company. On the other extremity of this block will be erected a steam-generating plant with an ultimate capacity of 140,000 k.w. for the Tokyo Electric Power Company, a subsidiary of the Toho Electric Power Company, whose activities are described in another part of this number of THE FAR EASTERN REVIEW. On the other half of District 4 will be another steam generating plant with an initial capacity of 15,000 k.w. operated by the Nippon Electric Power Company, while just outside the reclaimed area, to the north of the 4th district, is located the plant of the Fuji Electric Wire Company.

On the harbor side of the 5th district is found the tank installations of the Rising Sun, Nippon Oil and Standard Oil Companies and the Oil Department of the Mitsui Bussan Kaisha. In the northern half of the 5th district is located the office of the Tokyo Bay Reclamation Company and the new works of the Ishikawajima Shipbuilding Company, and just outside the reclaimed area are the saw mills of the Akita Lumber Company.

Across the canal on the 6th district the great new plant of the Shibaura Engineering Works is in process of erection. This is also described in another part of this number of THE FAR EASTERN REVIEW. Next door are the up-to-date Asano Shipbuilding Yards, erected during the war at an enormous outlay of capital, and across the canal in the 7th district is the new plant of the Asahi Glass Company, the finest in Japan. Adjoining this is the installation of the Chiyoda Oil Company, and then comes a sawmill operated by the Asano interests.



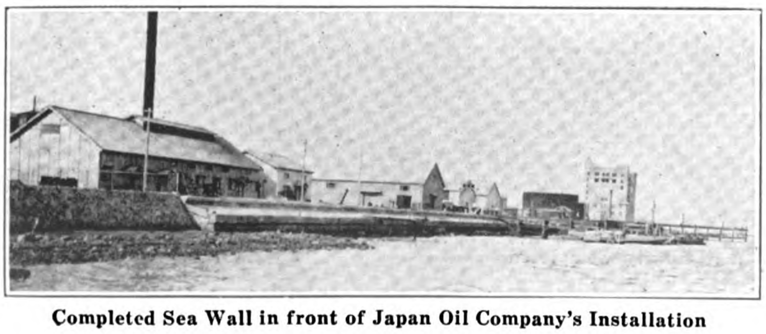
Asano Dry Dock at Tsurumi; Making Concrete Caissons for the Breakwater

Completed Breakwater

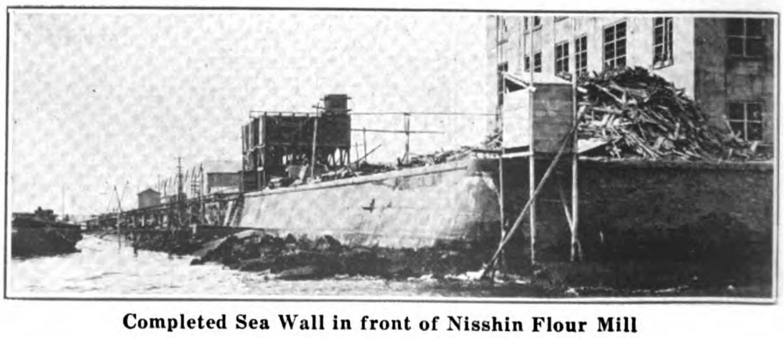
On that section of the reclaimed area known as Wakao Shinden are the works of the Japan Steel Tube Company, the South Manchuria Mining Department, and the Truscon Steel Company of Japan. To the east of these is found the plant of the Asano Cement Company, the largest in Japan, strategically located to supply the great reconstruction demands of the metropolitan district. Just north of this district is the Hamakawa transformer station of the Tokyo Bay Reclamation Company, receiving power from the company's own water plant in the Fuji district.

With this grouping of great industries in the Tsurumi district a start has been made that will be followed by other important factories seeking the facilities difficult to obtain in Tokyo.

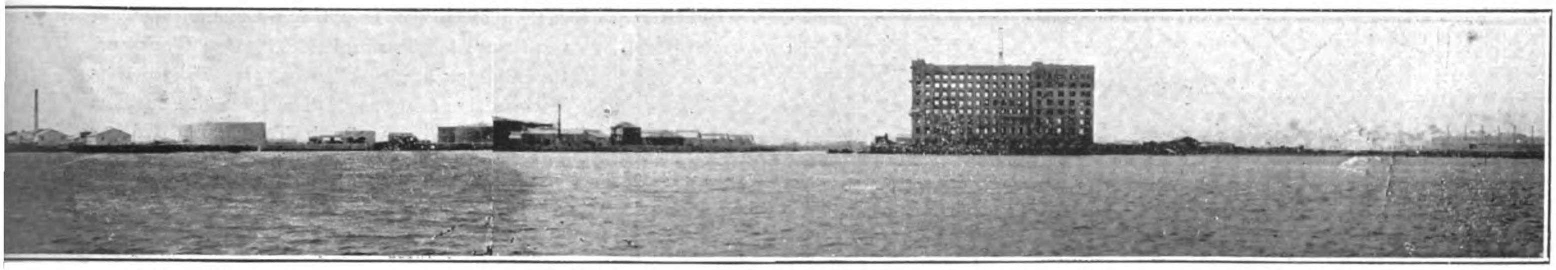
In the general plan of the projected Tokyo Bay improvements will be noted certain other sections to the north-east of the present reclaimed area, which the Tokyo Bay Reclamation Company is seeking to obtain permission from the Government to reclaim and develop. This would carry their operations to the mouth of the Tama river and connect with the plans of the Tokyo Harbor authorities. The main sewer disposal plant is to be located on reclaimed land at this point. The same plan shows the general



Completed Sea Wall in front of Japan Oil Company's Installation



Completed Sea Wall in front of Nisshin Flour Mill



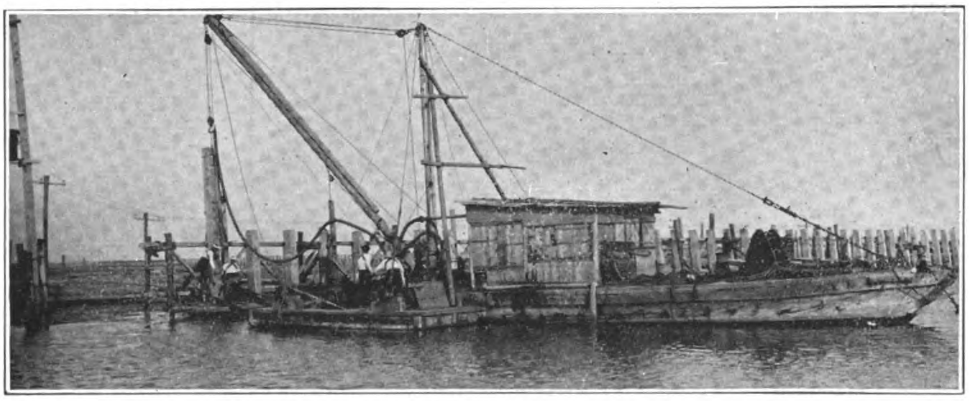
.: Mitsui Oil Tanks: Rising Sun Oil Co.: Nisshin Flour Mill: Japan Steel Pipe Works

ꝛ FRONT AT TSURUMI

outline of the projected Tokyo harbor improvements, which include the reclamation of the foreshore from the mouth of Tama river to the mouth of the Arakawa flood prevention canal.

Up to the mouth of the Tama river the breakwater protecting the harbor of the Tokyo Bay Reclamation Company forms the main section of the much-talked-of Tokyo - Yokohama canal, which from that point would follow a dredged passage across the mouth of the Tama and connect with the canals forming part of the Tokyo harbor improvements, also protected by a breakwater for its entire length. It may take some years to realize this project, but it will take shape gradually, and another 25 years will see this foreshore development created in order to satisfy the needs of a city which hopes in that time to have a population of over 7,000,000.

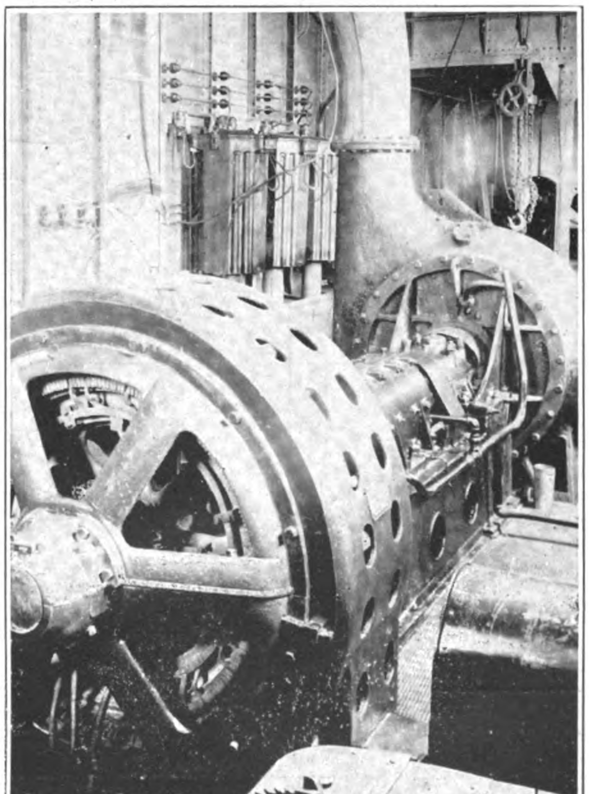
No. 1 Hydraulic Dredge; Asano Shipyards to the Left



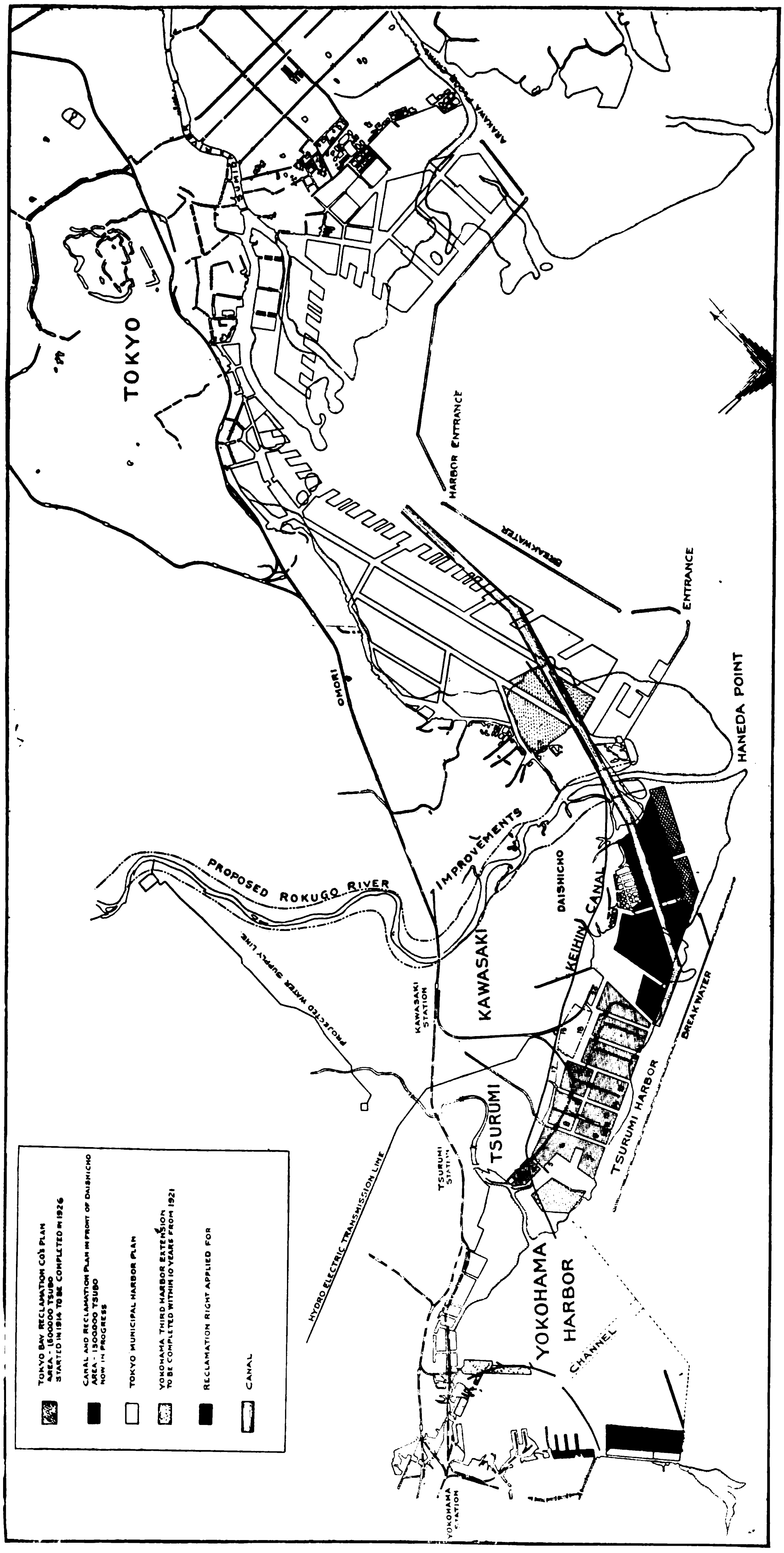
Reinforced Concrete Sea Wall under Construction

In addition to the major work of the Tokyo Bay Reclamation Company it will connect the roads of the reclaimed area with Shiomibashi on the national highway by a private road 606-ft. long and 24-ft. wide. From Shiomibashi along the left bank of the Tsurumi river another road, 3,120-ft. long and 24-ft. wide, will lead to the 4th district, and another from the same place to the 6th district, 3,780-ft. long and 24-ft. wide. From the town of Kawasaki to the Japan Steel Tube Works at Wakao Shiden another road, 8,394-ft. long and 24-ft. wide, will be built, a total of 15,831-ft. of new roads. The road from the 7th district to Oshima Shinden, a distance of 16,800-ft., will be widened from 9 to 12-ft. All bridges necessary for these roads will also be built at the Company's expense.

Cutter Head, "Suehiro Maru"



Pump Room, "Suehiro Maru"

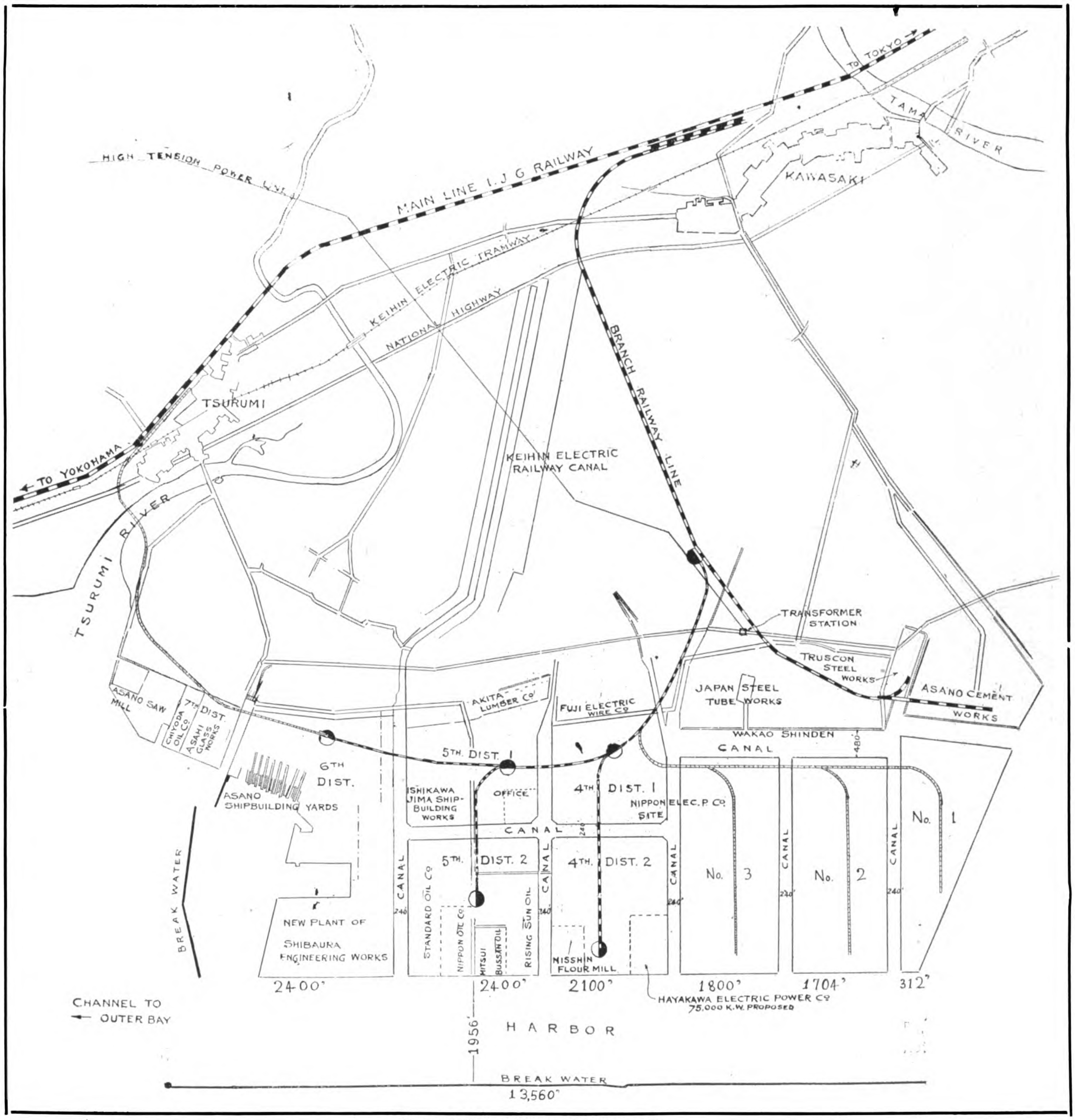


Plan of Tokyo Bay Improvements, showing the Completed Tsurumi Reclamation Work and the Rights applied for by the Tokyo Bay Reclamation Company. The Plan also outlines the future Tokyo and Yokohama Harbor Extensions and the location of the Canal connecting the two cities.

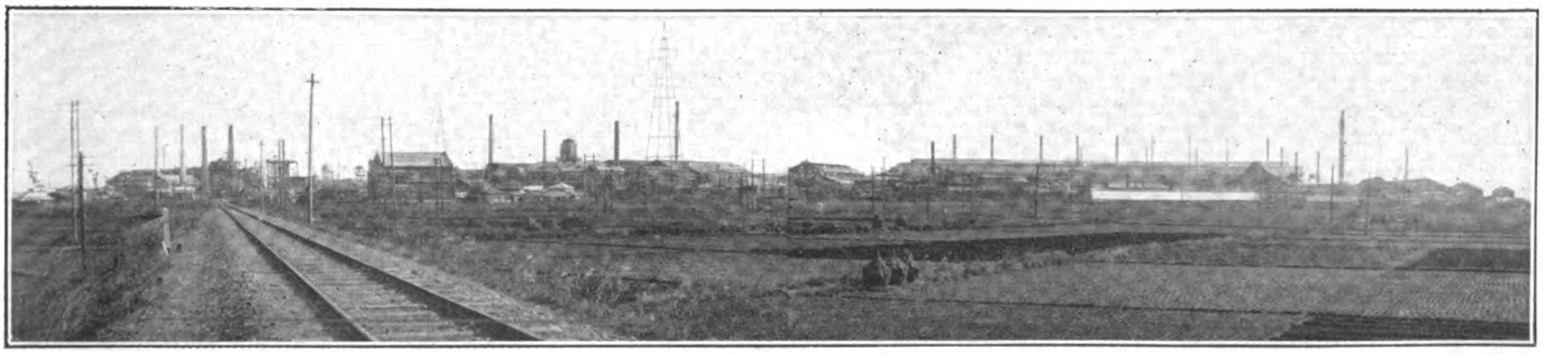
1. Tsurumi Wood Works
2. Naigai Petroleum Company
3. Chiyoda Petroleum Company
4. Asahi Glass Mfg. Company
5. Asano Shipbuilding Yard
6. Asano Iron Works
7. Shibaura Engineering Works
8. Ishikawajima Shipbuilding Company
9. Standard Oil Co. of New York
10. Nippon Petroleum Company
11. Mitsui Oil Department
12. Tokyo Bay Reclamation Co.'s Dry Dock
13. Rising Sun Petroleum Company
14. Nisshin Flour Mfg. Company
15. Tokyo Electric Power Company
16. Nippon Electric Power Company
17. Fusi Denki Seizo K.K.
18. Japan Steel Tube Company
19. Tokyo Bay Reclamation Co.'s Sub-station
20. Asano Cement Company.

For the present, a branch line connects the Asano Cement Works at Oshima Shinden with the main Government railway at Kawasaki station, 2½ miles distant. Late on branches will be carried to all the other districts in the industrial area.

The Company operates its own hydro-electric power station on the Sakawa, in Ochiai (42 miles distant), having a capacity of 8,250 k.w. There are three 2,750 k.v.a. generators operated by three 4,300 h.p. impluse water wheels. The output of over 12,000 h.p. is purchased by the plants in the industrial area, and to meet the increased power demand two other producing companies are erecting steam plants in the district. The Reclamation Company also operates its own water system, having erected reservoirs, filtration beds and pumping plant seven miles up the Tama river large enough to take care of all future needs of the district. Water mains carry the supply to all parts of the industrial area. A dry-dock and repair shop operated by the Reclamation Company will also be added to the equipment of the district.



General Plan of Tsurumi Reclamation



The Japan Steel Tube Works at Tsurumi

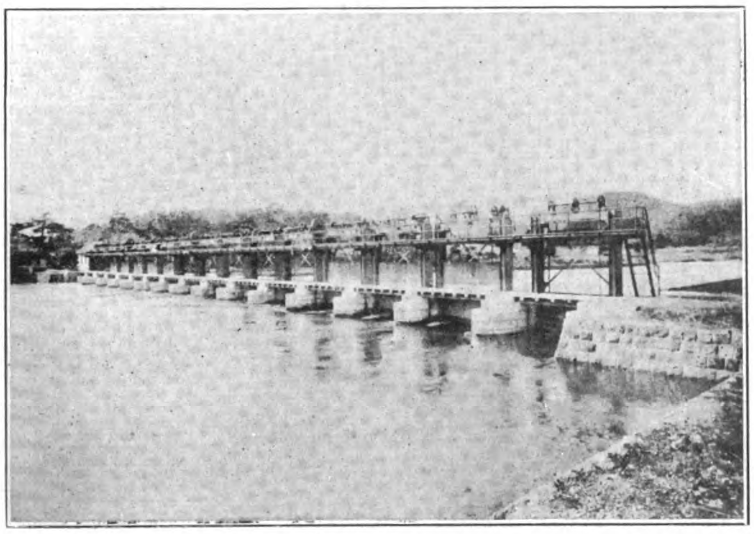
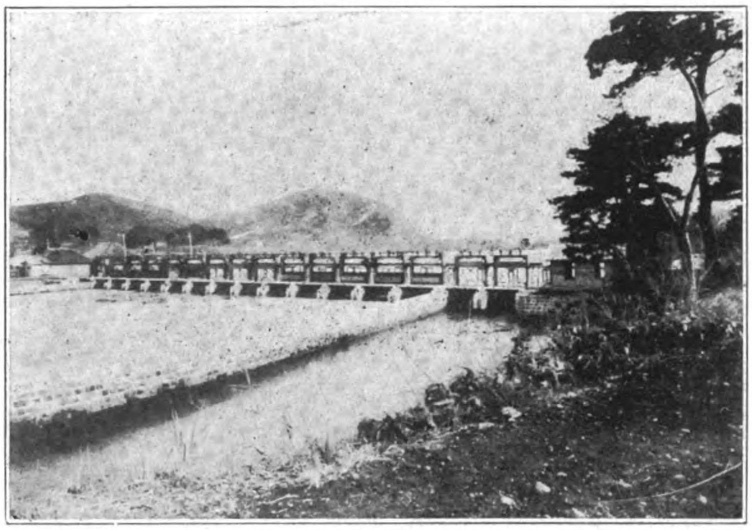
Lake Inawashiro, Showing Location of Four Tokyo Electric Light Company's Power Plants

TOKYO
A Million Kilowatt City

The Phenomenal Growth of the Tokyo Electric Light Company

SUPPLYING 4,000,000 electric lights and a gross total of nearly 300,000 k.w. of combined light and power at the end of 1924, the Tokyo Electric Light Company is now building 70,000 k.w. of new power plants, with a further 230,000 k.w. under projection. When we add to this 600,000 k.w. output the power available from the Daido, Kinugawa, Tokyo Electric Power (a subsidiary of the Toho Electric Power Company) and other companies feeding into the Tokyo district, the total supply is not far from a million kilowatts, excluding the power now generated and the new stations projected for operating the State railways and the Tokyo Municipal Electric Bureau. The total power output of the whole empire at the end of 1923 was 1,307,000 k.w. from hydro-electric installations and 755,000 k.w. from steam power plants, with a total of 21,690,000 electric lamps. The total authorized capital invested in the electric light and power business at the end of the same year was Y.2,366,-844,961, of which Y.1,703,194,756 was paid in, and Y.585,634,054 in outstanding debentures. Of this grand total, about one-tenth represents the capital of the Tokyo Electric Company (Y.258,000,000 authorized and Y.193,769,880 paid in), with Y.29,450,000 of indebtedness and Y.12,380.000 reserves. The Company's business district covers 12 prefectures: Tokyo, Kanagawa, Shizuoka, Yamanashi Chiba, Saitama, Gumma, Tochigi, Ibaragi, Nagano, Niigata, and Fukushima, including the cities of Tokyo, Yokohama, Hachioji, Yokosuka, Shidzuoka, Maebashi, Takasaki, Ashikaga, Kiryu, and Nagaoka. The total area of the above districts is nearly 9,000 square miles, or about one-tenth of the size of the main island of Japan. It is not necessary to go beyond these figures to establish the position of the Tokyo Electric Company as the premier public enterprise in Japan. They are also indicative of the rapid growth of power demand for the city of Tokyo and the keen competition that is taking shape in order to meet it.

The number of lamps in the city of Tokyo has increased from zero to four and a half millions in the past thirty years, doubling in the past four years. The increase in the capacity of motors has grown even faster than the lamp load, and the phenomenal growth of the district as a manufacturing centre is creating demands upon the generating companies that for the next ten years will tax their ability to cope with. To meet this condition, the ordinary method of building an individual sub-station supply from a series of power stations has proved inadequate, and it is now planned to connect the numerous sub-stations of the Tokyo

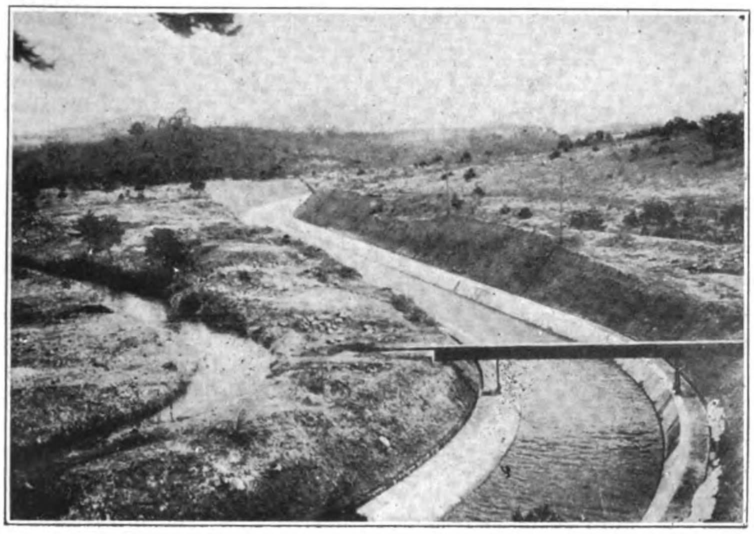



Regulating Gates of "Joruku-Kyo," the Intake at Lake Inawashiro to the Power Canal leading to No. 1 Inawashiro Power Station

Electric Company with two complete rings around the city of 154,000 volts and 66,000 volts.

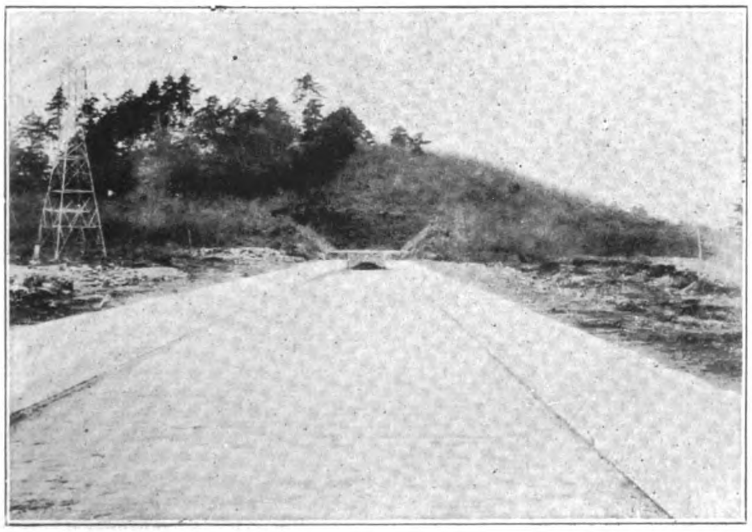
This power will be furthermore reduced in voltage and brought into the city by underground cables, as provided for in the general reconstruction plans for sub-surface work, at 22,000 volts and distributed at numerous sub-stations at voltages not exceeding 3,300. Suitable distributing transformers will again reduce the potential for the 220 volt motors and 100 volt lamps. The total power thus concentrated in the belt lines after present plans are fully developed will not be less than 750,000 k.w., which would meet the estimated demands of Tokyo by the year 1935. To supply this quantity of power some interesting additional installations have been made to the original Tokyo Electric Company's system, and to follow this development a brief history of the enterprise is necessary.

Starting in 1886 with a capital of Y.200,000, the business of

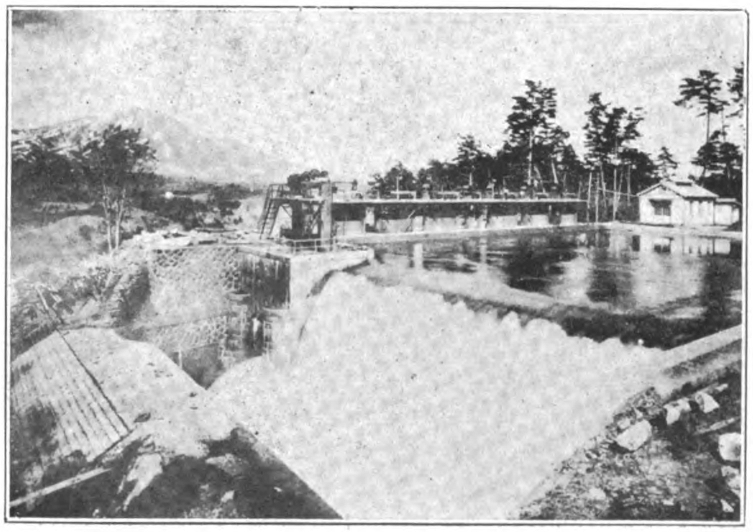


No. 1 Open Canal

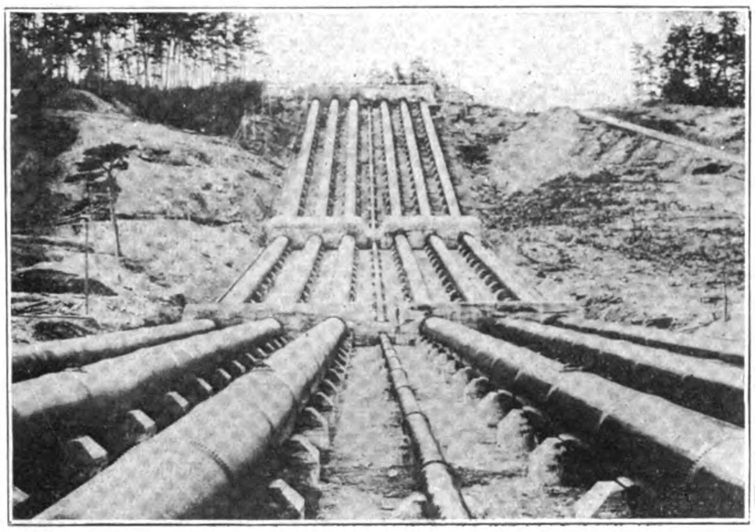
No. 1 Conduit



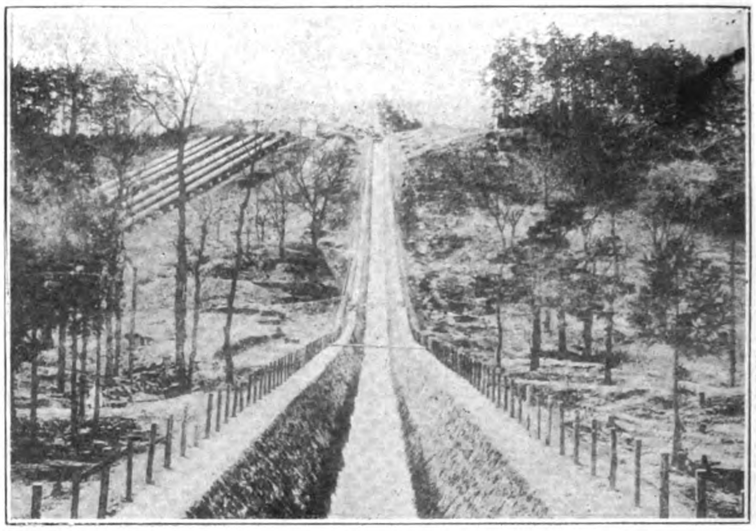
No. 1 Tunnel



Head Tank



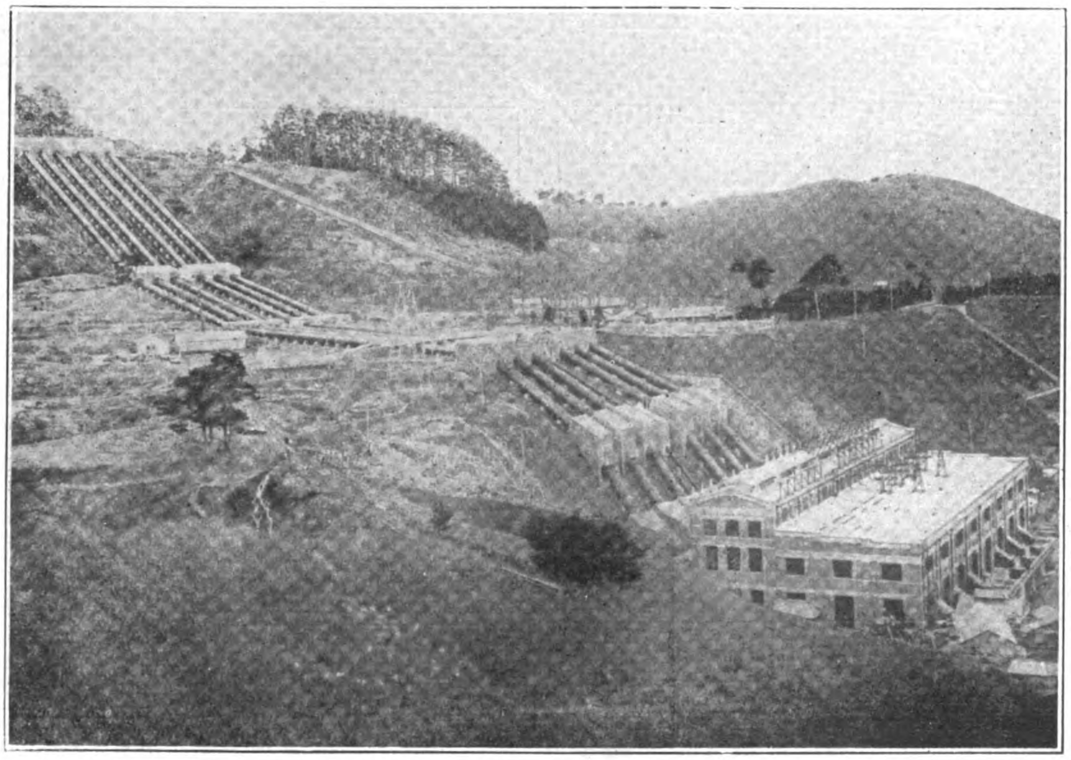
Pressure Pipe Lines for No. 1 Inawashiro Power House



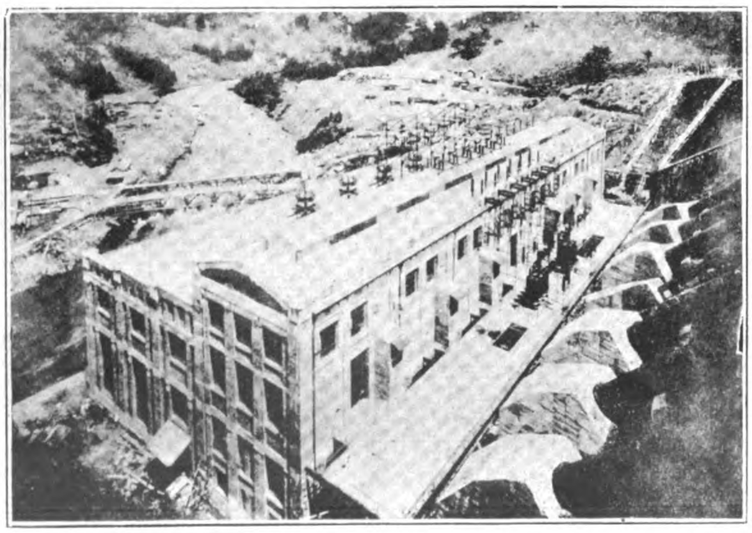
Spillway Canal

the company was largely confined to lighting the Imperial Palace, Government offices and a few stores and residences. The first installations were small steam plants driving direct current Edison generators. With the growth of the demand for lighting, the Tokyo Company amalgamated in 1890 with the Nippon Electric Light Company, and alternating current generators superseded the direct current installations. In 1908 a large steam station, equipped with five Westinghouse reaction type steam turbines, was placed in operation.

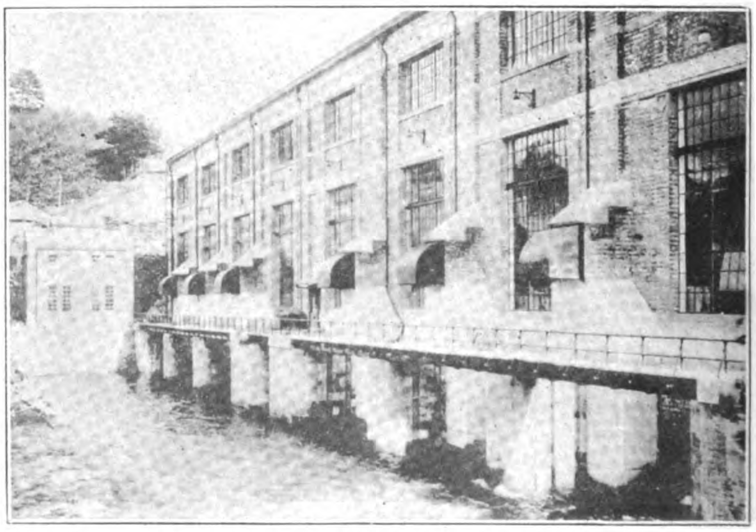
Various increases of capital were made until it reached Y.7,000,000 in October 1904, and during the next twenty years the Tokyo Electric purchased the rights and equipment of six competitors and amalgamated with twelve more, until at the present time it operates 32 power stations, 111 sub stations, 1 070 miles of aerial and 350 miles of underground transmission lines, nearly 5,000 miles of distributing mains, 49 miles of tramways and gas



No. 1 Inawashiro Power Station



Roof Installation of No. 1 Inawashiro Power House



Tail Race of No. 1 Power House

works supplying 275,000 cubic feet per day to three towns in the Tokyo district. The expansion of the company is shown by the following table :

Year		Stock Capital. Yen	Remarks
July,	1886	200,000	Established
August,	1887	500,000	Increase of Capital
July,	1889	1,000,000	do.
January,	1890	1,300,000	Amalgamation of Nippon Electric Light Co.
March,	1891	875,000	Decrease of Capital
August,	1891	835,650	do.
December,	1893	1,000,000	Increase of Capital
November,	1895	2,000,000	do.
September,	1899	3,500,000	do.
August,	1902	3,500,000	Purchase of Shinagawa Electric Light Co.
October,	1904	7,000,000	Increase of Capital
September,	1905	7,150,000	Amalgamation of Fukagawa Electric Light Co.
January,	1906	7,150,000	Purchase of Hachioji Electric Light Co.
February,	1907	18,000,000	Increase of Capital
July,	1907	24,000,000	Amalgamation of Tokyo Electric Power Co.
May,	1911	50,000,000	Increase of Capital
January,	1917	50,000,000	Purchase of Edogawa Electric Company
August,	1919	100,000,000	Increase of Capital
March,	1920	124,000,000	Amalgamation of Nippon Electric Light
April,	1921	146,000,000	Amalgamation of Tone Generating Co.
April,	1921	146,000,000	Purchase of Tone Tramway Company
May,	1921	166,000,000	Amalgamation of Yokohama Electric Co.
October,	1921	171,000,000	Purchase of Second Toshin Electric Co.
December,	1921	177,250,000	Amalgamation of Takasaki Hydro-Electric Power Company and Kumakawa Electric Co.
February,	1922	219,750,000	Amalgamation of Katsuragawa E. P. Co.
October,	1922	222,000,000	Amalgamation of Nippon Hydro-Electric Power Company
November,	1922	222,000,000	Purchase of Karasugawa Electric Power Co.
February,	1923	222,000,000	Purchase of Minakami Generating Co.
April,	1923	258,000,000	Amalgamation of Inawashiro H. E. P. Co. and Oshino Hydro-Electric Power Co.

The fixed policy of the company to maintain the lead in its own field was at all times justified by its earnings, which for years enabled it to declare an average dividend of ten per cent., fourteen per cent. for the two years prior to the earthquake, and eight per cent. for the latter half of 1923. The demand for light and power has steadily grown from 42,233 lamps and output of 30 k.w. of power demand in 1899 to 3,848,407 lamps and 286,520 k.w. gross output power demand at the end of 1924. During the last five-year period (1919-24) the total energy generated (including purchased power) increased from 422,000,000 k.w.h. to 1,350,289,700 k.w.h., the rated output of the 30 hydro-electric stations being 212,407 k.w. and 16,200 k.w. for the two steam plants. An additional 131,160 k.w. was purchased from other companies, making a grand total output at the end of 1924 of 359,767 k.w. The following list gives the names and particulars of the company's various power stations :

Water Power Stations.

Rivers	Power Stations	Effective Head Feet	Rated Output K.W.	Generators Unit K.V.A.	Generators No.	Transformers Unit K.V.A.	Transformers No.
Nippashi :	Inawashiro No. 1 ...	352	37,500	7,777	6	4,400	12
	Inawashiro No. 2 ...	229	24,000	6,666	5	4,400	6
Tone :	Atsuta	272	1,000	750	2	600	4
	Hakoshima	300	300	300	1	250 150	3 1
	Iwamuro	524	10,800	6,000	3	2,000	7
	Kamikuya No. 1 ...	360	2,400	600	4	800	4
	*Kamikuya No. 2 ...	383	13,500	6,660	3	6,700	4
	Kifune	51	500	500	1	—	—
	Komatsu	375	10,633	4,800	4	4,800	4
	Kumakawa No. 1 ...	465	2,339	3,000	1	1,500	3
	Kumakawa No. 2 ...	295	1,540	2,000	1	—	—
	Nurukawa	58	255	375	1	—	—
	Satomi	158	1,000	1,250	1	450	3
	Takatsudo	26	300	350	1	—	—
Shinano :	Domura No. 1 ...	233	4,000	2,200	3	3,350	4
	Domura No. 2 ...	80	2,000	2,500	1	—	—
	Domura No. 3 ...	37	1,050	1,450	1	—	—
	Minowa	210	2,300	2,875	2	1,900	4
	Yuzawa	991	6,500	4,375	2	4,800	2
			*7,500	4,375	2	—	—
Katsura :	Kanegafuchi... ...	380	2,390	3,500	1	—	—
	Komahashi	345	17,000	3,900	6	2,000	11
	Oshino	131	800	1,000	1	—	—
	Saiko	210	2,000	2,500	1	—	—
	Shishidome	470	16,800	7,000	4	3,500	9
	Yamura	374	13,500	6,000	4	3,000	9
	Yatsuzawa	389	35,000	7,700	6	4,000	12
Fuefuki :	Fuefuki No. 1 ...	342	2,900	3,000	1	3,000	4
	Fuefuki No. 2 ...	490	2,900	3,000	1	—	—
	Fuefuki No. 3 ...	716	3,000	3,300	1	—	—
Haya :	Tonosawa	700	3,300	2,000	2	750	7

*Under construction.

Steam Power Stations.

Power Stations	Rated Output K.W.	Generators Unit K.V.A.	Generators No.
Asakusa	4,000 (old)	2,000	3
Asakusa	*50,000 (new)	25,000	2
Enoshima	225	75 150	1 1
Kanagawa	14,500	3,750 7,500 3,000	2 1 1
Wakamatsucho	1,700	850	2

*Under construction ; old machinery, except 6 boiler units, removed to Kanagawa.

The chief damage to the plants of the company caused by the earthquake was confined largely to the buildings and power canals of eleven stations with an output aggregating 109,000 k.w. An outline of the damage is given in the following list :

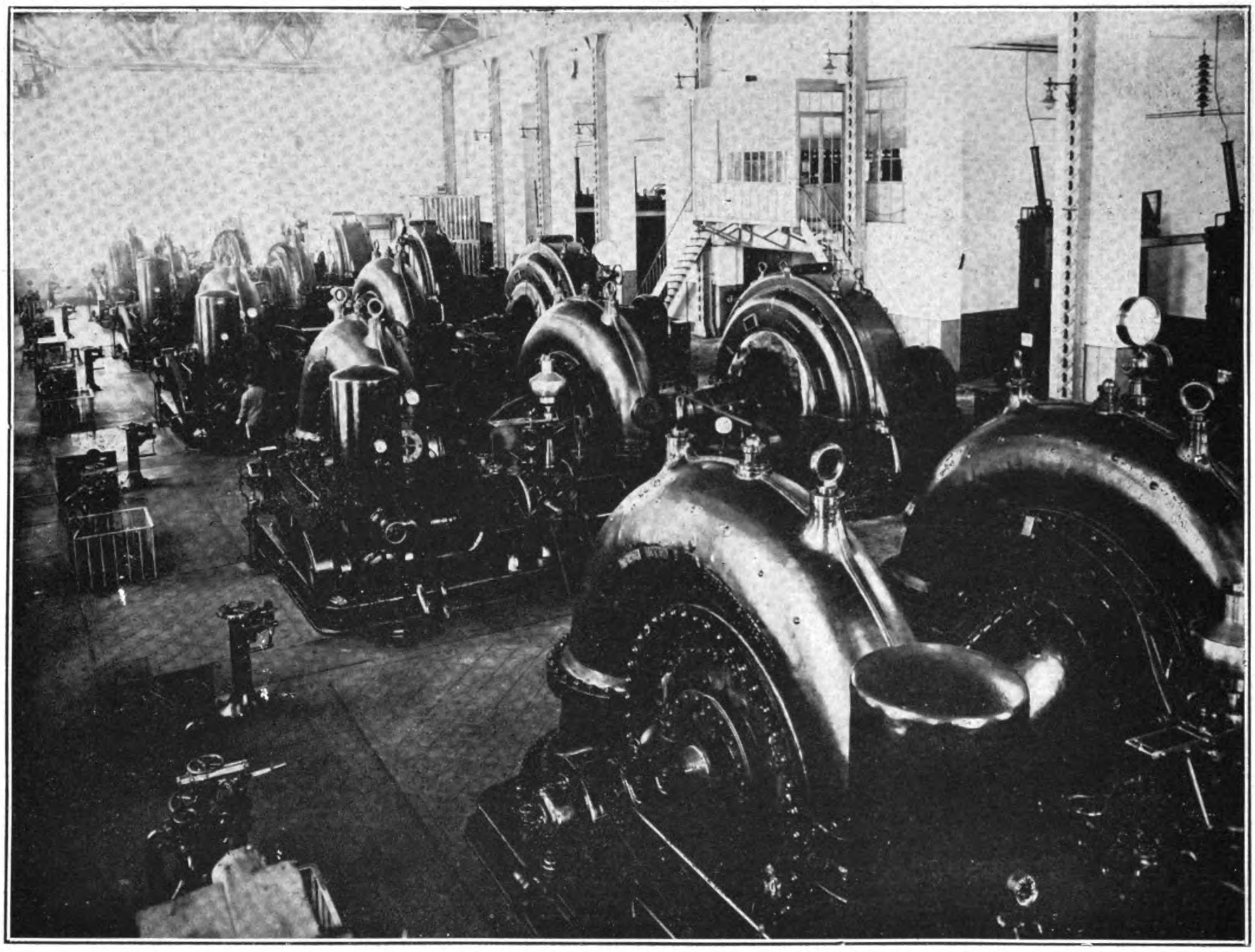
List of Damaged Power Stations.

Motive Power	Power Stations	Output. K.W.	Canals	Penstocks	Machineries	Buildings
Water :	Kanegafuchi	2,390	Slightly cracked	All right	All right	Slightly cracked
	Komahashi	17,000	Partly filled with sand	do.	do.	do.
	Oshino	800	Seriously damaged	do.	do.	Cracked
	Shishidome	16,800	Cracked and partly filled with sand	do.	do.	Partly collapsed
	Yamura	13,500	Cracks in the tunnel	do.	do.	Slightly cracked
	*Yatsusawa	35,000	All right	Crack in foundations ...	do.	All right
	Tonosawa	3,300	Partly collapsed and filled with sand	Rivetting injured ...	do.	Seriously cracked
Steam :	Asakusa (old)	4,000	—	—	do.	Collapsed and burned
	Enoshima	225	—	—	do.	Collapsed
	Kanagawa	14,500	—	—	do. except sw. apparatus	Partly collapsed
	Wakamatsucho	1,700	—	—	All right	Slightly cracked

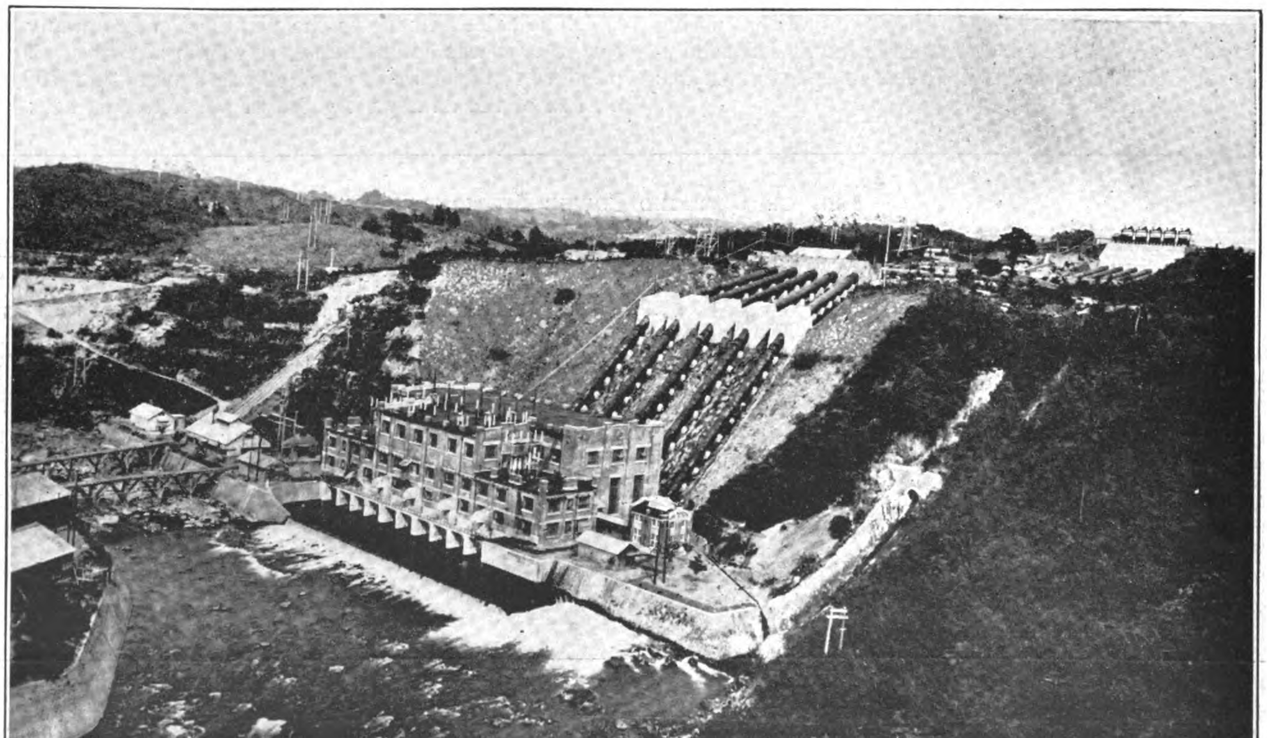
*—Dam of Ohno reservoir cracked ; crack in the head tank enlarged.

At the time of the earthquake the company owned 1,070 miles of aerial transmission lines, and except for a few towers in localities where the shocks were very severe the aerial transmission lines received little or no damage and were soon restored to working order. The underground cables were also intact, except in those exposed parts strung on bridges. Complete recovery was made soon after the disaster, and at the present time the high tension aerial and underground transmission lines of the company total 1,541 miles, as per the following table:

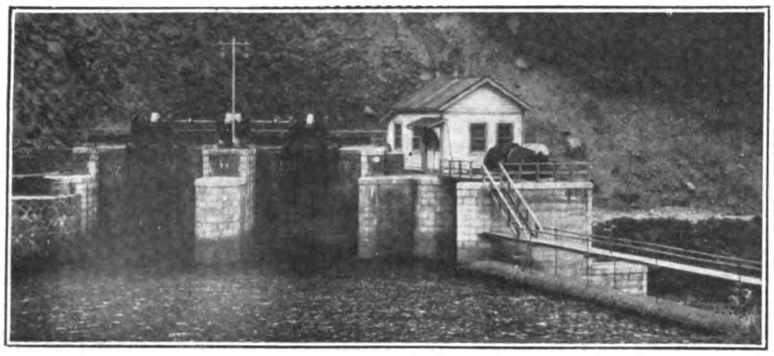
A POWER HOUSE EQUIPPED THROUGHOUT WITH JAPANESE MANUFACTURED MACHINERY.

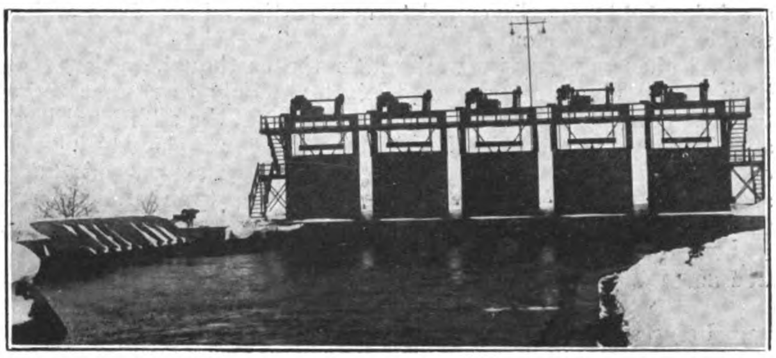


General View of Interior of No. 2 Inawashiro Power Station, Equipped throughout with Japanese Manufactured Machinery; Five Penstocks from the Tokyo Ishikawajima Shipbuilding Co., Five 6,666 k.v.a. Shibaura Generators operated by Five 10,250 h.p. Horizontal Twin Spiral Francis Turbines made at the Kobe Works of the Mitsubishi Dockyard and Shipbuilding Company; Six 115,000 volt, 4,400 k.v.a. Shibaura Transformers.



General View of No. 2 Inawashiro Power House: Head 230 feet.





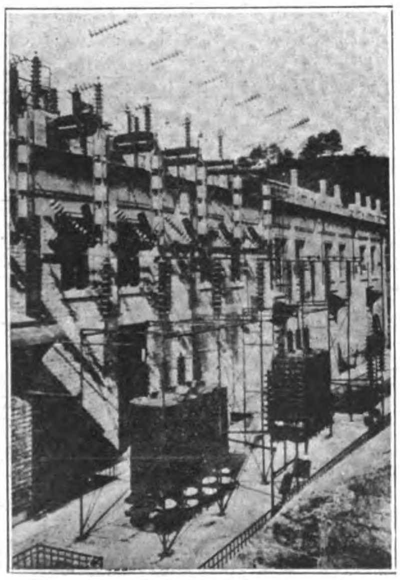
Inawashiro No. 2 Power House

Intake Gate House

Head Tank

List of Aerial Transmission Lines (Above 20,000 Volts)

Systems	Divisions Included in the System	Voltage	Length	No. of Circuits	Size of Conductors	Poles or Towers
		Volts	Miles		Circular Mils:	
Inawashiro	Inawashiro	115,000	141.3	2	197,600	Steel Tower
Joetsu	Joetsu	154,000	125.3	2	500,000 and 385,000	do.
	Joetsu Tie Line	66,000	4.2	2	114,700	Wooden Pole
	Komatsu...	154,000	4.6	2	205,500	Steel Tower
	Nagaoka	66,000	36.8	1	124,700	Steel Pole
	Yuzawa	66,000	6.8	2	200,000	Steel Tower
Maebashi (old)... ...	Arakawa	66,000	4.1	2	98,500	do.
	Fuji Paper Mfg. Co. Line ...	66,000	2.4	1	72,700	Wooden Pole
	Ashikaga...	66,000	5.0	1	98,500 and 41,600	do.
	Gyoda	66,000	5.9	1	41,600	do.
	Ichikawa...	66,000	6.0	2	205,500 and 59,200	Steel Tower
	Iwamuro...	66,000	28.9	2	98,500	do.
	Kameari	66,000	1.4	2	114,700	Wooden Pole
	Kiryu	66,000	8.0	1	44,800	do.
	Oana	66,000	13.8	1	41,600	do.
	Maebashi (old)	66,000	70.2	2	205,500 and 98,500	Steel Tower
	Sumida	66,000	4.6	2	205,500 and 171,500	do.
Maebashi (new) ...	Maebashi (new)	66,000	56.1	2	205,500 and 72,660	Wooden Pole
Takasaki	Takasaki	22,000	113.5	1 or 2	83,200 and 41,600	do.
Kumakawa	Kumakawa	55,000	37.6	1	114,700 and 91,000	do.
Toshin	Toshin	66,000	54.0	1 or 2	205,500 and 124,700	do.
Tochigi	Tochigi	22,000	34.7	1	59,200 and 41,600	do.
Ibaragi	Ibaragi	22,000	37.7	1	59,200	do.
Komahashi	Fuefuki	55,000	22.4	2	72,800	do.
	Komahashi	55,000	47.4	2	198,500	do.
Yatsuzawa	Yatsuzawa	55,000	38.9	4	198,500	do.
Yamura	Rokugo	77,000	10.9	2	131,400	Steel Tower
	Yamura	77,000	53.6	2	213,900	do.
Koyasu...	Sobu	66,000	20.2	2	197,300 and 100,800	Wooden Pole
	Sakaigi	66,000	5.9	2	197,700	Steel Tower
	Hodogaya	66,000	6.0	2	from 259,200 to 107,700	do.
Hakone	Hakone-Mine	66,000	39.2	2	from 242,500 to 152,400	do.
	Kamakura-Yokosuka	66,000	14.4	2	from 197,700 to 70,400	do.
	Fukara	66,000	12.2	2	72,700	do.
Keihin	Takasegawa	154,000	31.8	2	400,000	do.
	Total		1,105.8 Miles			



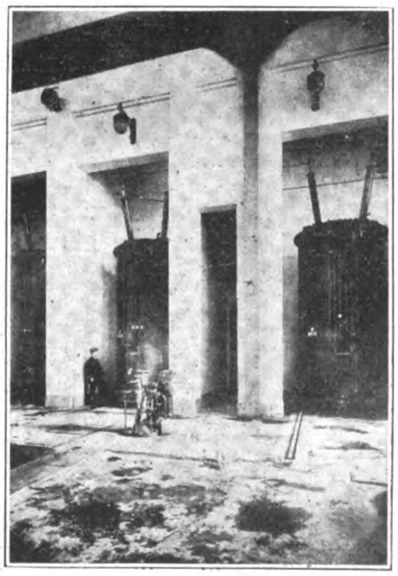
High Tension Lightning Arresters

Total length of the high tension transmission lines, both aerial and underground, owned by the company at the end of this term is classified according to voltages as follows:

Aerial lines—154,000 Volts, 161.7 Miles; 115,000 Volts, 141.3 Miles; 77,000 Volts, 64.5 Miles; 66,000 Volts, 406.1 Miles; 55,000 Volts, 146.3 Miles; 22,000 Volts, 185.9 Miles; Underground lines:— 22,000 Volts and 11,000 Volts, *436.0 Miles. Grand total, 1,541.8 Miles.

*This figure alone is counted in circuit miles.

At the time of the earthquake, the company owned and operated 111 sub stations with a total output of 740,000 k.w., the aggregate equipment capacity being about 999,000 k.v.a. Thirty-seven of these stations, having an aggregate capacity of 220,480 k.w., were damaged, though this was confined largely to the buildings. Over 39,450 k.w. capacity of transformers, 9,980 k.w. of motor generators and 4,000 k.w. of synchronous condensers were damaged. Repairs were, however, speedily executed, some of the stations having their capacity altered according to the local changes in demand, while three stations in districts awaiting settlement of the land adjustment scheme



Main Transformers

are being held up. Six complete new stations have been added to the list which follows.

Within less than two weeks after the earthquake orders had been placed for transformers sufficient not only to replace those burned, but also to provide for a large part of the additional load anticipated for reconstruction. Dependence was largely placed on the capacity of American manufacturers to supply this huge amount of material. Distribution and power type transformers to the total of 185,000 k.v.a. capacity were ordered from the General Electric Co., U.S.A., and initial shipment on an emergency basis was made on October 13th by this company.

List of Sub-stations of Tokyo Electric Light Co.

Sub-stations	Output. K.W.	Equipment. K.V.A.
Akabane	3,000	4,500
Aoyama	3,000	4,000
Arakawa	9,000	12,000
Asakusa	3,000	3,500
Ashikaga	3,300	4,100
Asukayama	4,500	6,000
Azabu	4,500	5,500
*Eirakucho	300	450
Fukagawa	5,400	6,300
Fukaya	900	1,050
Funakoshi	2,644	3,500
Gokurakuji	200	200
Hachioji	4,730	7,000
Hanyu	300	400
Hashiba	3,300	4,400
Hayashicho	4,800	5,600
Higashimachi	3,000	3,750
Hikawa	3,000	4,000
Hikifune	6,000	7,000
Hodogaya	27,750	35,500
Hongincho	D.C. 2,500	D.C. 2,500
Hongo	2,250	3,000
Honjo	4,500	5,500
Honsho	1,200	1,200
Ichikawa	6,000	8,000
Ichinomiya	600	800
Ikegami	4,500	6,000
Isezaki	1,500	2,000
Itabashi	3,000	4,000
Iwamoto	D.C. 130	D.C. 205
Jujo	2,400	3,200
Kamakura	1,500	2,000
Kameari	10,200	12,900
Kameido	33,400	90,000
Kanda	3,000	3,500
	D.C. 1,500	D.C. 1,920
Kawadacho*	3,000	4,000
Kayatsuki*	42,000	49,000
Kiryu	2,250	2,700
Kobikicho	D.C. 1,500	D.C. 1,500
Koenji	1,500	2,000
Kobinata	150	150
Koishikawa	2,400	2,800
Kojimachi	2,000	2,500
	DC. 850	D.C. 1,000
Komatsu	63,000	84,000
Koyasu	15,000	25,600
Kubocho	2,250	3,000
Kumagaya	1,200	1,600
Kuragano	900	1,050
Kurobo	300	400
Kyobashi	4,500	5,250
	D.C. 1,640	D.C. 2,140
Maebashi	1,500	1,750
Marunouchi	6,600	8,800
Matsubacho	3,600	4,400
Matsuda	256	340
Mejiro	30,000	40,000
Mibu	180	210
Minamisayacho	D.C. 2,500	D.C. 2,500
Minamiyoshida	3,000	3,750
Mine	6,000	7,000
Munetaka	450	450
	D.C. 300	D.C. 300
Nagaoka	9,000	12,000
*Nakatsugawa No. 1	43,500	58,000
Nakatsugawa No. 2	20,100	26,800
Namie	4,950	4,950
Negishi	3,000	4,500
Nenokamiyama	3,000	4,000
Nihonbashi	3,000	3,500
	D.C. 1,760	D.C. 2,260
Noda	600	600
Numata	300	350
Oi	3,600	4,800
Oji	7,800	10,800
Okegawa	450	600
Omama	225	225
Orihara	450	450
	D.C. 270	D.C. 270
Osagami	2,250	2,600
Osaki	3,000	4,000
Oshima	15,000	17,500
Ota	900	1,500
Oyama	600	800
Rokugo	17,000	26,000
Sakuragicho	3,750	4,500
Samoncho	2,250	3,000
Ohno	1,500	2,000
Satte	600	800
Senju	4,800	6,000
Shin-izumicho	D.C. 2,500	D.C. 2,500
Shinmachi	360	360
Shin-ogawamachi	2,250	3,000
Shitaya	4,500	6,000
Sumida	12,000	16,000
Tabata	48,000	56,000
Tachikawa	3,750	5,000
Taguchi	150	200
	D.C. 100	D.C. 100
Tajima	450	600
Tajimacho	2,750	3,500
	D.C. 100	D.C. 150
Takanawa	3,000	3,750
Takasaki	7,200	8,400
Takasegawa	30,000	40,000
Taru	150	150
Tatebayashi	4,650	5,800
Tokiwacho	3,860	5,000
	D.C. 130	D.C. 260
Toshimacho	2,250	3,000
Tsurumi	3,000	4,000
Umego	600	600
Uraga	2,366	2,755
Waseda	16,200	23,800
Yanagishima	6,000	7,200
Yodobashi	34,400	45,950
Yokosuka	15,000	20,000
Yoshiwara	900	1,050
*Zushi	4,550	7,000
Total	A.C. 600,171	829,990
	*118,500	*151,000
	D.C. 15,780	17,605
Grand Total	734,451	998,595

*Converted to Switching Station.

The six new installations mentioned above are as follows :—

Sub-stations	Rated Output. K.W.	Equipment Capacity. K.V.A.	Remarks
Hashimoto	51,000	68,000	New installation
Kawadacho	3,000	4,000	do.
Nishiarai	6,000	8,000	do.
Nakatsugawa No. 1	22,100	58,000	do.
Senzoku	30,000	40,000	do.
Takasegawa	14,440	40,000	do.

At the end of 1924 the total number and output of the serviceable sub-stations owned by the company was 108, with a total rated output of 809,941 k.w., and total equipment capacity of 1,111,060 k.v.a.

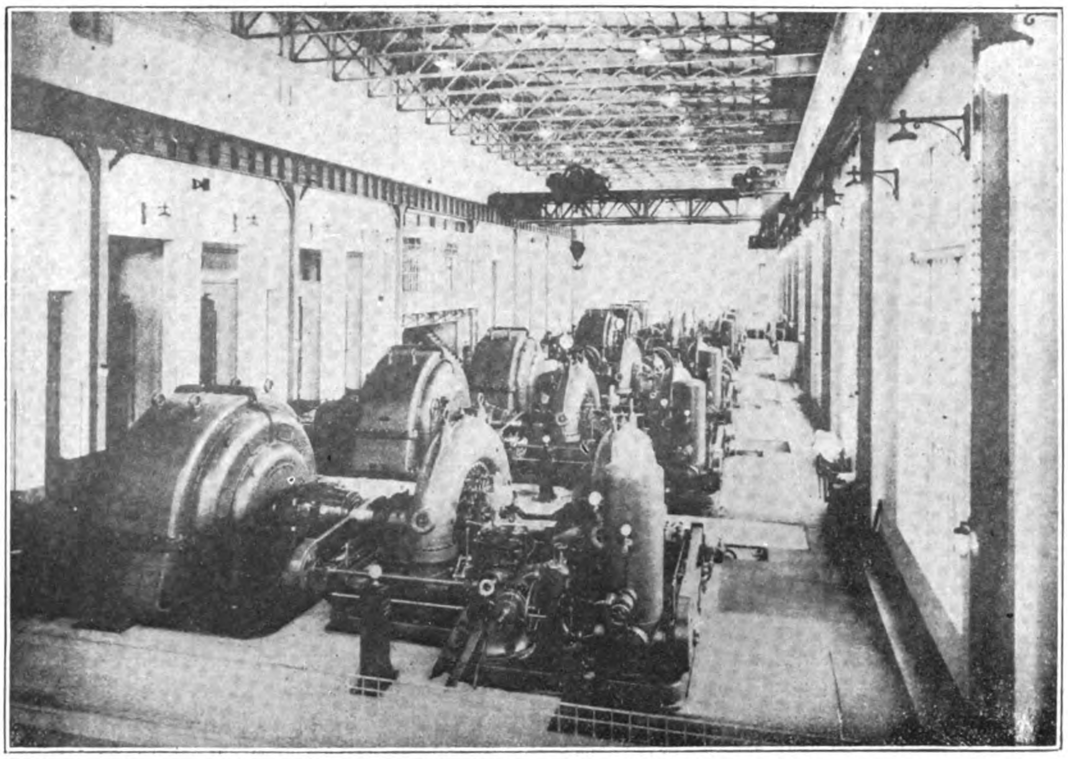
Before the disaster the Tokyo Electric Light Company's distribution system consisted of 4,660 miles of aerial and 260 miles of underground lines, 175,000 poles and 35,600 pole transformers. The damages to these distributing lines covered 570 miles of line with 27,200 poles and 10,300 pole transformers burnt. By the end of last year the distribution capacity of the company had been almost completely restored. Lines have been extended and pole transformers increased to the extent that the distribution capacity as a whole has been greatly enlarged. The distribution system at the end of last year is as follows :—

Locality	Length of Aerial Lines Miles	Number of Poles	Number of Pole Transformers	Length of Underground Lines Miles
Tokyo and Vicinity	1,677.00	75,838	24,273	269.01
Yokohama and Vicinity	728.24	32,132	5,351	5,26
Maebashi, Takasaki and Vicinity	2,538.89	79,988	8,544	4,42
Total	4,944.13	187,958	38,168	278.69

The light and power equipment of the company prior to the quake consisted of 4,356,500 lamps, 120,700 h.p. motor load connected and 155,700 k.w. of other power loads. The approximate damages to this equipment consisted in a loss of 554,200 lamps owned by consumers, 1,489,500 owned by the company, and a gross loss of motor and other connected power equipment of 102,000 k.w. Practically no damage was sustained by the motor and power equipment owned by the company, although 35,000 watt meters were burnt.

The Tokyo Electric Light Company operates 42½ miles of tramways at Maebashi and 6½ miles at Kamakura. The intensity of the seismic disturbance in the Kamakura district resulted in slight damages to the line between that town and Fujisawa, some parts of the permanent way being twisted or buried under fallen ground and part of a tunnel entrance destroyed. The repairs to this line were completed within twenty days.

The company also operates gas plants at Maebashi, Takasaki and Yokosuka, with a supply capacity of 25,000, 50,000 and 200,000 cubic feet per day espectively. The Yokosuka plant ruffered severely as a result of the quake, but was temporarily repaired and brought into operation within three weeks.



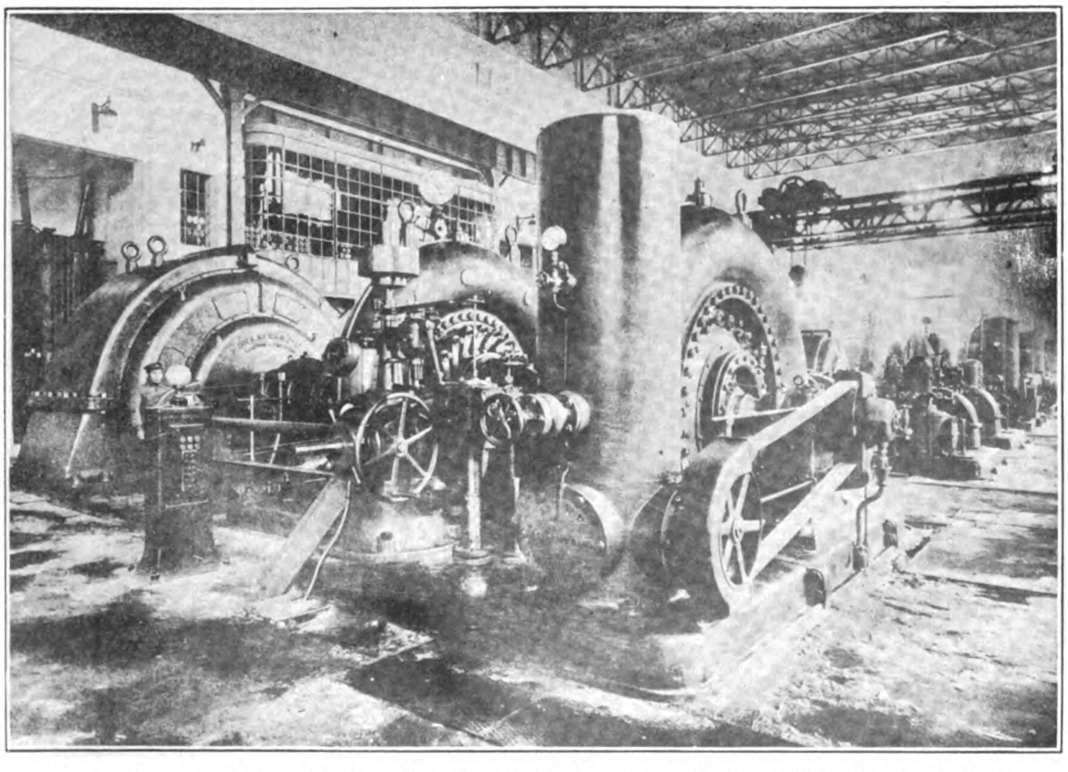
General View of Generating Room, No. 1 Inawashiro Power House; Equipped with Six 7,000 k.w. Dick, Kerr & Company (English Electric) Alternators driven by Six 11,250 h.p. J. M. Voith Horizontal Francis Double Spiral Water Turbines.

The approximate value of the damages to the various properties of the company are bulked as follows :

Distributing lines, light and power equipment ...	Y.10,994,726
Power stations, sub-stations and transmission lines...	3,247,276
Materials in stock and utensils	3,073,598
Gas supply and tramway equipment	144,068
Buildings and tools	2,794,011
Water-power Canals	308,539
Miscellaneous	84,771
Total	Y.24,646,989

In addition to this material loss, 41 employees connected with the Tokyo Head Office and 80 attached to the Yokohama branch (a total of 121) were killed.

The disaster called forth immediate and almost superhuman efforts to restore light and power to the stricken areas, and it is a high tribute to the character and organization of the company that all hands bent to the task of meeting the emergency in order to save the city from a further calamity arising from the complete paralyzation of all public utilities. Two days after the earthquake the electric motor driven hydraulic pump of the city waterworks was supplying water to a part of the metropolis, customers in the vicinity of the sub-stations connected up, and the army radio station at Nakano placed in operation. Power was supplied as quickly as possible to rice mills, newspapers and other essential small industries, and steet lighting turned on as quickly as the distributing lines were restored. In short, the very effective co-operation and strenuous work on the part of the organization brought such a rapid recovery that by the end of the year the total actual power output of the company amounted to about the same as it was before the catastrophe. By the end of last year the effect of the earthquake on the company was equivalent to about the loss of one year's normal increase in the demand. But even this was merely temporary, as the lessons taught by the disaster resulted in an increased demand for electric power by those concerns which formerly used steam, gas or other prime movers in their factories. The catastrophe also emphasized the necessity for the electrification of the steam railways, a wider application of electricty in the home, and for many industrial purposes where direct heat had formerly been employed.



No. 1 Inawashiro Power Station; Dick, Kerr (English Electric Co.) and Voith Water Turbine, Generating Set.

In order to meet this vigorous demand for power the Tokyo Electric Light Company started another construction program involving the erection

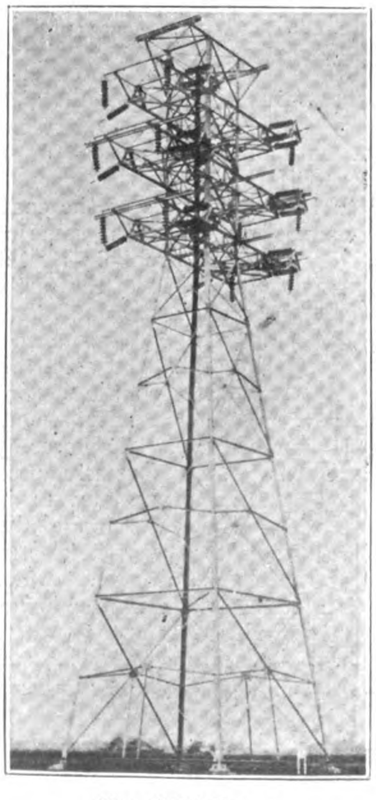
of the No. 3 (20,700 k.v.a.), and No. 4 (32,100 k.v.a.) Inawashiro water power plants, a new Inawashiro transmission line and a 50,000 k.w. steam plant at Senju. The old steam plants at Asakusa and Enoshima have been abandoned.

The new construction program is a sequel to the original Inawashiro development initiated in 1912 by Dr. Sengoku (now Minister of Railways), at that time president of the Inawashiro Power Company. The source of water supply is Lake Inawashiro, an ideal storage reservoir situated at an elevation of 1,700-ft. above sea level, 145 miles north of Tokyo, covering nearly 42 square miles of drainage area with a storage capacity of 3,500,000 cubic feet. The development of this source of power was undertaken by the Inawashiro Hydro-Electric Company, organized for the purpose by the Mitsubishi interests, who erected the first and second Inawashiro hydro-electric power stations that were subsequently absorbed into the Tokyo electric system when the two companies amalgamated in April 1923.

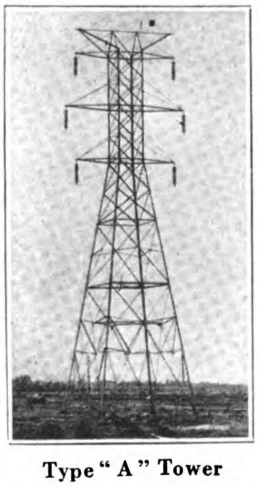
The new extension scheme calls for the construction of two additional stations deriving power from the Nippashi river. The great power demand necessitated increasing the voltage from 115,000 to 154,000 and quadrupling the volume of the giant switches. The new No. 3 plant will have three General Electric 6,900 k.v.a., and No. 4 plant three General Electric 10,700 k.v.a. vertical generators. To ensure the maximum efficiency of the water power supply a new steam station is also being erected at Senju, near Tokyo, in which two 25,000 k.w. Westinghouse turbo-alternators are being installed.

The original No. 1 and No. 2 Inawashiro generating stations received their power from the Nippashi river, the intake for No. 1 being placed at about 5,580-ft. down stream from its outlet at Lake Inawashiro. The length of the power canal is about 7,290-ft., consisting of two tunnels, four open canals, five conduits and two aqueducts. There are six (one spare) main pressure pipe lines with an inner diameter of 7-ft., and one exciter pipe line under an effective head of 352.4-ft. The water from the tail race discharges direct into the Nippashi river. The grade of the canal varies from 1-1,500 to 1-2,000-ft.

The generating plant of the No. 1 Inawashiro power house consists of six (one spare) J. M. Voith horizontal type double spiral Francis turbines, with a capacity of 11,250 h.p. each, operating at 375 r.p.m., with an effective head of 104 meters. These are connected to six Dick, Kerr & Company (English Electric Company) enclosed forced draught horizontal shaft alternating current generators of 7,000 k.w., power factor 90, three phase, 6,600 volts, 50 cycles, 375 r.p.m. The four direct current exciters have a 200 k.w. capacity each, 250 volts, 500 r.p.m., and are operated by J. M. Voith horizontal impulse turbines of 492 h.p. each, at full gate opening, with an effective head of 98 meters. The twelve main transformers from the Westinghouse Electric & Manufacturing Company are single phase, 50 cycles, 4,400 k.v.a. capacity, with 115,000 volts on the high tension side and 6,600 volts on the low. They are delta connected in both high and low tension sides, and oil cooled. The switching apparatus and switch boards were also supplied by the same company.



Type "B" Tower



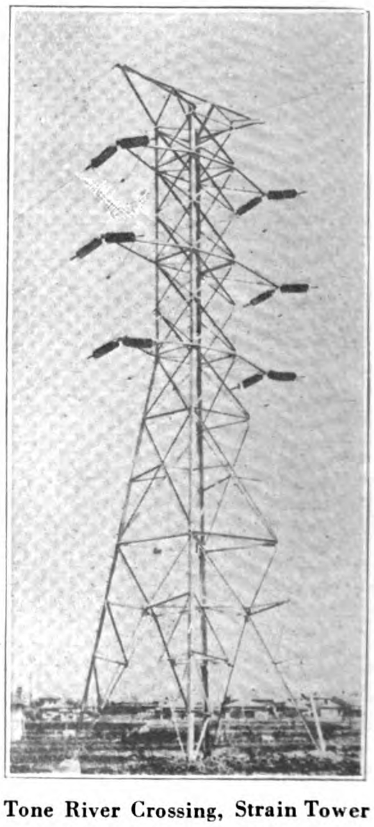
Type "A" Tower

The No. 2 Inawashiro power plant is located about 1,000-ft. down the stream from the site of No. 1 power-house, and is equipped throughout with machinery and apparatus made in Japan. The five penstocks were turned out by the Tokyo Ishikawajima Shipbuilding Company and the five water turbines at the Kobe works of the Mitsubishi Dockyard and Shipbuilding Company. These turbines are of the horizontal twin spiral Francis type with a capacity of 10,250 h.p. at full gate opening. The speed is 375 r.p.m.. and the effective head at full gate 226.5-ft. The alternating generators, six in number, are of the totally enclosed forced draught horizontal type of 6,000 k.w. capacity each, with a power factor of 90, three phase, 6,600 volts, 50 cycles, and 375 r.p.m., manufactured by the Shibaura Engineering Works. The exciters, five in number, and the main transformers are also from the Shibaura Engineering Works. The 115,000 volt transmission line into Tokyo, 140 miles in length, is carried on a total of 1,449 steel towers of three sizes made by the American Bridge Company. The receiving station for this No. 1 Inawashiro transmission line, located near the Tabata railway station in Tokyo, is equipped with twelve 4,000 k.v.a. Westinghouse shell type transformers and high tension breakers, and nine 500 k.v.a. auxiliary transformers made by the Shibaura Engineering Works. This station is also equipped with two 7,500 k.v.a. synchronous condensers and exciters, which with their switch gear were also made by the Shibaura Engineering Works. The main switchboard and switching apparatus, as well as the testing transformers, were supplied by the Westinghouse Electric and Manufacturing Company.

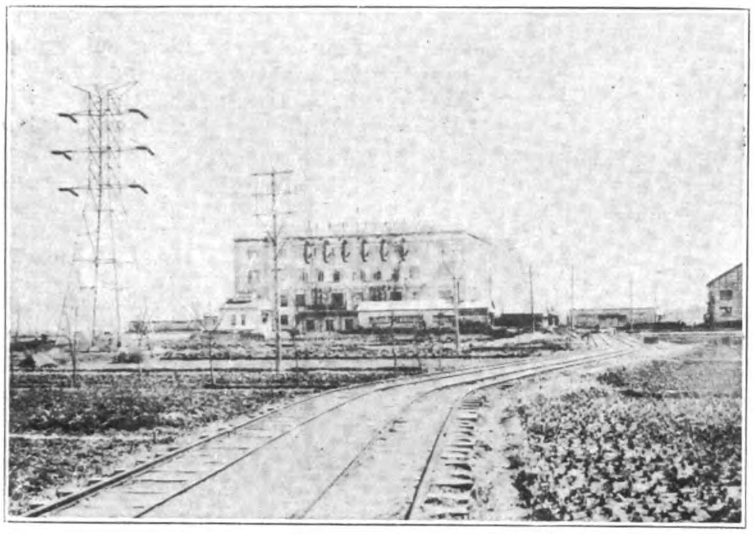
This original Inawashiro power supply soon became taxed to the limit, and by 1921 the number of lights in Tokyo had increased to over 3,000,000, with a total load calling for over 200,000 k.w. To meet this demand the Tokyo Electric Light Company erected its 154,000 volt Joetsu transmission line into the Shinano river district, bringing 50,000 k.w. of power from the two generating stations on the Nakatsu river (operated by the Shin-yetsu Electric Power Company, a subsidiary of the Tokyo company) to the Kameido receiving station in Tokyo.

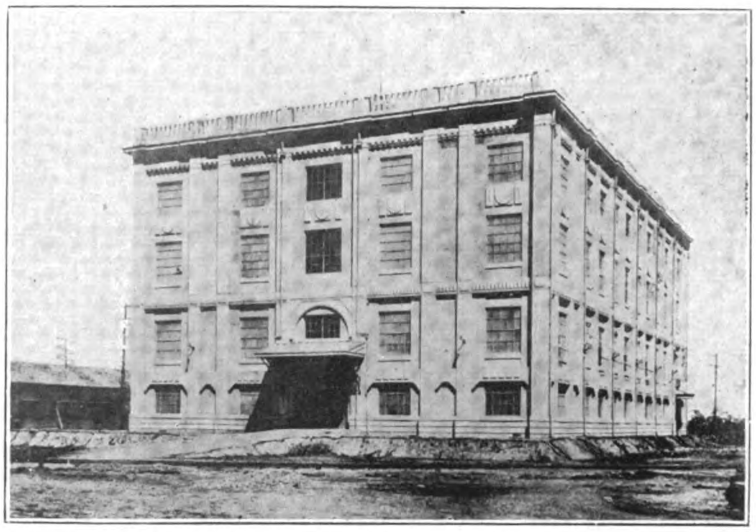
Of these stations, Nakatsugawa No. 1 is equipped with three General Electric 14,444 k.v.a. horizontal generators driven by Allis Chalmers water turbines. Power is stepped up by a bank of three G.-E. 15,000 k.v.a. water-cooled transformers to the line potential of 154,000 volts. Nakatsugawa No. 2, the older of these stations, has two General Electric 9,500 k.v.a. generators and a bank of three 6,667 k.v.a. G.-E. transformers connected to the main transmission line.

Other power stations are tapped into this line at two points, as shown on the map of the transmission system which accompanies this article. At Kayatsuki, four 7,000 k.v.a. self-cooled transformers step-up the power from the four 4,375 k.v.a. generators at the Yusawa generating station, and further down the line, at Komatsu, four giant transformers of three, winding each 21,000 k.v.a., are installed, the tertiary winding receiving the power at 6,600 volts from the Komatsu station equipped with four 4,800 k.v.a. generators. The primary winding receives power from the 66,000 volt transmission line, which in turn is fed by the Iwamuro and Kamikuya generating stations. The Iwamuro station includes three 6,000 k.v.a. generators



Tone River Crossing, Strain Tower

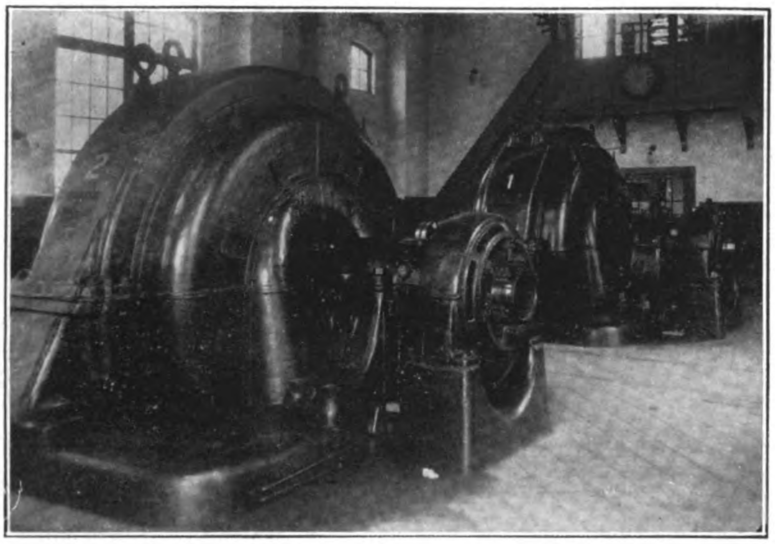


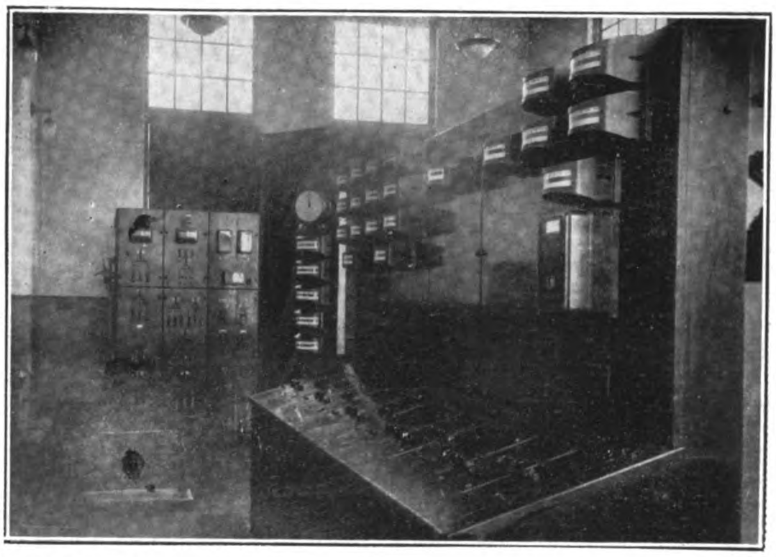


Tabata Receiving Station, Tokyo. Front and Rear Views.

feeding into two banks, each consisting of three 2,000 k.v.a. OIWC transformers.

The Kamikuya station consists of three 6,667 k.v.a. generators feeding into a bank of three 6,700 k.v.a. transformers. A spare transformer is provided in each station. The Kameido sub-station at Tokyo, installed in 1922, has nine 15,000 k.v.a. G.-E. transformers with two 15,000 k.v.a. synchronous condensers for regulating the voltage. Westinghouse high tension switchboard equipment designed for heavy duty, including the largest size of "G-22" breakers, are used throughout on the Joetsu transmission line. This line is to be further loaded by the installation of the Kochi power station, which will feed about 16,000 k.w. into the Komatsu

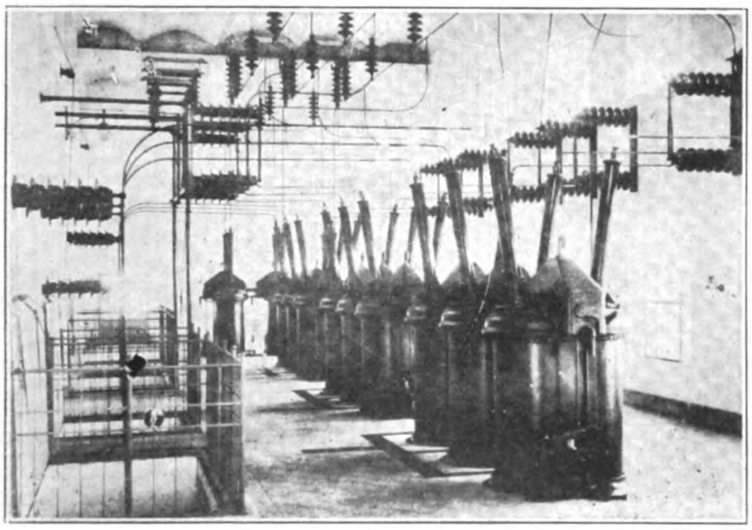


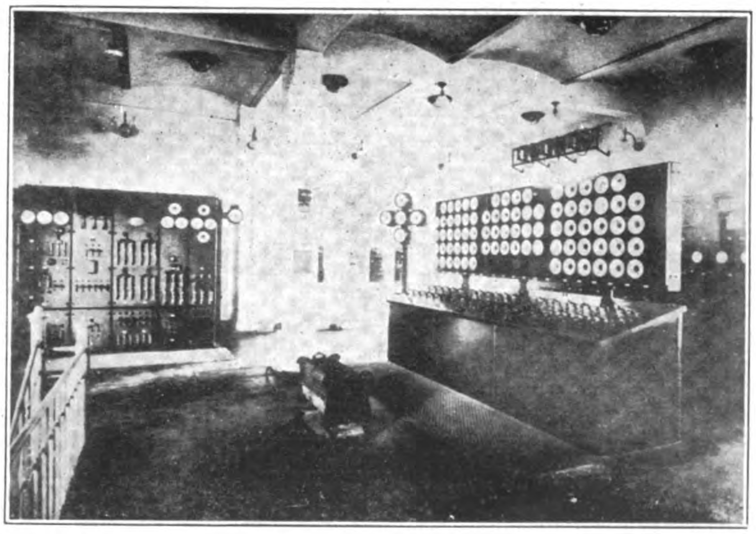


Tabata Receiving Station, Tokyo

Two 7,500 (9,000 maximum) k.v.a. Synchronous Condensers

Control Board for the Synchronous Condensers

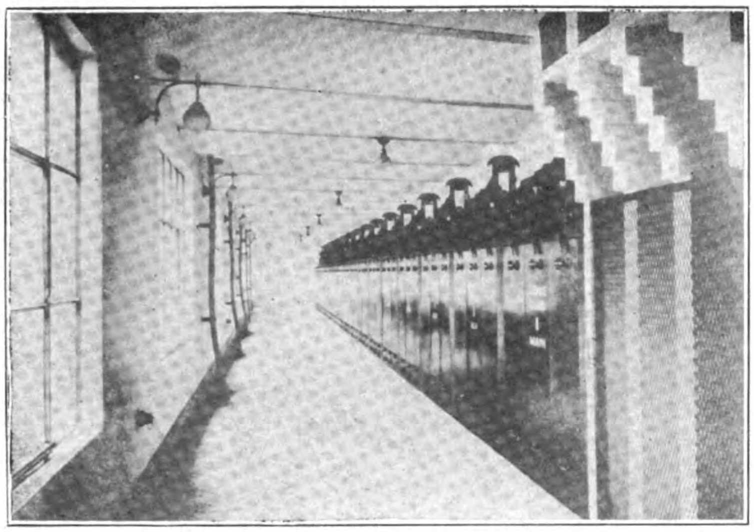


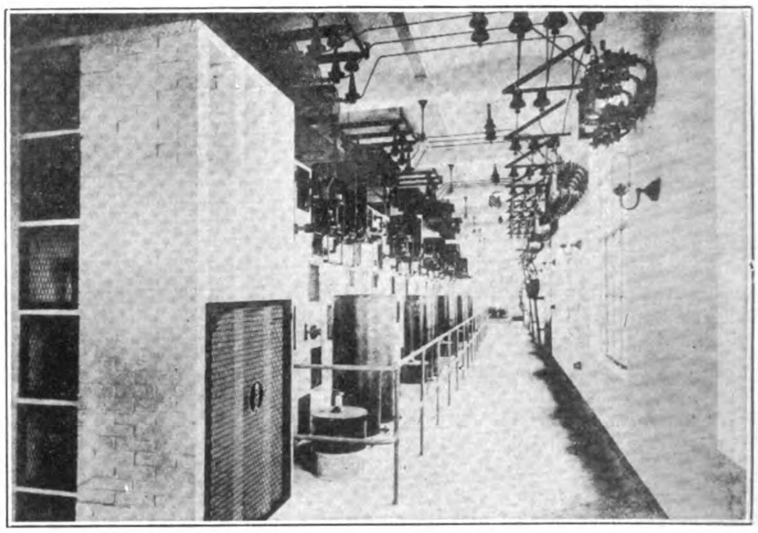


Tabata Receiving Station, Tokyo

High Tension Switch Room

Main Control and Service Board





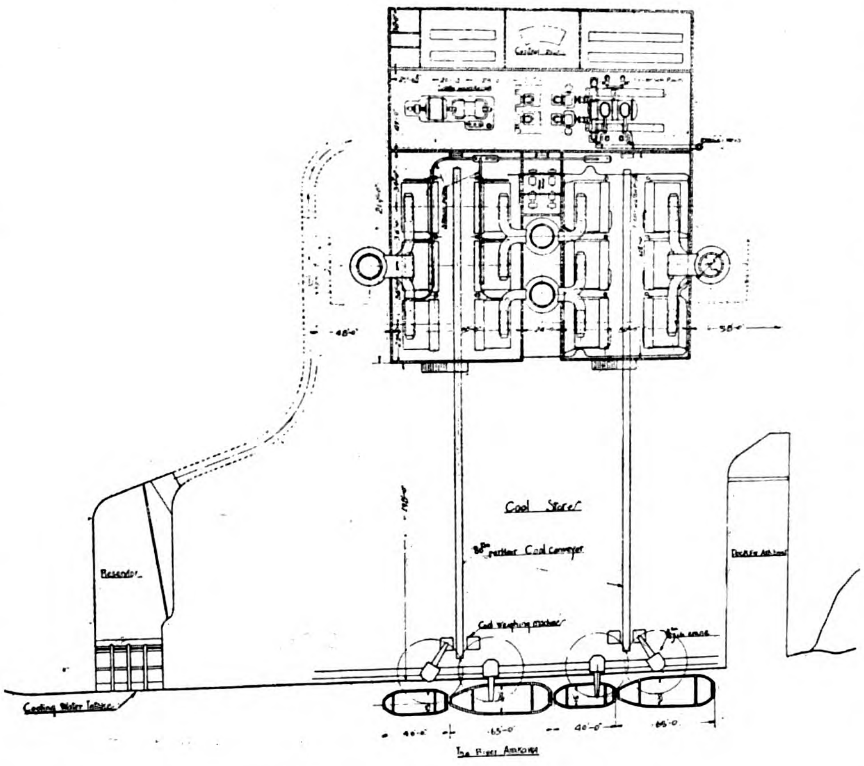
Tabata Recieving Station, Tokyo

11,005 Volt Oil Switch Room.

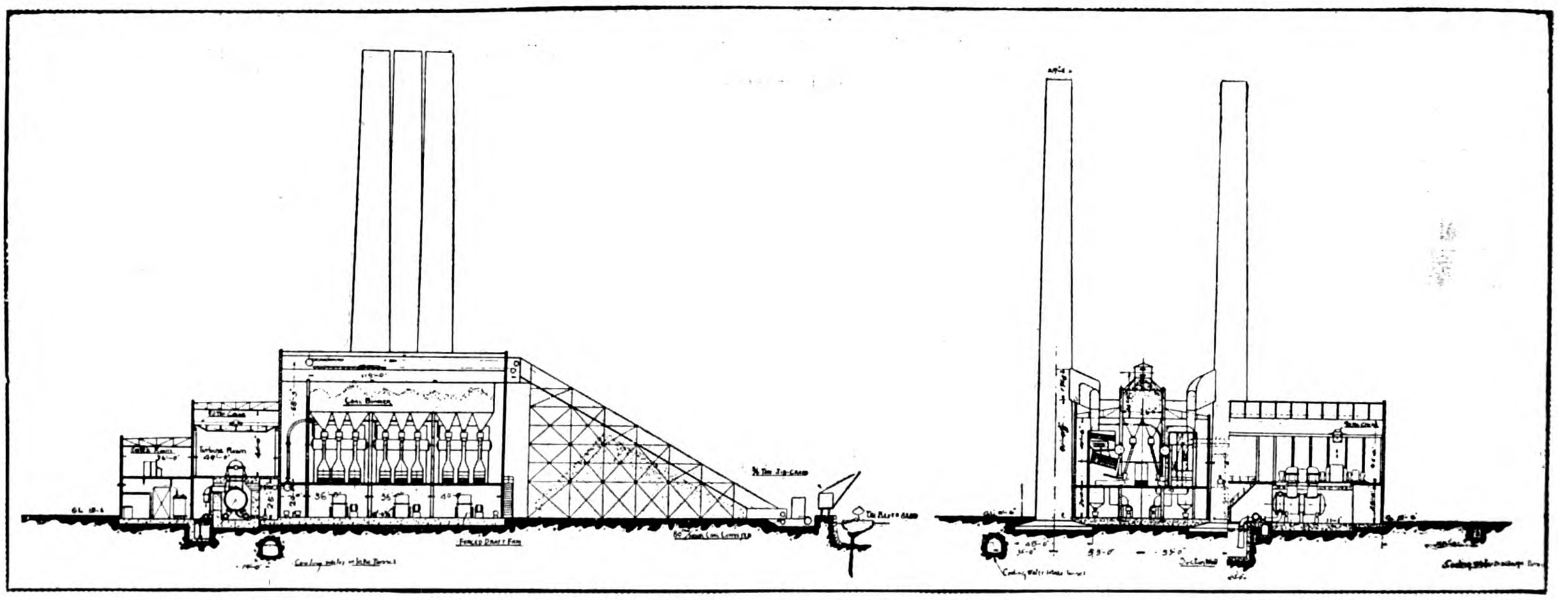
11,000 Volt Busbar Room.

step-up transformers. Furthermore, this line will be called upon to receive the power from the great 150,000 k.w. hydro-electric plant on the Shinano river, to be built by the Shin-yetsu Electric Power Company. When the Joetsu transmission line is increased to carry the full load from the Shinano and Nakatsu river stations, the total power from this one line will amount to over 250,000 k.w.

By September 1923 the demand for power in Tokyo had again almost reached the available generating capacity of the Tokyo Electric Light Company's system. At the end of May 1923 the company was supplying 4,220,000 lights and 272,000 k.w. of power, and plans were at once devised for immediate extension. The earthquake caused a temporary reduction in power and lighting demands, but by the end of 1924 the demand had again reached the limit of generating capacity, and prompt steps were again made to supply the climbing load.

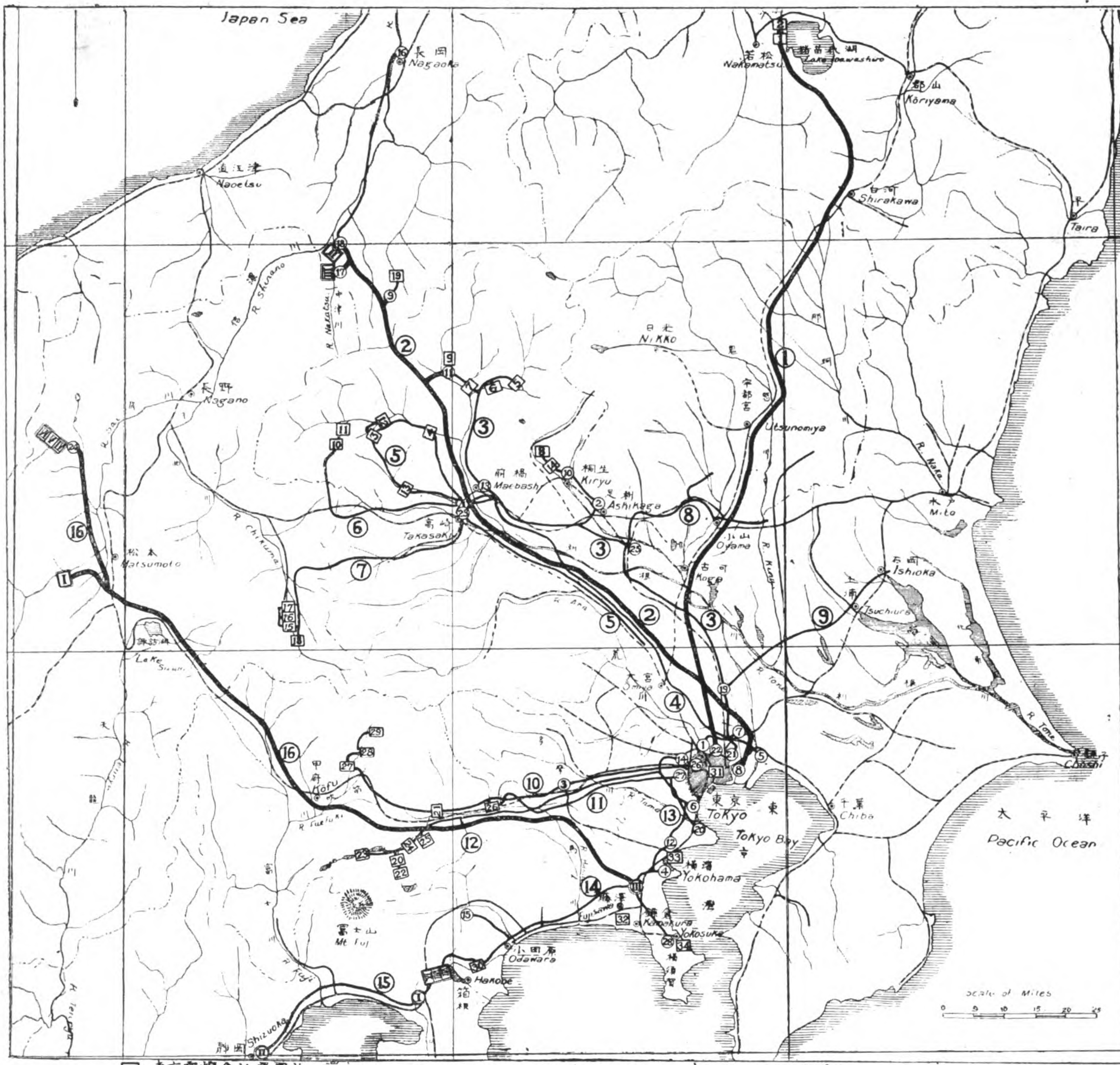


This new extension is the one briefly referred to above, utilizing the additional power stored in Lake Inawashiro for the erection of the No. 3 and No. 4 Inawashiro stations, supplemented by the Senju steam station. It also calls for another Inawashiro transmission line to carry 154,000 volts to Tokyo. Recognizing that even with these two new stations the increased supply would only satisfy the rapidly mounting demand for a short period, provision was made in the transmission equipment to bring additional power from



Plan and Side Elevation of the 50,000 k.w. Senju Steam Power Station of The Tokyo Electric Light Company, Now in Process of Erection.

Transmission System of Tokyo Electric Light Co. Oct. 1923.



□ 東京電燈會社發電所. Generating Station of Tokyo E. L. Co.
□ 傍系會社發電所. Generating Station of Subsidiary Co.
○ 東京電燈會社主要變電所. Main Substation of Tokyo E. L. Co.
○ 傍系會社變電所. Substation of Subsidiary Co.
━ 十万「ヴォルト」以上送電線路. Transmission Line above 100,000 volts.
─ 十万「ヴォルト」以下送電線路. Transmission Line below 100,000 volts.
○ 送電線路系統. System of Transmission Line.

發電所及變電所. Generating Station & Substation

東京電燈會社 Tokyo E. L. Co.

水力發電所 Water Power Plant.

1.	猪苗代第一	Inawashiro No. 1.	2.	猪苗代第二	Inawashiro No.2.	3.	厚田	Atsuta.	4.	箱島	Hakoshima.	5.	岩室	Iwamuro.
6.	上久屋第一	Kamikuya No. 1.	7.	上久屋第二	Kamikuya No.2.	8.	貴船	Kifune.	9.	小松	Komatsu.	10.	熊川第一	Kumakawa No. 1.
11.	熊川第二	Kumakawa No.2.	12.	温川	Nurukawa.	13.	里見	Satomi.	14.	高津戸	Takatsudo.	15.	土村第一	Domura No. 1.
16.	土村第二	Domura No. 2.	17.	土村第三	Domura No. 3.	18.	箕輪	Minowa.	19.	湯沢	Yuzawa.	20.	鐘ヶ淵	Kanegafuchi
21.	駒橋	Komahashi.	22.	忍野	Oshino.	23.	西湖	Saiko.	24.	鹿留	Shishidome.	25.	谷村	Yamura.
26	八ッ沢	Yatsuzawa	27.	笛吹川第一	Fuefukigawa No. 1.	28.	笛吹川第二	Fuefukigawa No.2	29.	笛吹川第三	Fuefukigawa No. 3.	30.	塔ノ沢	Tō no sawa

火力發電所 Steam Power Plant

31.	浅草	Asakusa.	32.	江ノ島	Enoshima	33.	神奈川	Kanagawa.	34.	若松町	Wakamatsuchō.

主要變電所 Main Substation.

1.	荒川	Arakawa	2.	足利	Ashikaga.	3.	八王子	Hachioji.	4.	保土ヶ谷	Hodogaya.	5.	市川	Ichikawa.
6.	池上	Ikegami	7.	亀有	Kameari	8.	亀戸	Kameido.	9.	萱付	Kayatsuki,	10.	桐生	Kiryū.
11.	小松	Komatsu	12.	子安	Koyasu.	13.	前橋	Maebashi.	14.	目白	Mejiro.	15.	峰	Mine.
16.	長岡	Nagaoka.	17.	中津川第一	Nakatsugawa No.1.	18.	中津川第二	Nakatsugawa No.2.	19.	大相模	Ōsagami.	20.	六郷	Rokugo
21.	隅田	Sumida	22.	田端	Tabata.	23.	高崎	Takasaki.	24.	高瀬川	Takasegawa.	25.	館林	Tatebayashi.
26.	早稲田	Waseda.	27.	淀橋	Yodobashi.	28.	横須賀	Yokosuka.						

傍系會社 Subsidiary Co.

水力發電所 Water Power Plant.

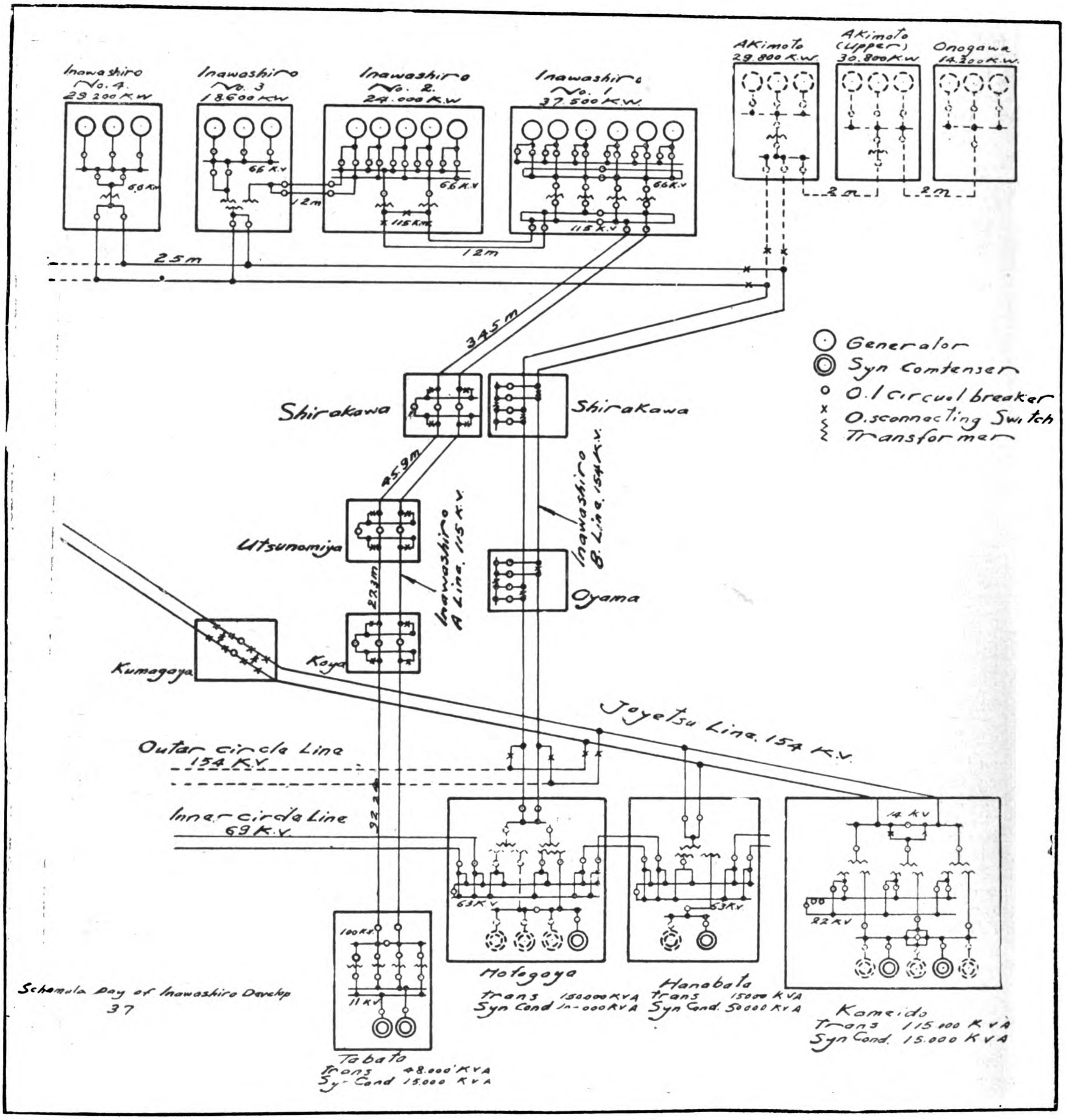
I.	龍島	Ryūshima.	II.	中津川第二	Nakatsugawa No.2.	III.	中津川第一	Nakatsugawa No.1.	IV.	高瀬川第一	Takasegawa No.1.	V.	高瀬川第二	Takasegawa No.2.
VI.	高瀬川第三	Takasegawa No.3.	VII.	深良川第一	Fukaragawa No.1.	VIII.	深良川第二	Fukanagawa No.2.	IX.	深良川第三	Fukaragawa No.3.			

變電所 Substation.

I.	三島	Mishima	II.	静岡	Shizuoka.	III.	戸塚	Tozuka.

送電線路系統. System of Transmission Line.

1.	猪苗代	Inawashiro.	2.	上越	Jōetsu.	3.	前橋(旧)	Maebashi. (Old)	4.	前橋(新)	Maebashi. (New)	5.	高崎	Takasaki.
6.	熊川	Kumakawa.	7.	東信	Tōshin.	8.	栃木	Tochigi.	9.	茨城	Ibaragi.	10.	駒橋	Komahashi.
11.	八ッ沢	Yatsuzawa.	12.	谷村	Yamura.	13.	子安	Koyasu.	14.	箱根	Hakone.	15.	静岡	Shizuoka.
16.	京浜	Keihin.												



Schematic Diagram of the Inawashiro Development.

the stations on the Nagase river. These stations include Akimoto No. 1, 29,800 k.w., Akimoto No. 2, 35,800 k.w., and the Onogawa, 14,200 k.w., bringing the total new power contemplated up to 79,800 k.w.

In No. 3 Inawashiro station will be installed 3-ATB 6,900 k.v.a., 250 r.p.m., 6,600 volt, 3 phase, 50 cycle vertical General Electric Company generators, direct connected to Escher Wyss turbines.

In No. 4 Inawashiro station will be installed 3-ATB 10,700 k.v.a., 250 r.p.m., 6,600 volt, 3 phase, 50 cycle vertical General Electric Company generators, direct connected to Escher Wyss turbines.

In each station excitation of 250 volts D.C. will be supplied by two exciters, one water wheel driven, the other connected direct to induction motor. These exciters are each of 225 k.w. capacity in No. 3 station, and 340 k.w. capacity in No. 4 station, so that in either case all three generators may be excited by any one exciter.

Furthermore, in order to relieve the 115,000 volt line of some of its load and provide a spare outlet for Inawashiro No. 2 station, a 50,000 k.v.a. transformer bank will be installed in Inawashiro No. 3. This comprises four 16,500 k.v.a. Westinghouse three-winding shell type transformers with a primary winding capacity of 6,500 k.v.a. for stepping up the 6,600 volt power from Inawashiro No. 3.

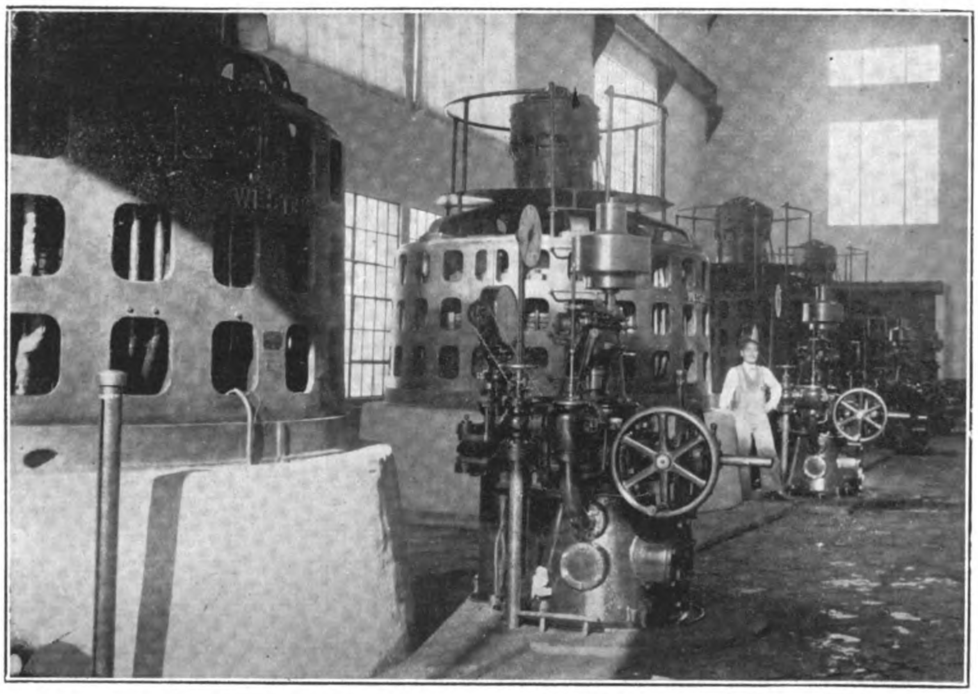
The tertiary winding is designed for 6,370 volts, with tap for 6,900 volts, and a secondary wound for 154,000 volts, with tap approximately 5 and 7½ per cent. above normal. When power is received from Inawashiro No. 2, the line drop will feed into the

6,370 volt taps, while should a fault occur on the 154,000 volt transmission line it will be possible to feed the power back through the No. 2 generating station, and thence through transformers to the 115,000 volt line by connecting on the 6,900 volt tap.

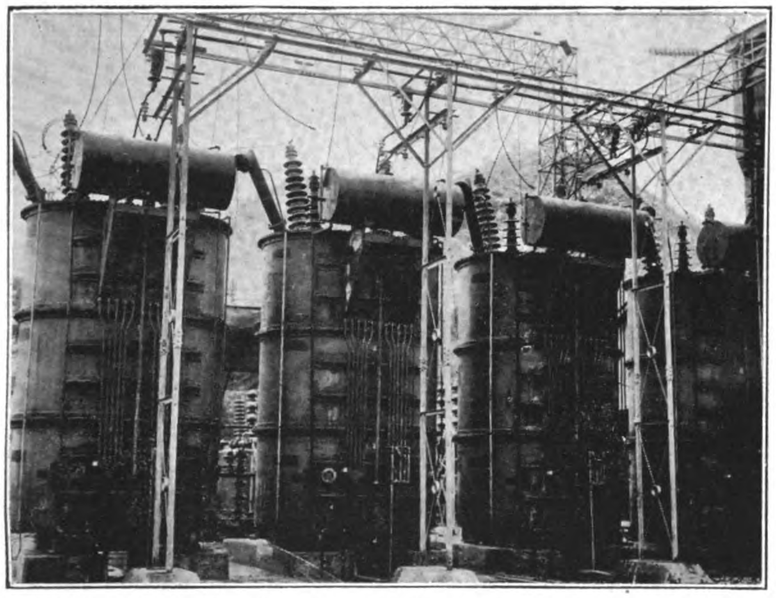
The transformers at Inawashiro No. 4 station are supplied by the General Electric Company and consist of 4-WCJ 50 cycle, 10,000 k.v.a., 89,000/-154,000 Y-6,600 volt units. On the way to Tokyo two switching stations, the Shirokawa and the Oyama, are provided for on the 154,000 volt line, and the double circuit transmission line on arriving at Tokyo is divided between two sub-stations, one at Hanabata and the other at Hatogaya.

The Hanabata sub-station will be provided with three 25,000 k.v.a. three-winding transformers, receiving power at 140,000 volts. The secondary winding will deliver approximately 28,000 k.v.a. per transformer to the 66,000 volt distributing belt line which will surround Tokyo.

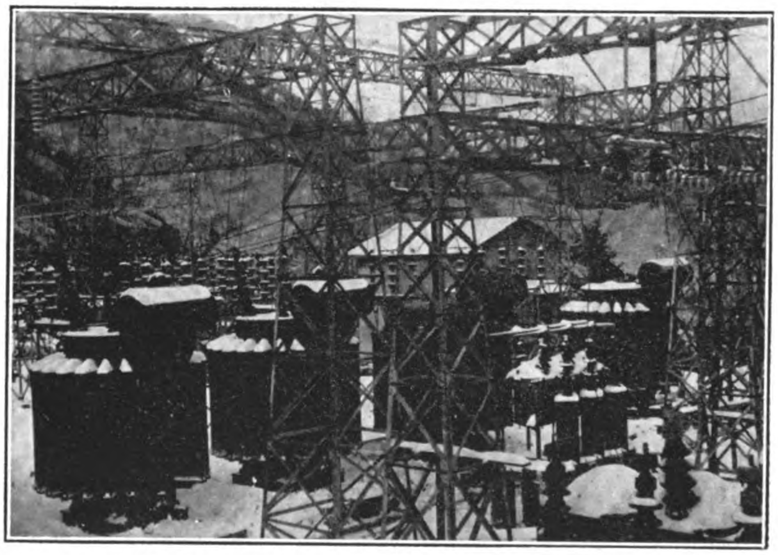
The tertiary winding at 11,000 volts will supply current to two 25,000 k.v.a. synchronous condensers and some local feeders. These synchronous condensers; furnished by the General Electric Company are rated ATI. 10 pole, 25,000 k.v.a., 600 r.p.m., 11,000 volt, 3 phase, 50 cycle.,



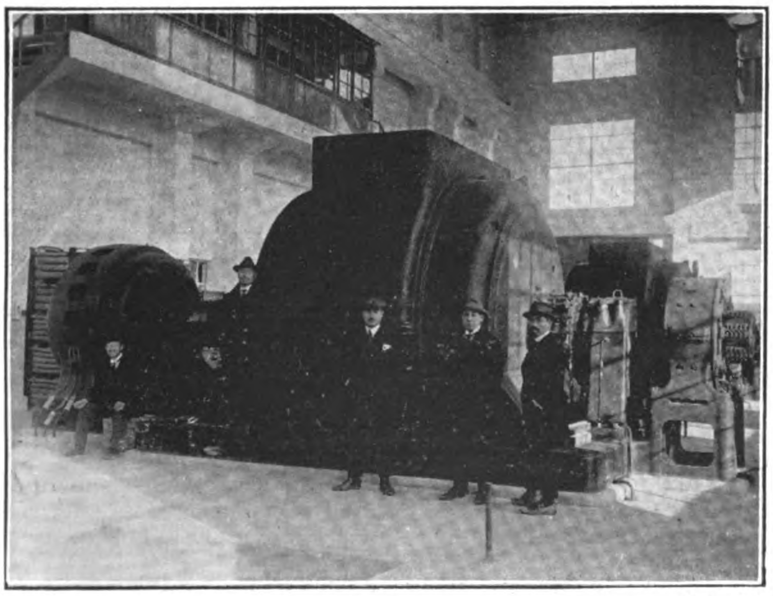
Westinghouse Generators at the Komatsu Power Plant of the Tokyo Electric Light Co.

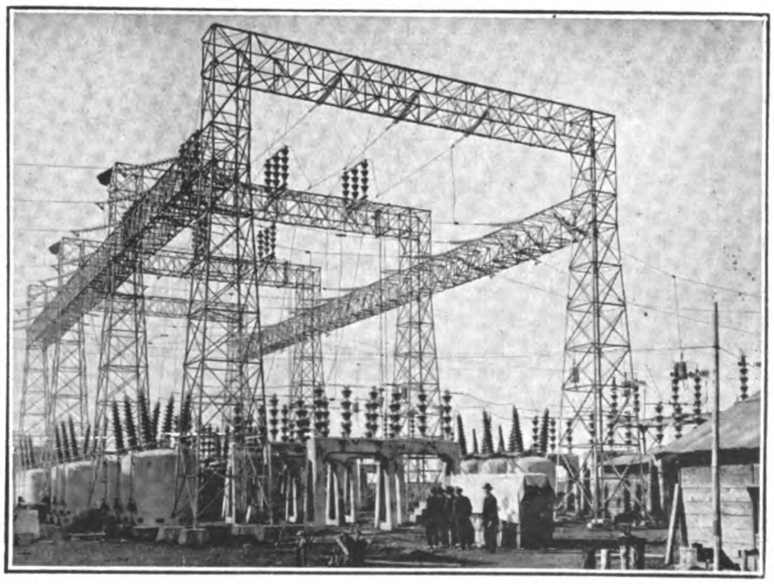


Outdoor Switching Equipment of the Komatsu Sub-station of the Tokyo Electric Light Co.; Westinghouse Type "G-2" O.C.B.



Keyatsuki Sub-station of the Tokyo Electric Light Co., Westinghouse Equipment.





Kameido Sub-station

15,000 k.v.a. Westinghouse Synchronous Condensers.

Westinghouse 154,000 volt, 22,000/11,000 Circuit Breakers.

Fig. 1.

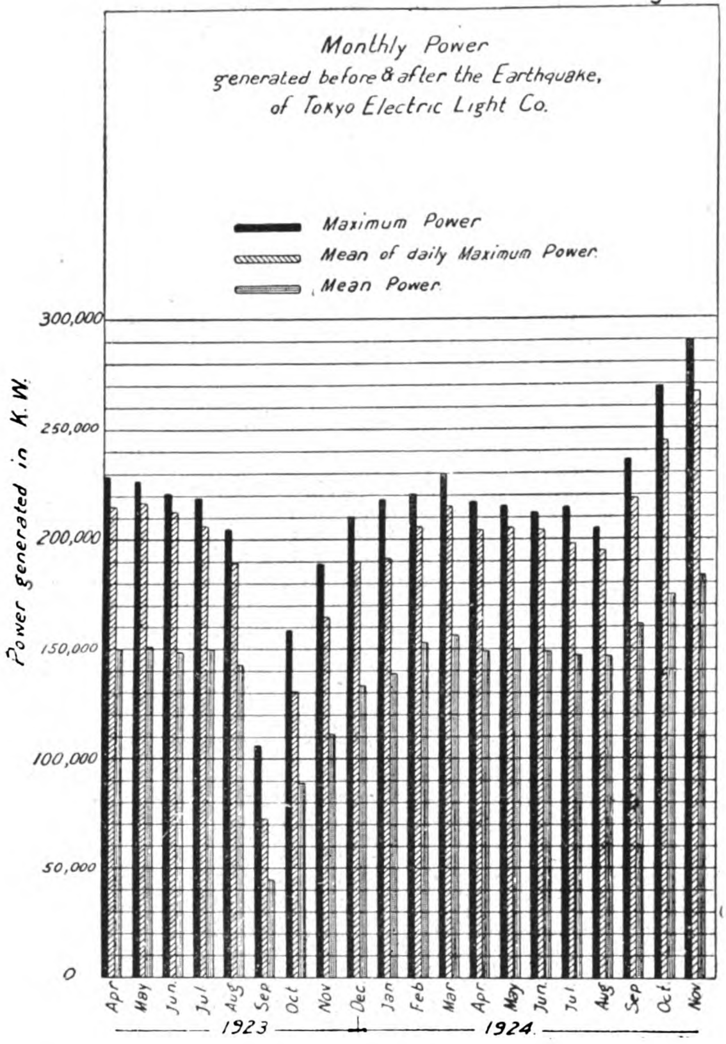
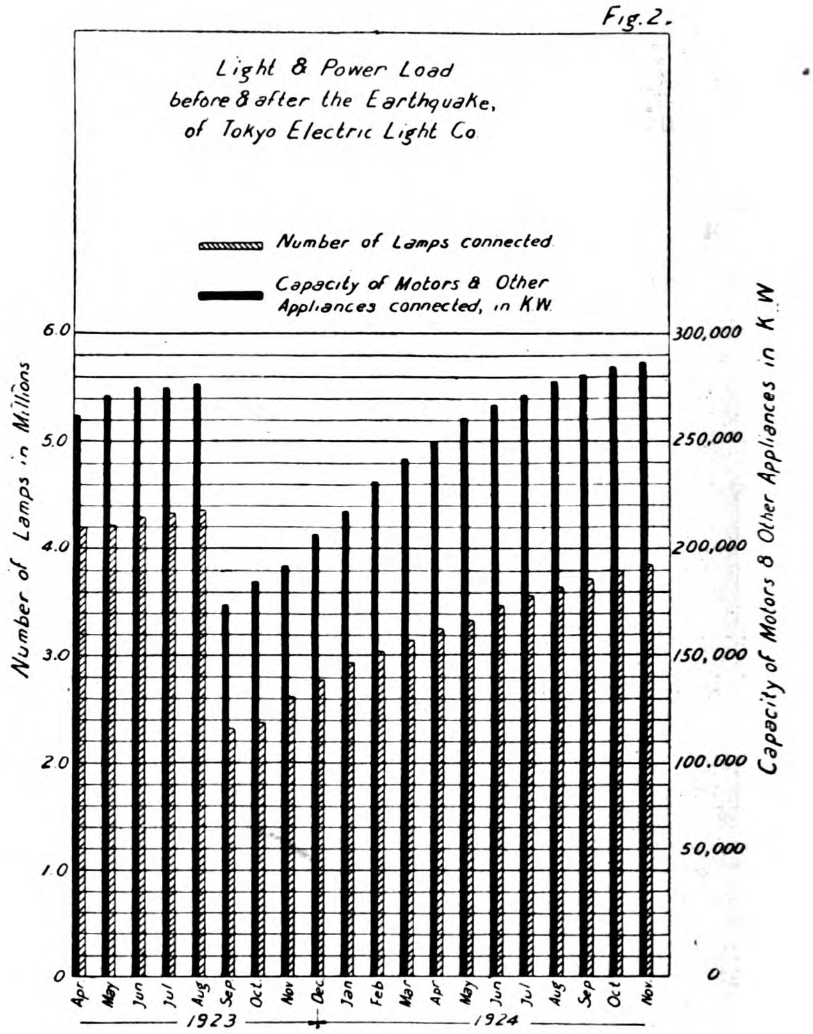


Fig. 2.



The Hatogaya will be practically a duplicate of Hanabata except that provision will be made for doubling the capacity at a future date. It will then contain 150,000 k.v.a. of transformers, and a 100,000 k.v.a. of synchronous condensers. The Hatogaya is directly connected to a double circuit transmission line, and provision is made for connecting it to the Joyetsu line. The Hanabata station will for the present supplement the Kameido station in handling power from the Joyetsu line. The diagram on page 378 fully describes the contemplated arrangement of the Inawashiro development and the location of their transmission and belt lines.

The other great 154,000 volt transmission line feeding into the Tokyo district is the Keihin, carrying power from the Ryushima and the three Takesegawa stations in the Fuji district to the Totsuka sub-station near Yokohama. However, the recent power demands in Tokyo have resulted in a connection with the Keihin high tension line at Shiojiri through seven 10,000 k.v.a. Westinghouse transformers to tap the great Daido system. This Daido power comes from its Momoyama generating station, taking 17,000 k.w. from this source. Another 34,000 k.w. is taken from the Takesagawa station of the Toshin Electric Company and 25,000 k.w. of this combined power is diverted to Tokyo through the Hashimoto switching station, where it is stepped down by a 50,000 k.v.a. Westinghouse transformer back to 66,000 volts and conveyed to the Senzoku sub-station near Tokyo. Thus, through the interlocking systems of the Tokyo Electric, Keihin and the Daido, a tie is effected between Tokyo and Osaka which will in future years feed power back and forth according to the relative demands of these two great centres of industry and population.

The Shinano and Nagatsu Power District

The Tokyo Electric Light Company's Joetsu 154,000 volt transmission line taps the Shinano and Nagatsu river power district, one of the most important of Central Japan. Here, on the Nagatsugawa, are located the two completed power-houses of the Shinyetsu Electric Power Company (a subsidiary of the Tokyo Electric Light Company), feeding 57,000 k.w. into the Joesutsu line, with a further 14,000 k.w. projected installation utilizing the same water-power. On the Shinano river, further down stream, the same company proposes to erect a 160,000 k.w. station, and still further down is to be located the super-power plant of the Imperial Railways for furnishing the current to operate the main Tokaido railway line. A map of this district is shown on page 408.

The current generated at the No. 2 power-house is boosted from 11,000 volts up to 66,000 at the open-air transformer station of the Tokyo Electric Light Company, and together with the current from the power-houses at Yuzawa, Komatsu, Iwamuro and others, is transmitted to the Kameido transformer station at Tokyo, a distance of 127 miles. The capacity of the plant is 18,000 k.w.

The effective head of water is about 560 *shaku* (559-ft.), with a flow of 500 cubic *shaku* per second. There are two Allis-Chalmers Francis water wheels of 13,000 h.p., each working at 600 r.p.m. direct, connected to two General Electric generators of 10,000 k.v.a. each, 11,000 volts, 50 cycles. The switchboard instruments and appliances are from the Westinghouse Electric Manufacturing Company. There are four open-air transformer stations (one in reserve), each of 6,700 k.v.a. capacity, single phase, where the first pressure of 11,000 volts is stepped up to 89,000 volts (with 66,000 taps). With star connections this pressure is still further boosted to 154,000 volts.

The water supply for this power-house passes through a tunnel two *ri* in length, fed from a regulating resrvoir with an effective depth of 8-ft. and a capacity of 2,430,000 cubic *shaku*. The normal flow is 350 cu. *shaku* per second, and with the maximun flow of 500 cu. *shaku* per second the reservoir will supply the plant for a continuous run at its full capacity of 18,000 k.w. for 4½ hours. A special feature of this plant is a rolling head gate.

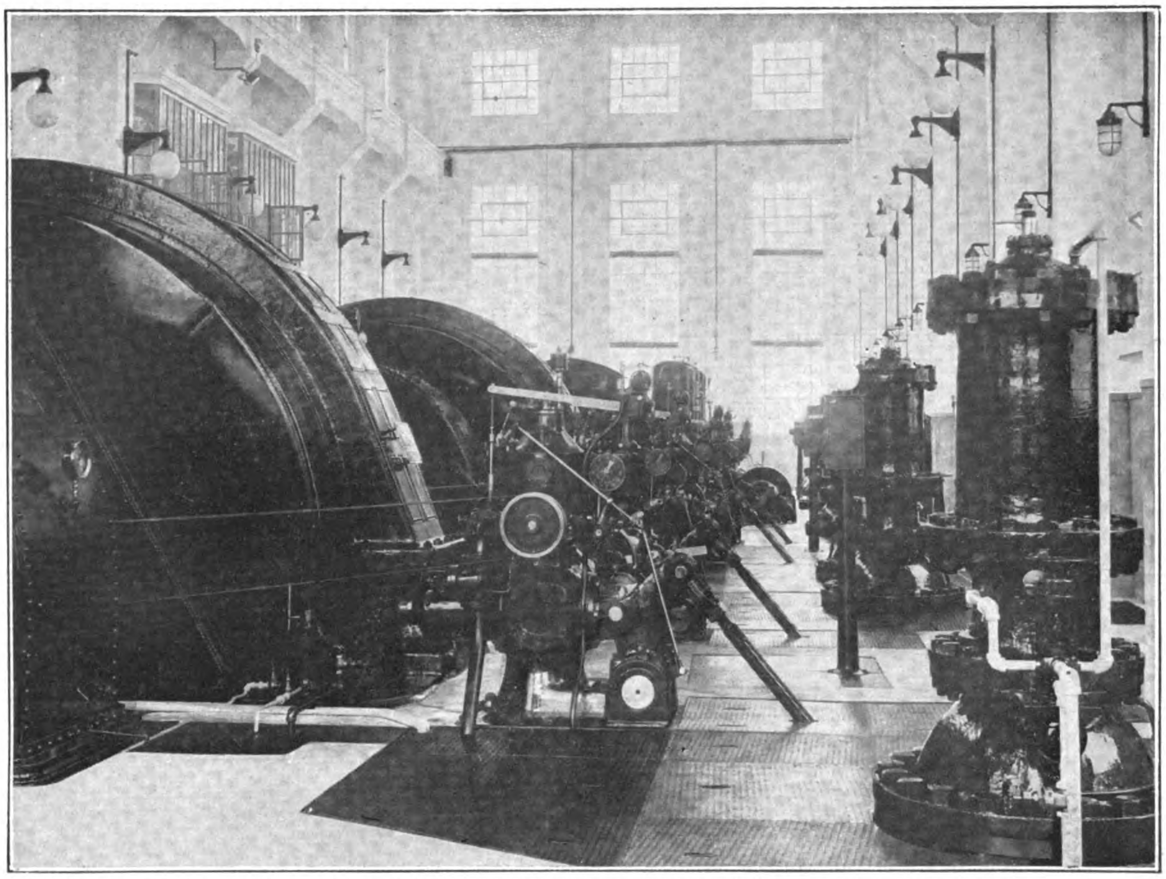
No. 1 Power House

This is a new power-house just completed, located at a point 120 yards below the intake to the No. 2 plant in order that its used water may raise the volume of the river water which flows through the head race of the No. 2 plant.

The control dam in the main river at the intake is 100-ft. ong, with an additional dam 50-ft. long across the branch stream which flows into it at this point. The head gate is of the rolling type, 40 feet in length by 5-ft. in diameter. The head race is 20,900 yards long with a gradient of 1-1,250. Almost all of this is tunnel work which covers 19,649 yards, the rest being covered ditch. The regulating tank has an effective capacity of 2,500,000 cubic *shaku* with an effective depth of 8.7-ft.

The flume pipes are three in number, arched and lap riveted. The total length is 2,697 feet, with a diameter at the top of 5 feet and a thickness of $\frac{3}{8}$-inch, increasing to $1\frac{13}{16}$ inches at the lowest part where the diameter of the pipe reduces to $3\frac{1}{2}$-ft. These come together in a Y, the ends of which taper off to the sluice gate valves. The total weight of these pipes is 2,200 tons. They were supplied by the Kellogg Company of America.

The power-house building has a total area of 1,124 square yards, with 748 square yards devoted to the turbine and generating room. There are also three smaller houses, 3 by 94 *tsubo*. The generating room is equipped with an Hidachi overhead traveling crane 38-ft. long with a lifting capacity of 55 tons. There are three motors, 80, 30 and 10 h.p. respectively, with a speed of 8-ft. in winding, 75-ft. in longitudinal, and 35-ft. latitudinal movement per minute.



Generating Room of the No. 1 Nakatsugawa Power House of the Shin-yetsu Hydro Electric Company, Equipped with Three 14,444 k.v.a. General Electric Generators driven by Three Allis-Chalmers, 18,000 h.p. Impulse Water Wheels; Westinghouse Switchboard

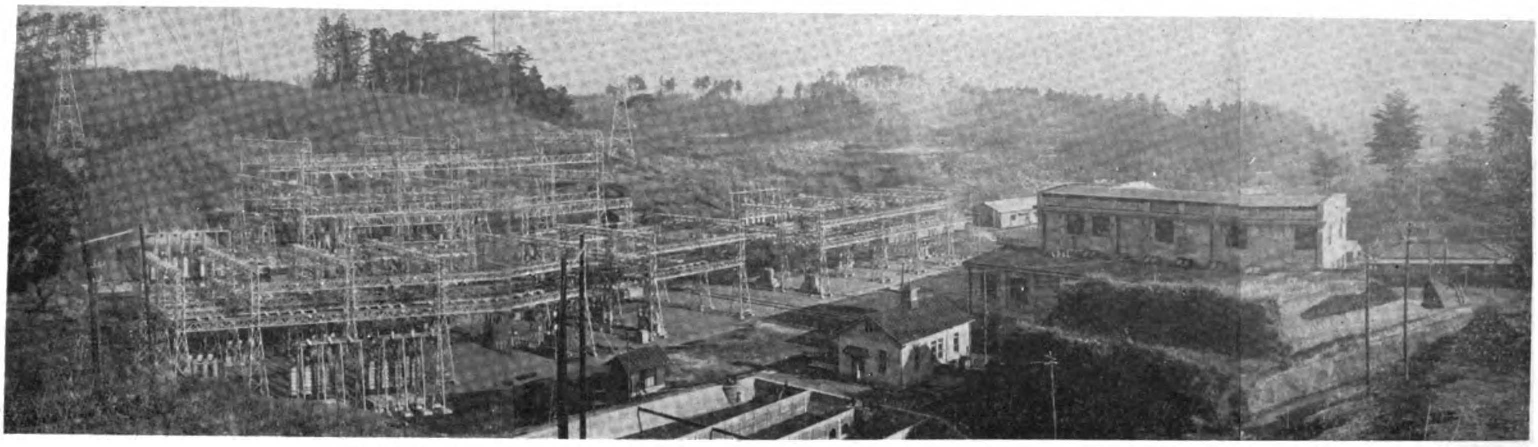
The generating equipment consists of three Allis-Chalmers horizontal axis impulse water wheels with overhung single jets and independent control developing 18,000 h.p. at 3,000 r.p.m. with a specific speed of 3.43. These are connected direct to three General Electric generators, rated at 14,444 k.v.a. three-phase, 50 cycles, 11,000 volts, with a rated efficiency of 97.2 at full load, 96.6 at three-quarter load, and 95.6 at half load. A Westinghouse power regulator of the broad range type is also installed. The 235 k.w. 250 volt General Electric exciter is driven by a 400 h.p. impulse wheel at 985 r.p.m. manufactured by the Dengyosha Company.

The auxiliary equipment of the power-house consists of three station transformers, of which two are three-phase 100 k.v.a., 11,000 volts—220 and 110 volts, and one three-phase 350 k.v.a. transformer 11,000—3,300 volts. There are two 5 k.w., 220 volt generators operated by electric motors for charging the accumulator, which has a capacity of 100 amp. hours, 220 volts, discharging in three hours ; two 15 h.p. motors for the oil pump attached to the speed regulator ; one 3 h.p. motor for the air compressor attached to the oil tank of the speed regulators ; two 25 h.p. motor-driven cooling water pumps. One set of the above equipment is for reserve purposes. The open-air transformer is furnished by the Tokyo Electric Light Company and is provided with four (one in reserve) single-phase oil transformers, 15,000 k.v.a., manufactured by the General Electric Company. The first pressure of 11,000 volts is stepped up to 89,000 volts, and with star connections it produces 154,000 volts. The cooling water comes from the reservoir supplied by the motor-driven cooling pumps.

The difficulties surrounding the construction of the No. 1 power-house were trying in the extreme, especially in the transport of materials from the power-house site to the head tank. Up this incline a winding track had to be built with the cars hauled up by winches operated by motors. One of these motors of 550 h.p. operated a winch which raised a load of 50 tons, and another of 300 h.p. operated another winch raising 25 tons. Several special motors were also used to raise loads of ten tons in laying the iron pipes in the head flume. In addition a tramway line 13 miles long (2ft. 6-in. gauge) was laid from the entrance of the gorge to the power-house site on which 24 electric locomotives were in constant operation.

One of the features of this construction job was the two huge stone-crushing plants operated by electricity and equipped with 200-h.p. crushers which had to be erected to supply the work. As the river bottom could not furnish the large amounts of gravel and sand required for concrete mixing, a side of the mountain was blasted out to provide material that was crushed to dust and the screenings used as a substitute for sand and gravel. Over 8,000-lbs. of blasting powder were used in two blasts, and over Y.500,000 expended on the crushing plants alone.

The highest head of water in Japan (1,980 *shaku*; effective, 1,850 *shaku*) is used at the power plant of the Besshi copper mine (owned by the Sumitomo Company), but the capacity of the power plant is only 4,000 k.w. Compared with this, the head of water at the No. 1 power-house of the Shin-yetsu Company, generating more than 200,000 k.w., is the most powerful in Japan. The difficulties in laying the pressure pipe under these conditions were unparalled in Japan. At one place it was necessary to lay the pipe at an angle of 50 degrees. Interest in this plant has not ceased with its completion, as there still remain difficulties that must be met and solved in order to assure its safety and operation during the winter months. Then all the drainage channels in the catchment basin will be blocked with snow, and a continued snowfall may start an avalanche that might block the head entrance. Again, the districts over which the transmission line passes are covered deep with snow during the winter months, and the transmission of a 150,000 volt current through this snow-covered territory will be watched with the greatest interest, as it is the first time it has been attempted in Japan.



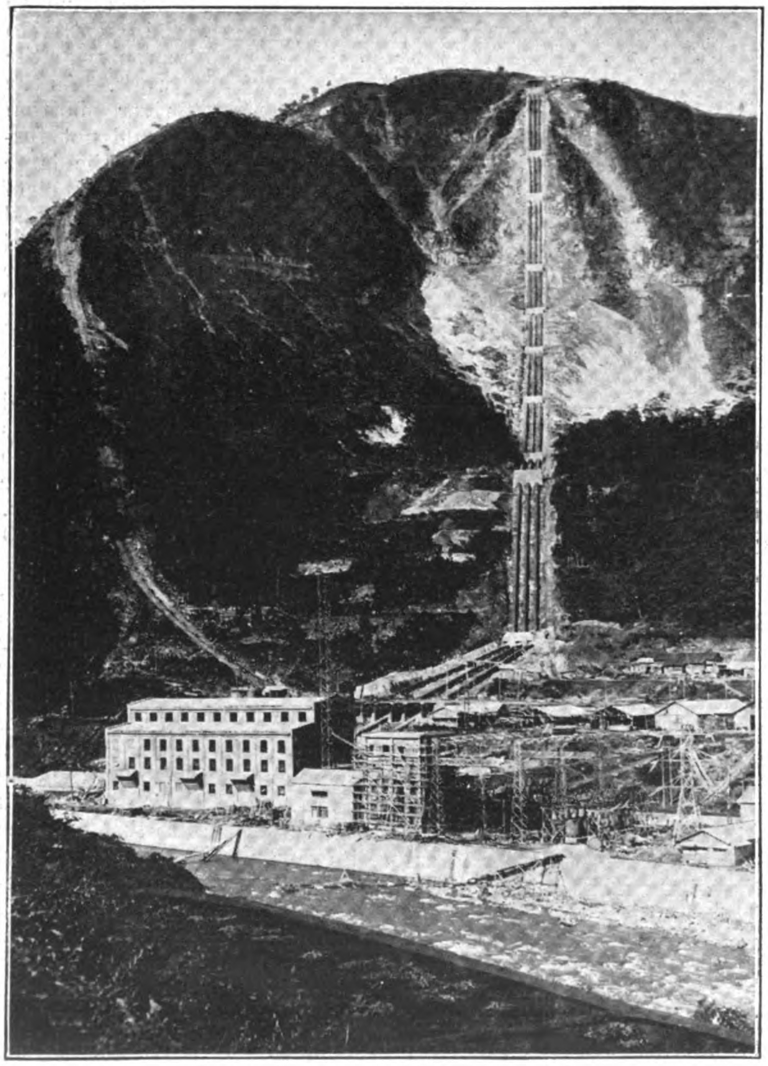
The Yokohama Receiving Station of the Keihin Electric Power Company at Totsuka

The Keihin Line

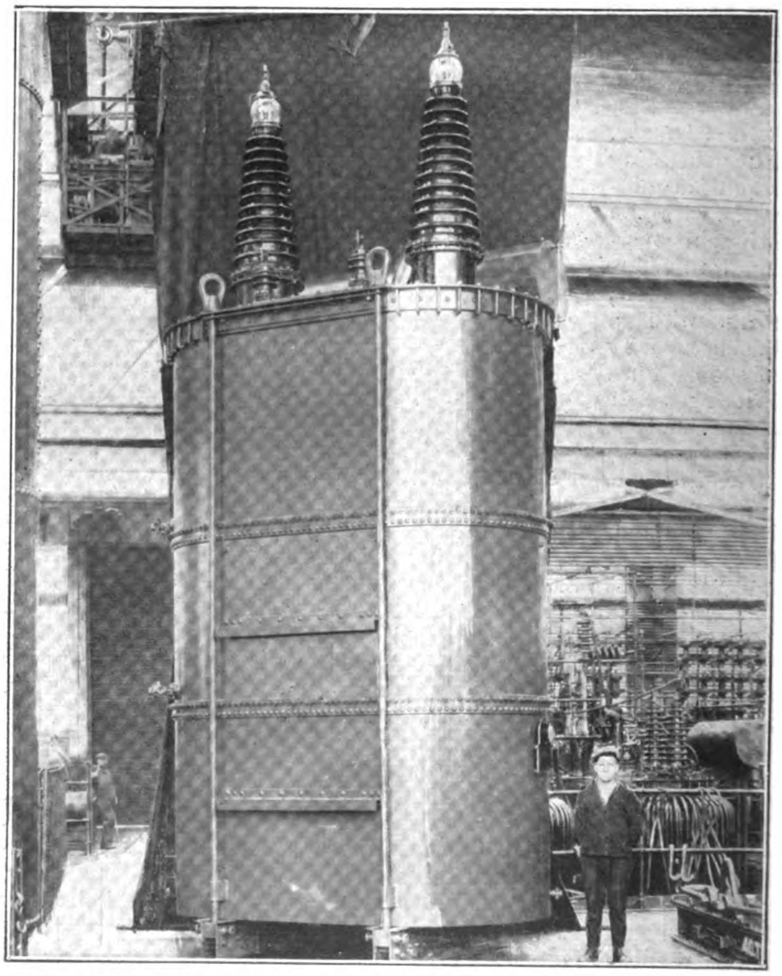
To the south and west of Tokyo lies the Fuji power district, with its lakes and rivers fed from the snows of the surrounding mountains. Here are located some of the largest of the new power stations, feeding on one side into Nagoya and Osaka over the lines of the Daido Electric Power Company, and into Tokyo over the 154,000 volt transmission line of the Keihin Hydro-Electric Company, another subsidiary of the Tokyo Electric Light Company. Over this line is transmitted the initial 17,000 k.w. from the Momoyama plant of the Daido Company, the connecting link between the two great power systems supplying Osaka and the Tokyo district.

The Keihin Hydro-Electric Company was one of the pioneer companies to accept the 154,000 volt transmission standard, feeding at this pressure into Yokohama and Yokosuka since 1923. The first unit of this system is the new Ryushima generating station located on the Saikawa, having a capacity of 20,050 k.w. The receiving station at Yokohama is equipped for 66,000 k.v.a. and the two are connected by 125 miles of double circuit transmission line.

The power for this station is obtained from the Saikawa river, which has its source on the Japanese alps. The normal flow is 720 cubic feet per second and 400 cubic feet minimum, with an effective head of 430-ft. The water, led through a canal 5.78 miles long (97 per cent. tunnels), takes in the Oshirokawa and Kurokawa rivers on its way to the head tank at Ryushima. Two lines of riveted steel pipe, 810-ft. long, 7-ft. 6-in. and 7-ft. in diameter, $\frac{5}{16}$-in. and $\frac{5}{16}$-in. minimum and maximum thickness, convey the water from the head tank to the station. There are also two regulating ponds with storage capacities of 1,920,000 and 2,260,000 cubic feet for assuring the peak load during the winter months.



No. 1 Power House of the Shin-yetsu Electric Power Company located on the Nakatsu River 43,333 k.v.a.

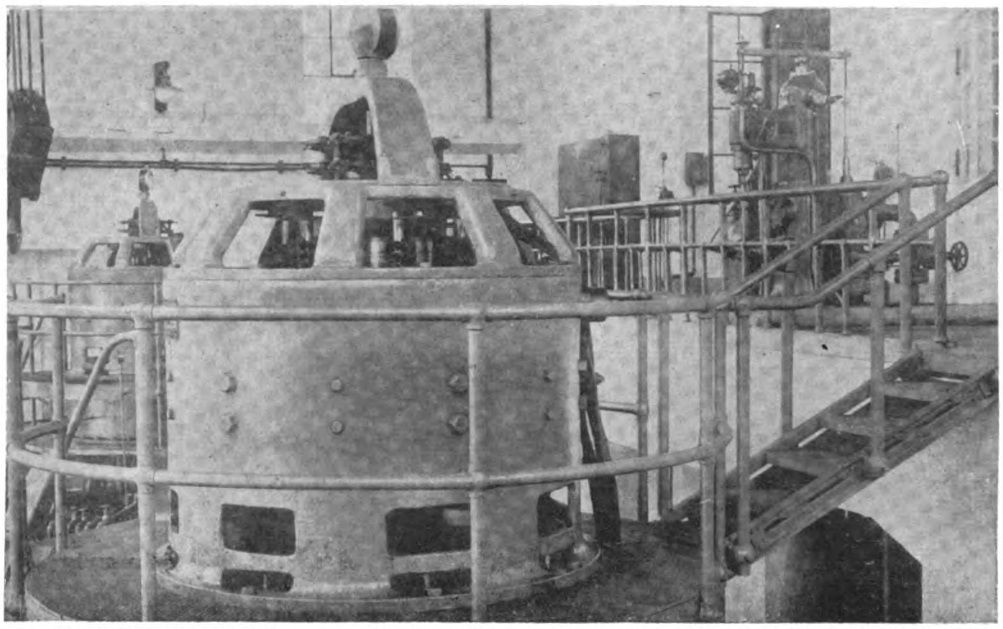


Type WCJ-50-10,000-89,000/154,000Y-6,600 General Electric Outdoor Transformer for the 154,000 volt Joyetsu Transmission Line of the Tokyo Electric Light Company, Ltd.

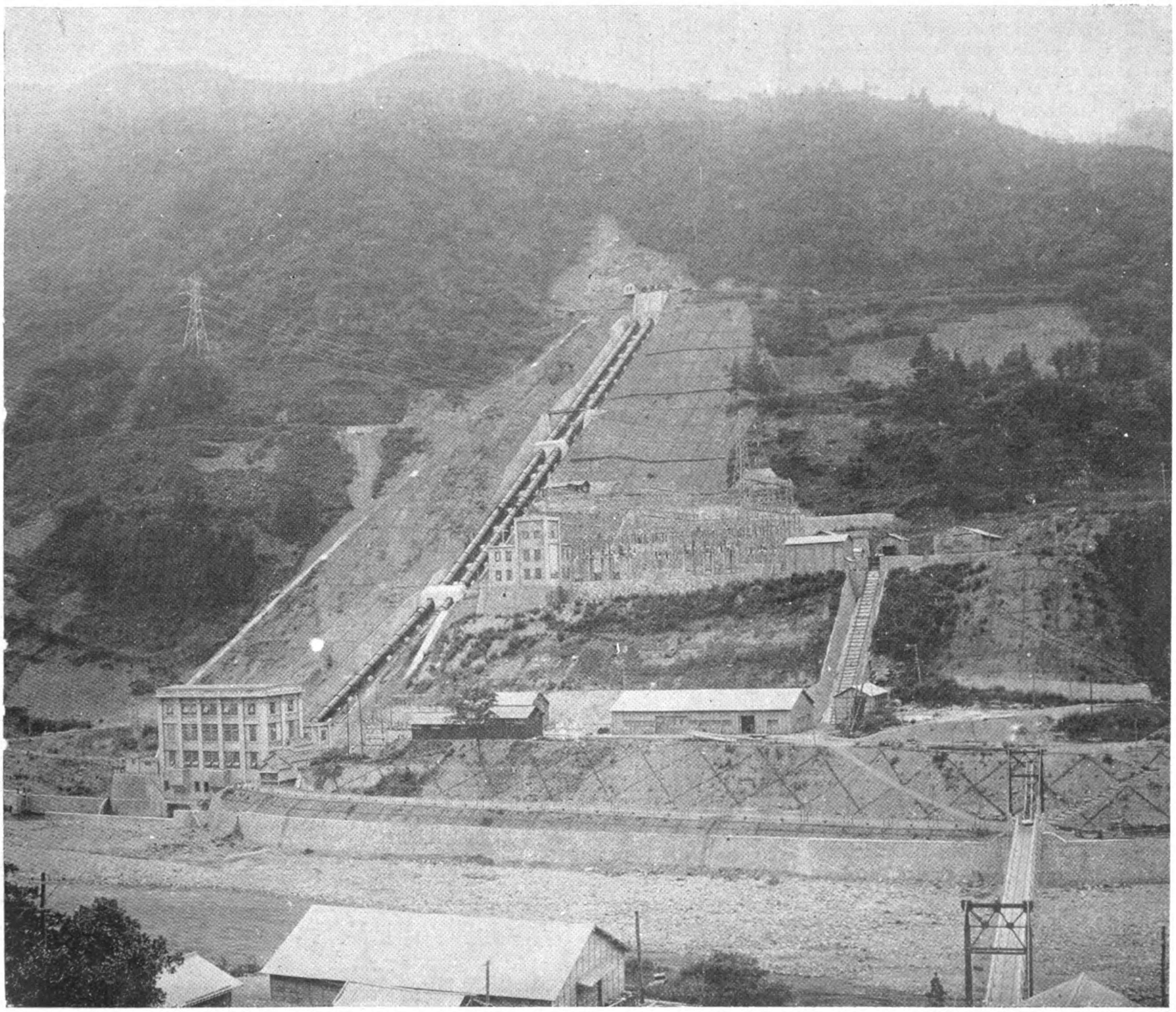
Power House

As will be seen from the illustration, the power station consists of an indoor and outdoor installation, the latter being located half-way up the hill. The power-house of reinforced concrete construction is equipped with two Allis-Chalmers vertical shaft Francis type turbines developing a maximum of 18,000 horse-power at 375 r.p.m. These turbines are provided with water-cooled lignum-vitae bearings and telescopic draft tubes for easy handling and inspection of the runners. The governors, installed on the switchboard floor for convenience of attendance, are fitted with shaft fly-balls. Pressure regulators of 60 per cent. discharge capacity are also provided for safety.

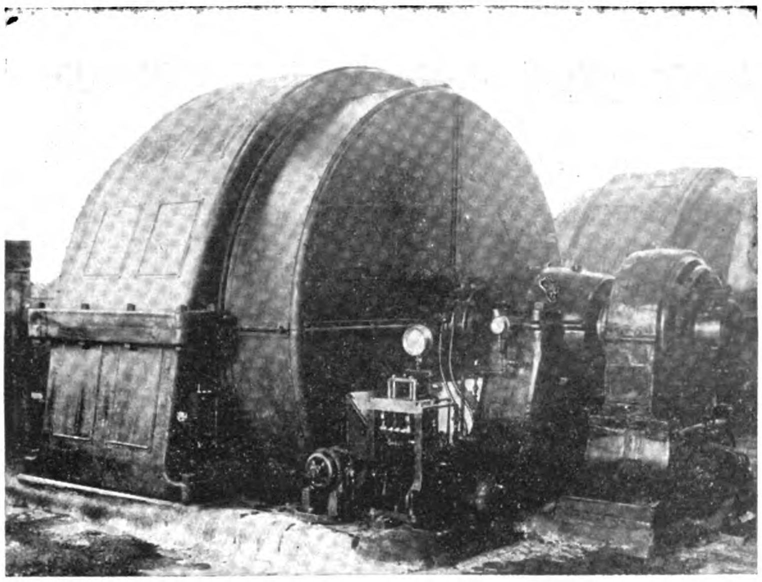
The turbines are coupled direct to General Electric generators, each 13,000 k.v.a., 6,600 volts, 50 cycles, with fly-wheel effect of 1,100,000-ft.-lbs. These generators are fitted with spring thrust bearings. The direct coupled exciters are 180 k.w., 250 volts, direct current, shunt type

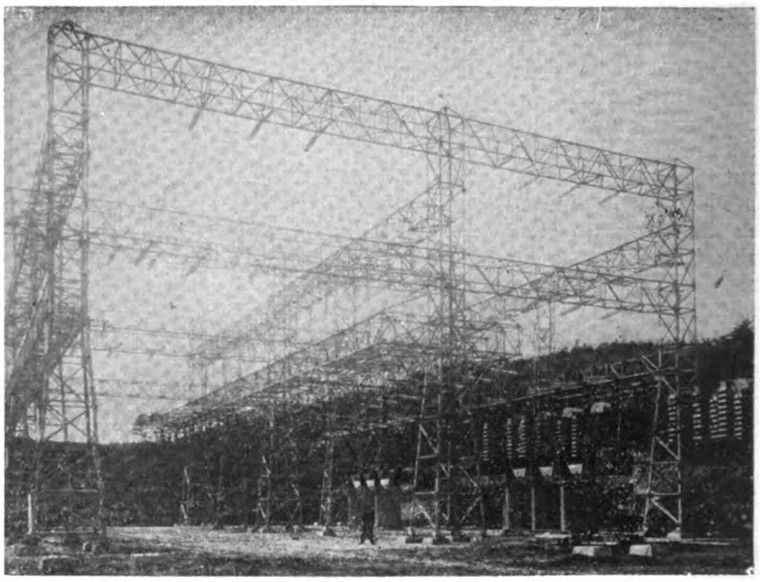


Direct Coupled Exciters at the Ryushima Station, showing also the Allis-Chalmer Turbine Governor in Switchboard Floor



View of the Ryushima Generating Station of the Keihin Electric Power Co. Capacity 26,000 k.v.a.





YOKOHAMA RECEIVING STATION, KEIHIN ELECTRIC POWER COMPANY

15,000 k.v.a. Synchronous Condensers

Outdoor Sub-Station, 154,000 volt side

with commutating poles, each capable of exciting two generators.

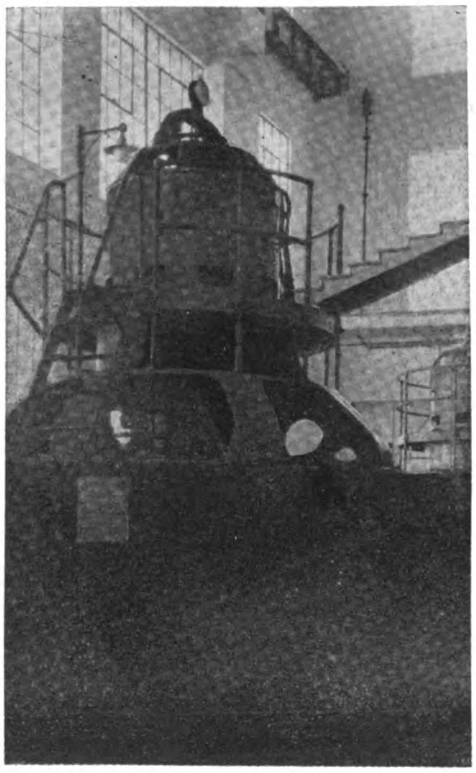
The main control board is of the G. E. bench type, double bus system arranged on bus bar compartments. The 6,600 volt circuit breaker is of the H. 6 oil type made by the General Electric Company, their interrupting capacities being guaranteed to 20,000 ampères at 15,000 volts normal frequency.

Outdoor Installation

This consists of two G.-E. step-up transformers, each single phase, water-cooled, 6,600 k.v.a., 6,600-89,000 volts, 50 cycle, connected up delta-star, the neutral point being grounded through 900 ohms resistance, The double bus arrangement is on a steel frame structure. The oil circuit breakers for 154 k.v. are of the FHKO-36-42 B type made by the G.-E. Company, the interrupting capacities being guaranteed at 2,300 ampères at rated voltage and frequency. The first oxide film lighting arresters for such high voltages to be used in Japan have also been installed.

Transmission Line

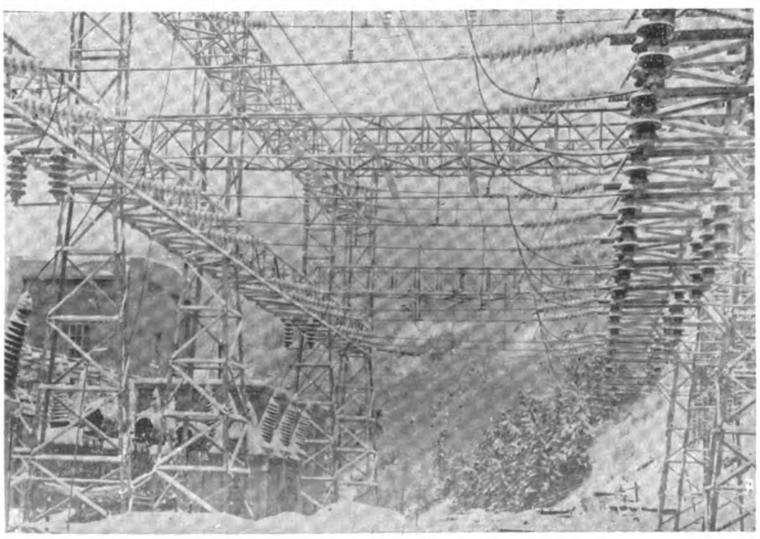
The transmission line extending from Ryushima to Totsuka, near Yokohama, 125 miles in length, cost Y.10,000,000, or about fifty per cent. of the total installation cost. The line not only transmits power from the Ryushima station, but takes 17,000 k.w. from the Momayama generating station of the Daido Electric Power Company, and 34,000 k.w. from the Takasegawa station of the Toshin Electric Company at the Shioziri switching station, distributing 25,000 k.w. of this power to Tokyo at the Hashimoto switching station.



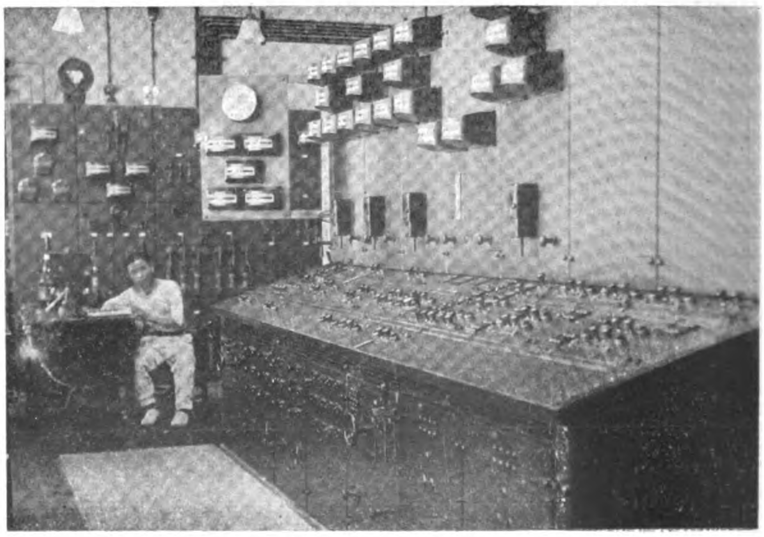
One of the 13,007 k.v.a., G.E. Water Wheel Driven Alternators

The conductors used are steel-reinforced aluminum cables, 409,000 c.m., from the American Aluminum Company, and 400,192 c.m. copper cables of Japanese manufacture. The aluminum cables are used on the first ten-mile section where transmitted power is assumed to be less than in the further sections.

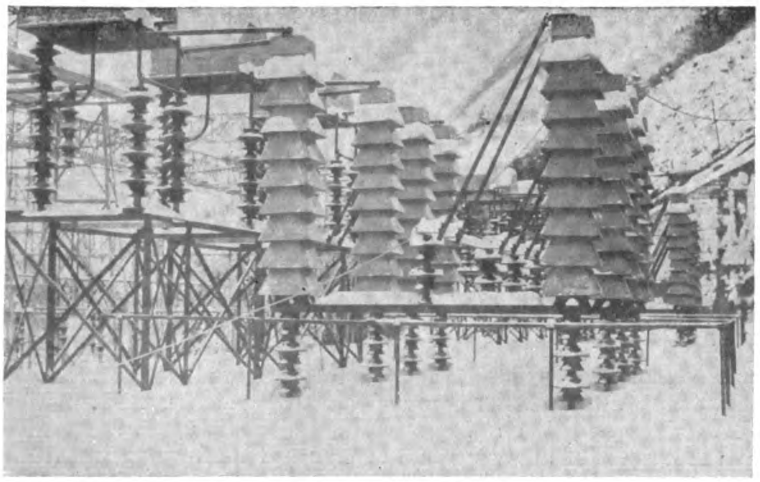
There are 942 galvanized steel towers set on concrete foundation, including 689 standard towers, 168 angle towers, 68 strain towers, 8 transposition towers and 9 special towers carrying three-phase single circuit on each side and a ground cable on their tops. Thel ine conductors are arranged vertically, the upper and lower laying conductors on a vertical plane with a horizontal offset of 2-ft. 5-in. for the middle conductor and vertical spacing of 13.5-ft. The line, transposed four complete turns in the total length, is subdivided in five sections by switching stations, where future incoming and outgoing lines will be connected



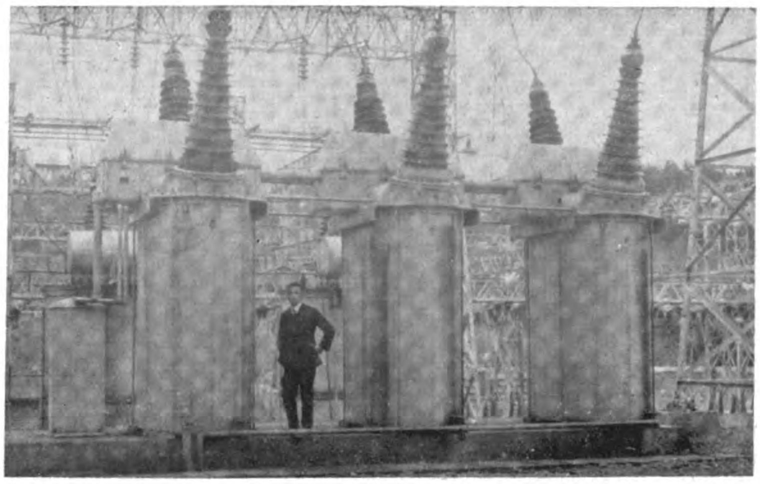
Outdoor Switching Station at Ryushima



Control Switchbeard at Ryushima



Oxide Film Arresters on the Yokohama Line



154,000 Volt Oil Circuit Breakers on the Yokohama Line

Insulators are of the suspension type, ten inches in diameter, part manufactured by the Ohio Brass Co. and part in Japan. There are ten units for standard towers and eleven units for angle and strain towers, etc. Care has been taken that eleven unit stringing is used for high altitudes (4,000-ft. above sea level) along the line. Four circuits of telephone lines are on separate wooden poles, and satisfactory communication is obtained. A relay combination of 6 inverse time limit overload relays IA-101, an auxiliary relay PQ-3, and a duo directional over-current relay IB-Y2, furnished by the General Electric Co., is used at the sending end for line protection. Another relay combination of 3 inverse time limit overload relay, a reverse power relay IK-105, and a low current inverse time limit overload relay IA-103, is used at the receiving end for line protection.

Receiving Station

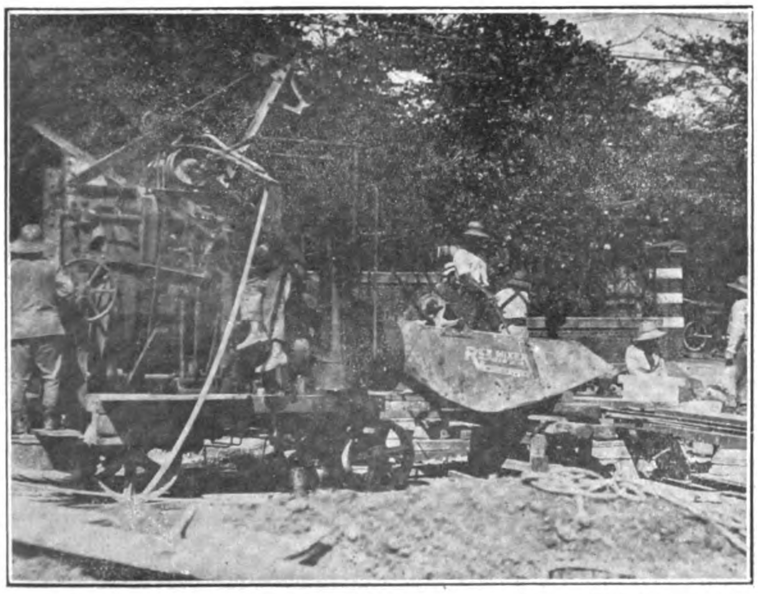
At the receiving station the transmited power is stepped down from the transmission voltage of 140,000 volts to the feeder voltage of 66,000 volts, and combining the power from the Hakone power stations of Tokyo Dento Kabushiki Kaisha, is distributed to Tokyo, Yokohama and Yokosuka. Two banks of G.-E. step-down transformer, each single phase, water-cooled, 10,000 k.v.a., 11,000 k.v.a., 5,000 k.v.a., 80,900-38.1,000-11,000 volt, 50 cycle are connected up star-star-delta, the tertiary windings of 11,000 volt being provided for synchronous condensers.

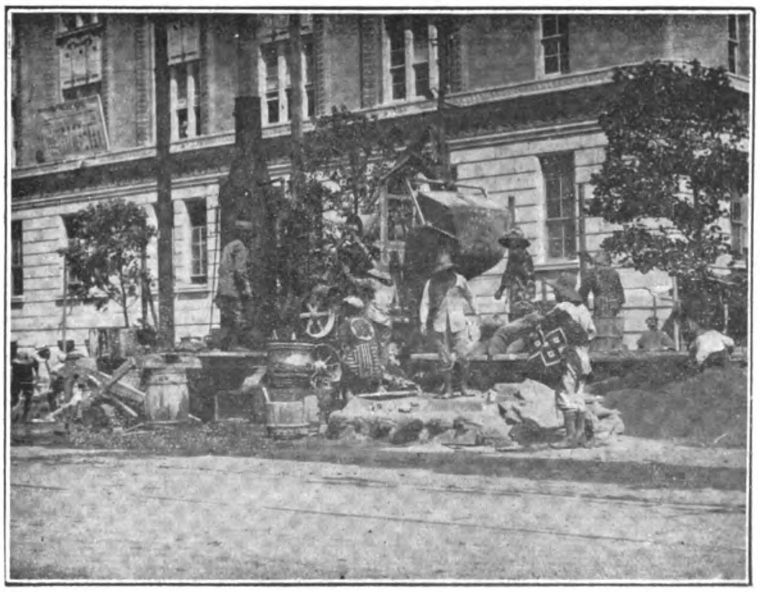
Two G.-E. synchronous condensers, each 15,000 k.v.a., 11,000 v., 3 phase, 50 cycle, 600 r.p.m., are installed. Condensers are started by starting compensators. Buses for 140 k.v. and 66 k.v. are arranged on outdoor steel structures. Bus for 11 k.v. is arranged in bus bar compartment.

All switching equipments are manufactured by the General Electric Co. The station will supply power to a sub-station of the Imperial Government Railways in the near future and play an important rôle in the railway electrification.

The Keihin Denryoku has also ordered from the General Electric Company the electrical equipment for what will be the largest automatic hydro-electric power generating station in Japan. The station, to be constructed on the Oshiro river, will consist of a 3,500 k.v.a generator driven by a J. M. Voith Company water wheel, with full automatic control designed to perform automatically and in proper sequence all of the operations of starting, running, and shutting down ordinarily performed by the station attendant in a manually operated station. By simply energizing the transmission line from the controlling power station the wheel is started, the generator is synchronized, and assumes its load.

The equipment includes in addition to the usual protective device of a manually operated station, protection against sustained overloads, hot bearings, low voltage, underspeed, overspeed, and other irregularities usually cared for by the station attendant.





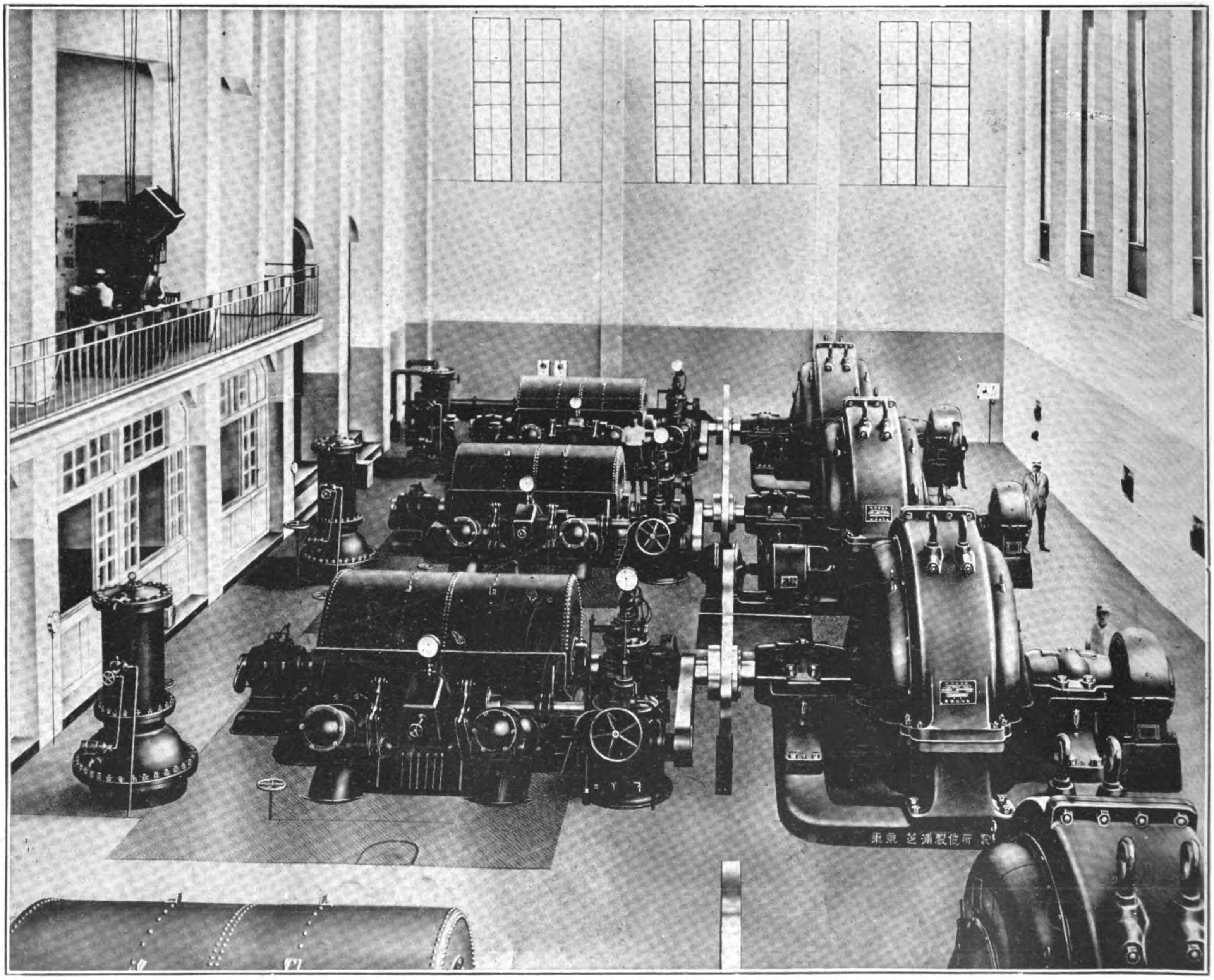
REX CEMENT MIXER USED BY THE TOKYO MUNICIPAL ROAD IMPROVEMENT BUREAU

A 500,000 Kilowatt Development

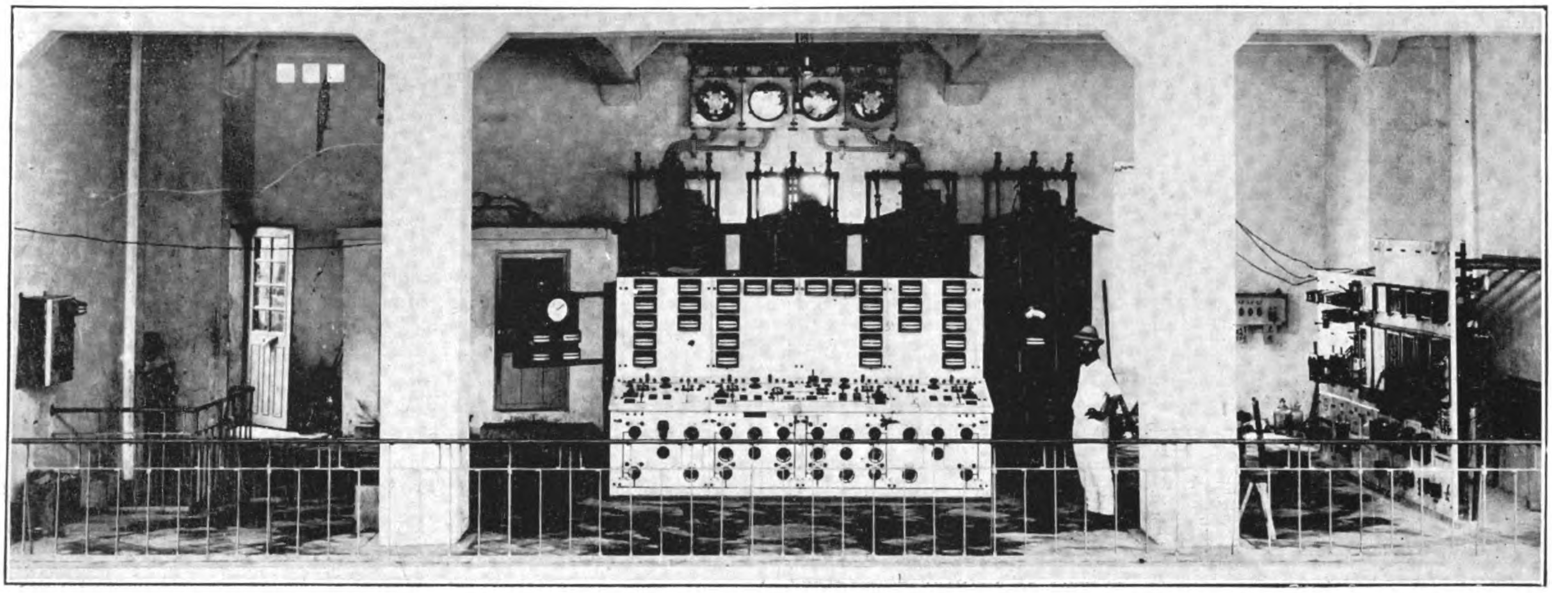
A New Super-Power Enterprise To Supply the Tokyo-Yokohama District: Far-Reaching Plans of the Toho and Tokyo Electric Power Companies

A SUPER-POWER DEVELOPMENT which will take its place amongst the four biggest producers in Japan is the outgrowth of the amalgamation early this year of the Hayakawa and Gunma Electric Power Companies under the name of the Tokyo Electric Power Comany, Ltd. The new enterprise is closely affiliated with the Toho Electric Power Company, the second largest retailer of power in Japan. In fact, the plans of both companies so dovetail into each other that any description of the activities of one would be incomplete without some reference to the other; and when this is told, it will be found that interlocking directorates and power sales agreements have created such a close community of interests between the Toho and the Daido Electric Power Companies that any comprehensive survey of the field must also include the activities of the latter. As the Daido recently established connections with the Tokyo power market by connecting up its Mumayama plant with the Keihin line and feeding into the system of the Tokyo Electric Company, the interests of these four big producers are more or less identical; and, although serving the same market, their relations are being developed along lines of co-operation and not of competition. It augurs well for the future of electric power development in Japan that this commendable spirit of co-operation in the interchange of power exists between those big producers. It not only makes for the steady development of Japan's power resources, but inspires that confidence in the future prosperity of the industry so essential to the successful financing of the many plans for extensions and improvements.

The announcement that the new combination intends to develop power resources in the next few years that will supply 500,000 k.w. to the Tokyo district, followed by the placing of orders for two 35,000-k.w. steam generators to be installed in its Kawasaki (Tokyo) station, at once centered the attention of the business world on its activities. The fact that it is so closely allied with the Toho, and that the experts of this company will direct its affairs, is accepted as a guarantée that it will carry through its program. Both the Daido and Toho companies are controlled by the same interests, Mr. M.



The Kuretsubo Power Plant of the Tokyo Electric Power Company; Equipped with Four 8,000 k.v.a. 11,000 volt, 50 cyles Generators, manufactured by the Shibaura Engineering Works, driven by four 10,000 h.p. Pelton Water Wheels manufactured by Boving & Company.

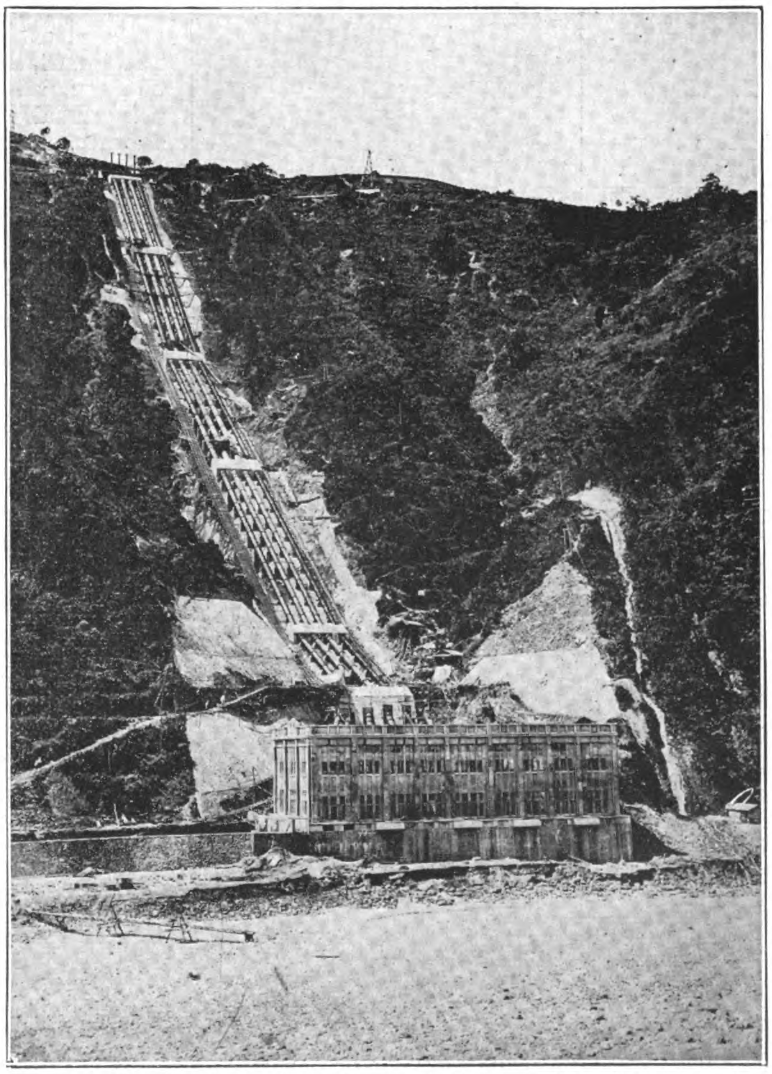


Switch Board of the Kuretsubo Power Plant of the Tokyo Electric Power Company; Made by the Shibaura Engineering Works.

Fukuzawa, president of the Daido Company, being also honorary president of the Toho, while the active head of the latter organization is its vice-president and general manager, Mr. Y. Matsunaga, whose remarkable success in the direction of the Kyushu Electric Power and Traction Company places him amongst the foremost of Japanese public utility operators. Both of these are names to conjure with in Japan, a further assurance that co-operation rather than keen and ruinous competition will smooth the way of the new company in carrying forward its program.

The territory served by the Tokyo Electric Power Company between Tokyo and Yokohama, covering nearly 50 square miles, is an ideal one for development. This section, owing to its excellent transportation facilities with a deep-water outlet at Tsurumi and Yokohama, is destined to become the industrial center of eastern Japan. Many large and important industries have already erected manufacturing plants along the seashore, while the hill section overlooking the bay and Yokohama harbor is rapidly being transformed into beautiful residential districts. Omori, Tsurumi, Kawasaki and other points are experiencing a boom since the earthquake, many families seeking permanent homes there in preference to relocating in the near-by cities. The Tokyo Electric Power Company not only supplies these districts with light and power, but holds a franchise which permits it to sell power in Yokohama and Tokyo as well as in the important suburbs of Shinagawa, Meguro, Yodobashi and Nakano.

A feature of the development in this district is the program of the Denyen Real Estate Company to build some 5,000 new homes on the line of the Meguro-Kamata Inter-urban Electric Railway, every house to be fitted throughout with electrical apparatus for lighting, cooking, heating, etc. This is the outcome of the propaganda for the electrification of the home, started last year by a group interested in reducing fire risks and bringing greater comfort into the home. In this " electric home " district will also be located two of the best institutions of learning in Japan, the Higher Commercial and the Higher Technical Colleges. These colleges will also be electrified in every respect with modern electrical equipments. Home electrification has become a slogan, and the proposed 5,000 electric homes will be followed by many others in the company's territory.

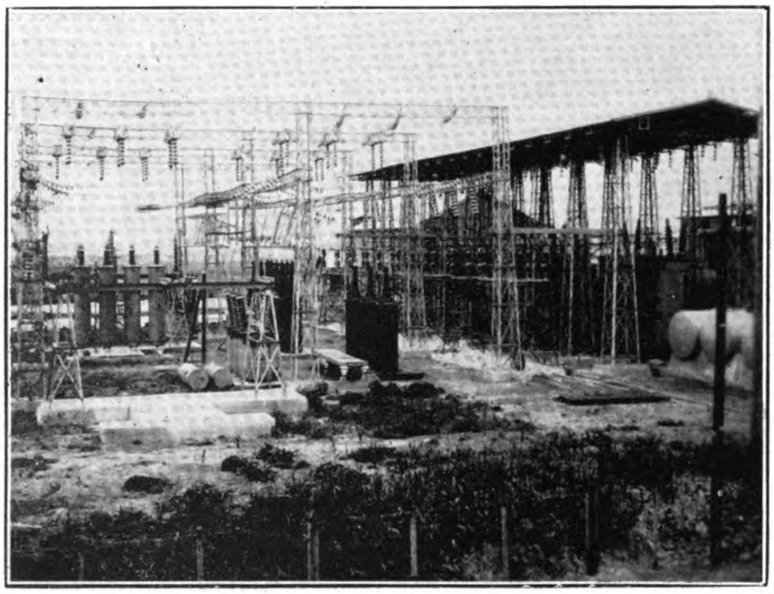


The Kuretsubo Power Plant (20,000 k.w.) of the Tokyo Electric Power Company.

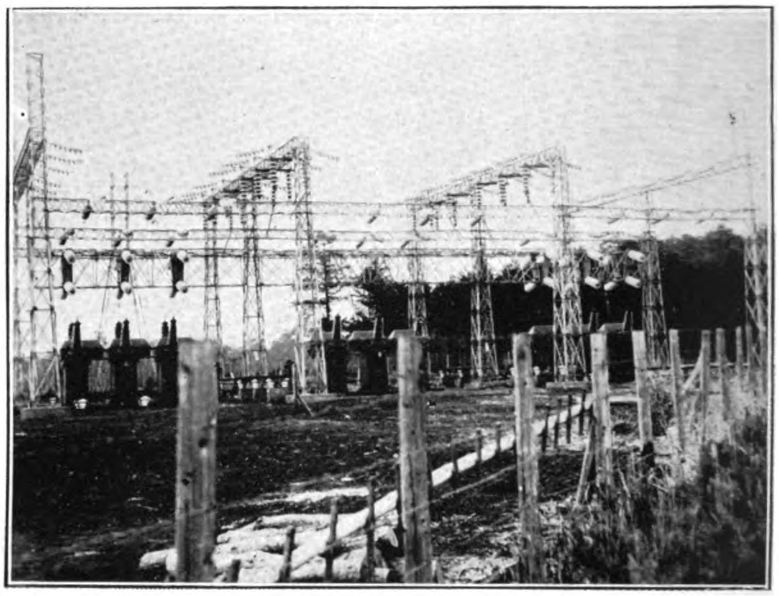
The company also serves Shizuoka, one of the richest prefectures in Japan (situated midway between Nagoya and Tokyo), noted for its tea, silk, cotton goods, sea products, vegeable oils, etc. It has the mildest climate in the main island, and consequently raises abundant farm products, which are shipped to Tokyo and Nagoya. The company also serves a territory in Gunma prefecture.

The growth of the Tokyo Electric Power Company, Limited, formed by the amalgamation of several companies in the last several years, is typical of the general course of electrical development in Japan. One of its principal component enterprises, the Hayakawa Electric Power Company, organized on June 28, 1918, with a capital of Y.8,000,000, took over by consolidation in 1920 the business and properties of the Anglo-Japanese Hydro-Electric Company, increasing its capital to Y.15,000,000.

On March 12, 1924, the Toho Electric Power Company, Limited, organized the Hayakawa Industrial Company with a capital of Y.15,000,000, and subscribed to all the stock, paying in a quarter on the date of its foundation. The Toho also acquired some shares of the old Hayakawa Electric Power Company. On March 31, 1924, the Hayakawa Industrial and Electric Power Companies were



Kawaski Sub-Station No. 1



The Kichijoji Switching Station

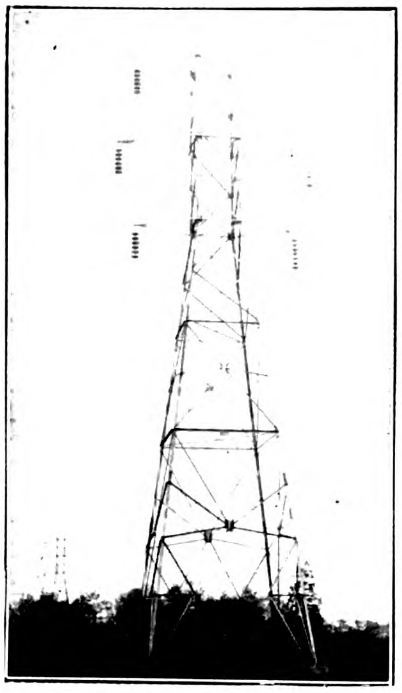
amalgamated and the Toho Electric Power Company assumed control of the new combination, whose capital was increased to Y.30,000,000.

While the Hayakawa Electric Power Company was extending its activities in the Tokyo district and in Gunma prefecture, the Guma Electric Power Company, organized in 1917, developed water power in Gunma prefecture and in 1922 started the transmission of power to Kawasaki City, located midway between Tokyo and Yokohama.

Early in 1925 these two concerns amalgamated under the name of the Tokyo Electric Power Company, Limited, with a capital of Y.42,250,000, serving over 144,000 lighting customers and approximately 11,500 power customers in the most densely populated sections of Japan. New customers are being added as the company's power generating facilities increase. The company also operates an electric railway in Gunma prefecture.

Power Plants

The company's power plants have a total generating capacity of 128,000 k.w. This includes the new Tokyo steam plant, under construction, with an initial installation of two 35,000 k.w. steam turbo generators, and an ultimate capacity of 140,000 k.w.



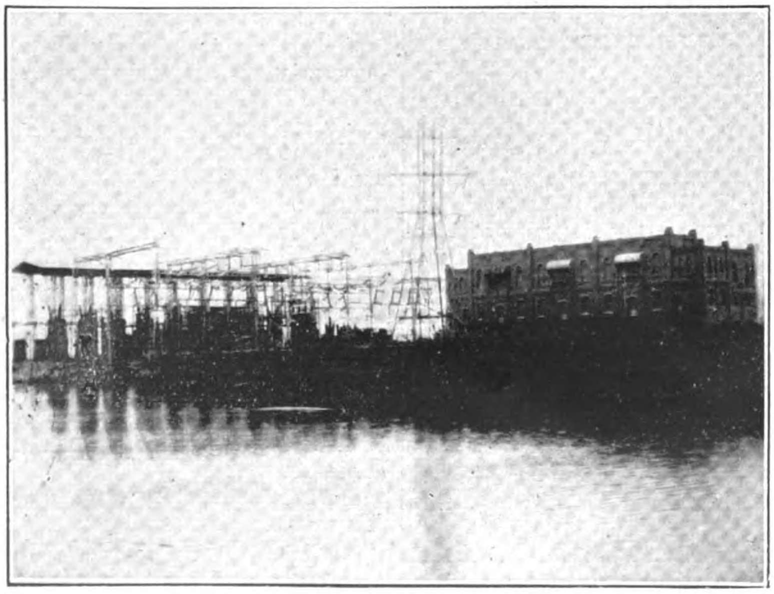
Steel Towers in 110,000 volt Transmission Line

Tokyo Steam Power Plant

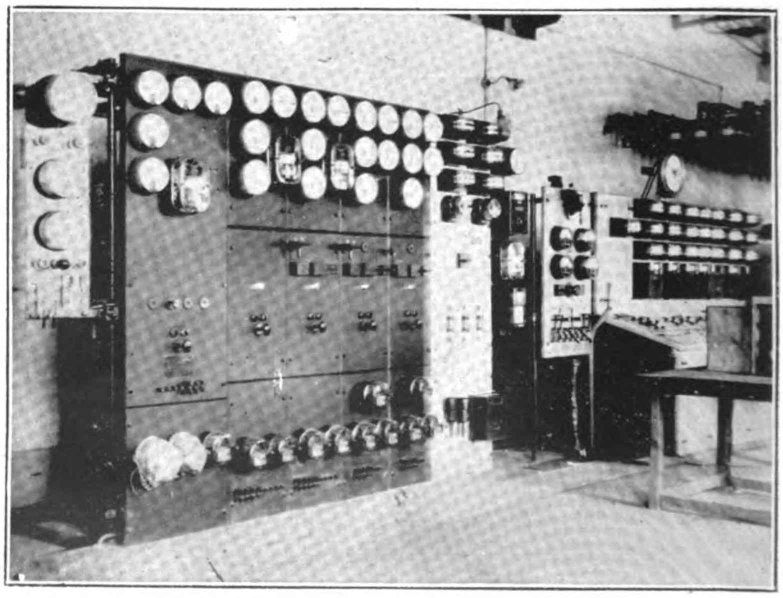
In the Tokyo district there is always a power shortage during the dry season, which extends from December to March, at a time when the demand reaches its maximum.

In order to meet the rapidly growing demand in its territory, the Tokyo Electric Power Company plans to develop water powers in the Tashiro, Oi, and Tenryu rivers. The Tenryu will be developed by the Toho Electric Power Company and also build the most efficient super-power steam plant in Tsurumi. The steam plant costs less per unit and can be built in a shorter period.

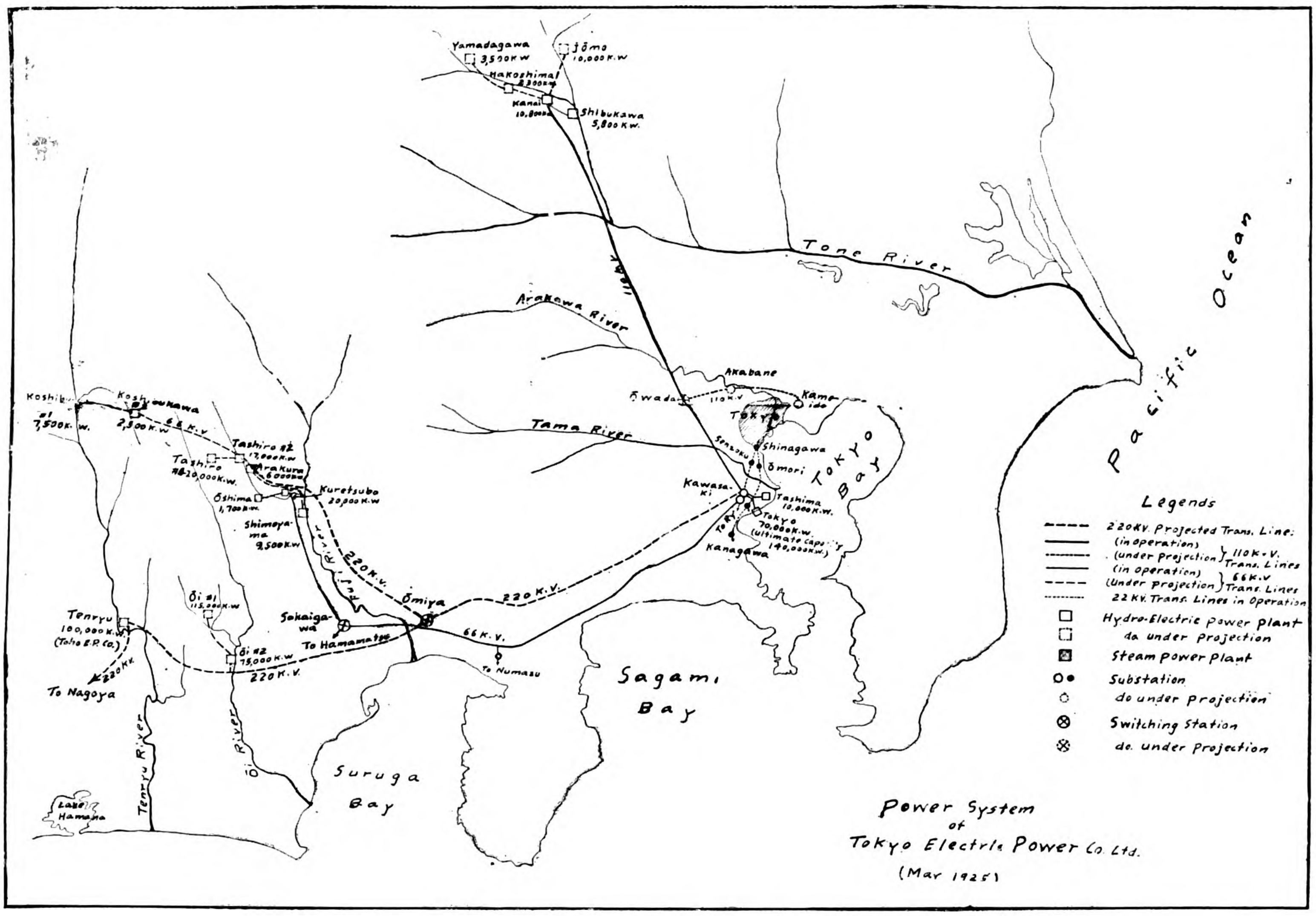
Sufficient water for condensing, good transportation and coal handling facilities are two essentials for a modern steam power plant, and in these respects the new plant, covering a site of 30,000 *tsubo*, is ideally located on the reclaimed land at Tsurumi, with abundant sea water for condensers, and where coal can be unloaded from 10,000-ton steamers direct to the storage yard. The plant will require at least 1,000 tons of coal per day even during the next four or five years, when its load is comparatively small.



General View of Kawasaki Sub-Station No. 1.



Switch Board of Kawasaki Sub-Station No. 1.

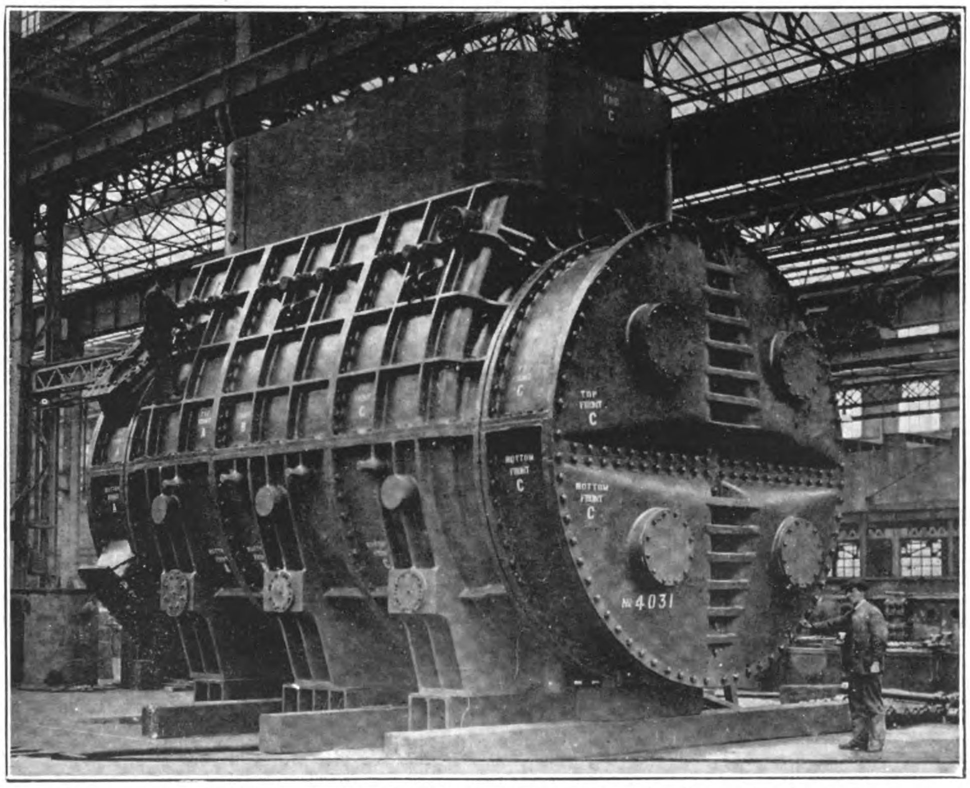


Power System of the Tokyo Electric Power Company, (May, 1925)

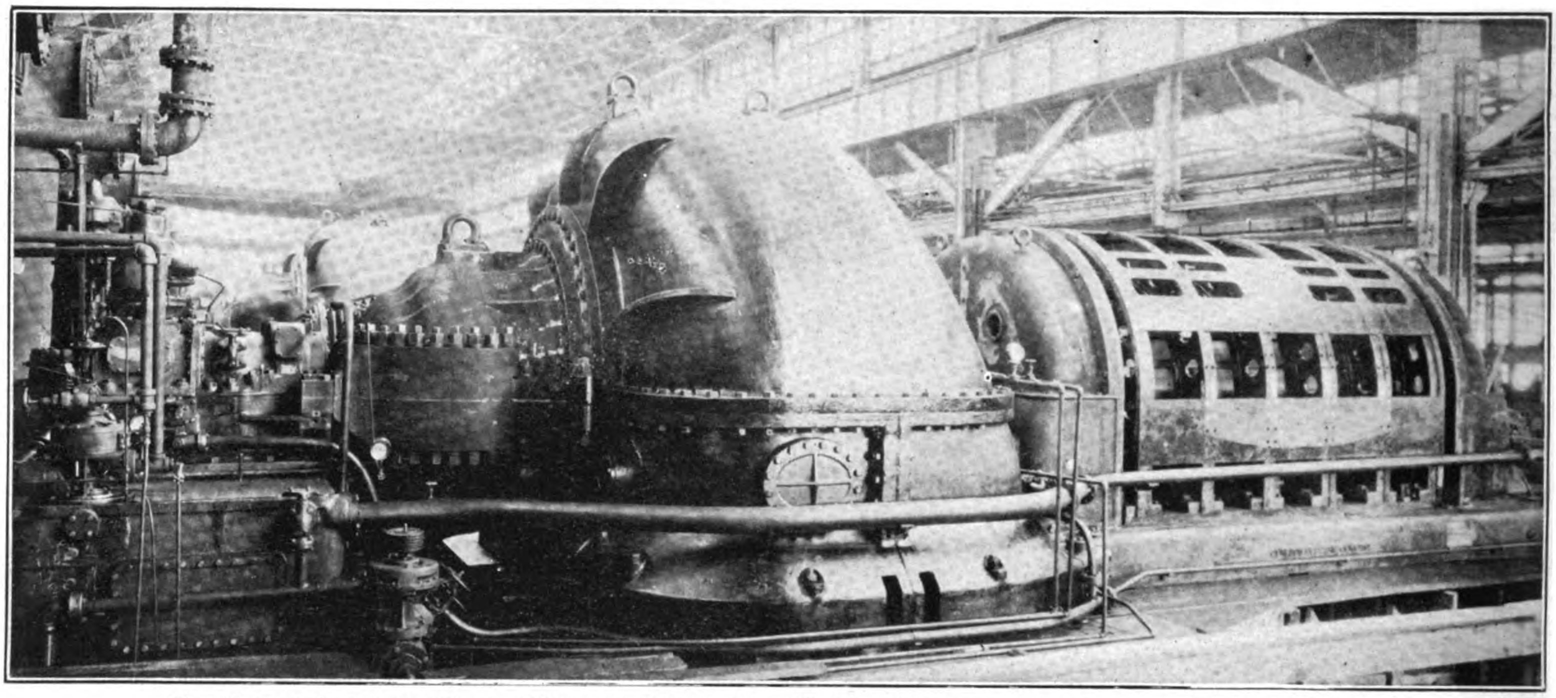
Turbo-Generators.—The two main steam turbo-generators for this plant are of the Curtis Impulse type manufactured by the General Electric Company of America. The turbine proper contains twenty impulse stages and embodies all up-to-date improvements, including steel shell, monel metal buckets, and automatic provisions for emergency stopping.

An interesting feature is the provision for the extraction of steam from two of the intermediate stages, the extracted steam to be used for heating the feed water before it is pumped into the boilers. The system of feed water heating adopted is known as the Allen contraflow, and includes deaereators, evaporators, and closed heaters, all supplied by extracted steam. With this combination of heating system and twenty-stage turbine, remarkable steam economies will be effected, by which a kilowatt hour will be generated with an expenditure of only 9.6 pounds of steam. The pressure of 375 pounds and temperature of 750 deg. F. at which steam will be supplied to these units is the highest yet adopted in Japan and follows the best American practice.

The alternating current generators connected to these turbines will be the largest ever shipped to Japan. They are rated 35,000 k.w., 43,750 k.v.a., 50 cycle, 3 phase, 11,000 volts, 1,500 r.p.m. A novel feature will be the installation of GE closed type air coolers, by means of which the cooling air for these generators will be circulated in an enclosed system. Heat will be removed by means of cold water circulated through the tubes of these coolers. This system is now being adopted by practically all of the large power stations in America. The accompanying photograph gives a good



45,000 sq. ft. (35,000 k.w,) "Contraflo" Condensers for the Steam Turbo-Generators at the Kawasaki Palnt of the Tokyo Electric Power Co., Ltd. Two of these Condensers have been furnished by W. H. Allen, Sons, & Company, Ltd.



Two General Electric 35,000 k.w., 1,500 r.p.m., 20 Stage Steam Turbine-Generator Set for the Kawasaki Steam Plant of the Tokyo Electric Power Co., Ltd.

idea of the appearance of these machines, and the internal construction is shown in the cross section illustrated at the end of this article.

Power for operating station auxiliaries will normally be supplied through a transformer bank connected to the station bus bars, but for starting up and for emergency operation there is provided a 2,500 k.w. 3,300 volt Curtis type house turbo-generator made by the General Electric Company. This unit will run idle during normal operation of the plant, receiving only sufficient steam to overcome machine friction, and will be so regulated that if failure of the auxiliary transformer bank occurs the turbine will immediately pick up the station service load and avoid shut-down of the plant.

As the load increases, an additional two 35,000 k.w. units will be added, making the total capacity of the plant 140,000 k.w.

Kuretsubo Plant

The Kuretsubo hydro-electric power plant, completed in 1923, is situated on the Hayakawa, a tributary of the Fuji river. It has a generating capacity of 20,000 k.w. and 750-ft. of effective head, and utilizes 430 cubic ft. of water per second. A part of the power generated by this plant is transmitted to Kawasaki.

Four 8,000 k.v.a. horizontal generators manufactured by the Shibaura Engineering Works are connected to water wheels, each rated for 10,000 h.p., manufactured by Boving & Co. There are four Shibaura 3 phase main transformers, each rated for 8,000 k.v.a., raising voltage from 11,000 to 66,000 volts.

Kanai Power Plant

The Kanai power plant is situated on the Agatsuma river, some 83 miles north-west of Kawasaki. Its effective head is 140 ft. and the available quantity of water is 1,200 cubic ft. per second. Its total generating capacity is 10,800 k.w., having three 3,600 k.w. 3 phase, 50 cycle, 6,000 volt Shibaura generators.

The plant contains nine 3,500 k.v.a. single phase transformers, manufactured by the Westinghouse Electric Manufacturing Co., primary sides of which are wound for 6,600 volts and secondary sides 66,330 to 60,730 volts. Three transformers are connected in star to give 110 k.v. for the transmission line. There are also four 1,250 k.v.a. transformers for local service.

Shibukawa Plant

The Shibukawa power plant is located at the down stream of the Kanai plant and has an effective head of 69-ft. Its generating capacity is 6,000 k.w., having two 4,250 k.v.a. Westinghouse generators connected to Escher Wyss water wheels.

Power Plants

HYDRO-ELECTRIC PLANTS

	Name of Plant	Generator No. of Unit.	Generator Capacity of each Unit K.V.A.	Authorized Capacity. K.W.
1.	Kuretsubo, completed June, 1923 ...	4	8,000	20,000
2.	Kanai, completed October, 1922... ...	3	4,250	10,800
3.	Shibukawa, completed March, 1925 ...	2	4,250	5,800
4.	Tomoegawa, completed January, 1916 ...	1	1,750	1,500
5.	Koyama, completed July, 1911	2	825	1,400
6.	Shirase, completed January, 1920 ...	1	1,500	1,119
7.	Oshima, completed November, 1920, and is now under reconstruction... ...	—	—	1,700
8.	5 Small power plants	—	—	407
9.	Arakura, under construction	—	—	6,000
	Total			48,726

STEAM POWER PLANTS (around Tokyo)

Name of Plant	Generators K.W.	Capacity K.W.
Tashima to be completed in 1925...	2—5,000	10,000
Tokyo, to be completed in 1926	2—35,000	70,000 (Ultimate capacity 140,000 k.w. 4-35,000 units)
Total		80,000 (ultimate 150,000 k.w.)

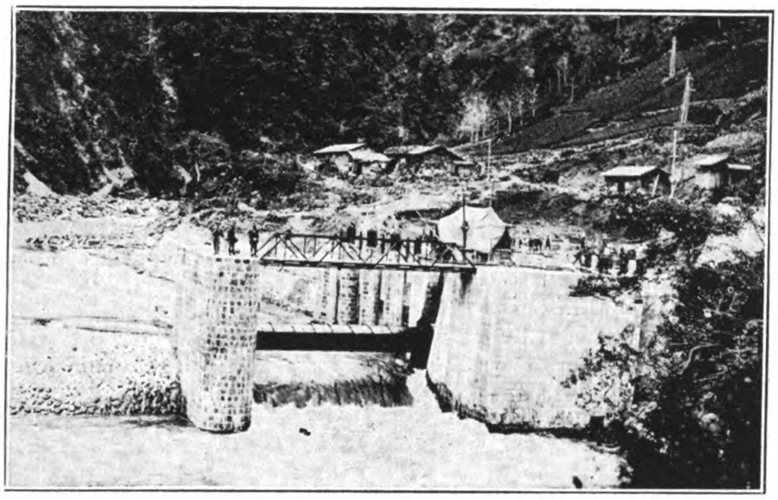
TRANSMISSION LINES

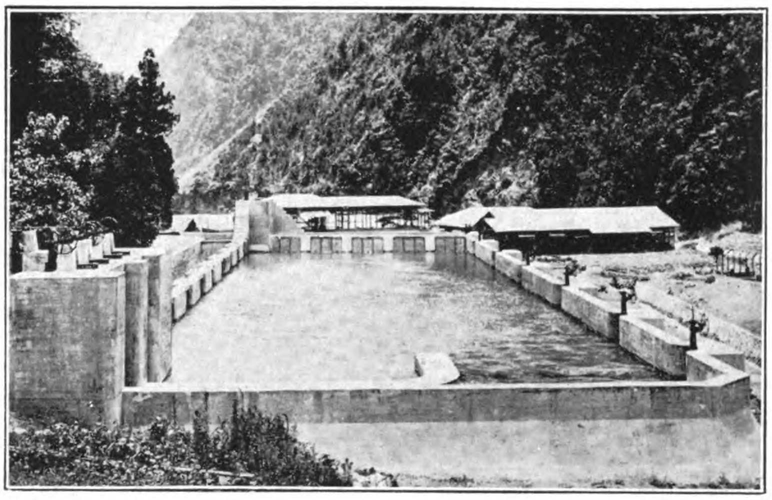
The company has approximately 440 miles of transmission lines, most of the double circuit type of construction. Steel towers are exclusively used for 110 k.v. line, while for 66,000 volts, concrete, steel, and wooden poles are used. Gantry towers are used where lines cross rivers, railroads, etc.

The following table shows the important transmission lines:—

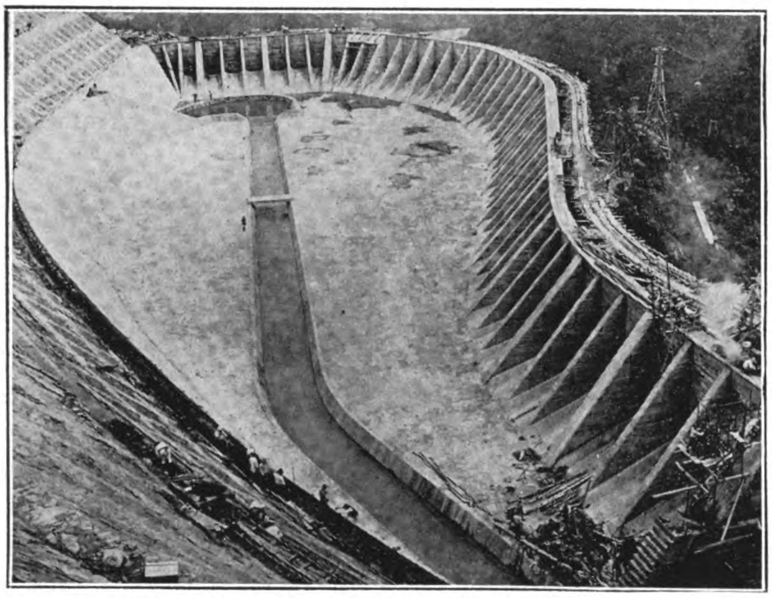
TRANSMISSION LINES (constructed)

Voltage	Construction		Transmission Distance—Miles
110,000 volts ...	2 circuits steel towers		83.80
66,000 volts ...	Mainly 2 circuits concrete poles, steel poles and towers		151.28
35,000 volts ...	Mainly 2 circuits all wooden poles except where it crosses rivers		140.77
22,000 volts ...	Underground lines	5.20	
	Overhead lines	19.56	
Total ...			24.76
11,000 volts and under			40.57
Total length of Transmission Lines			441.18

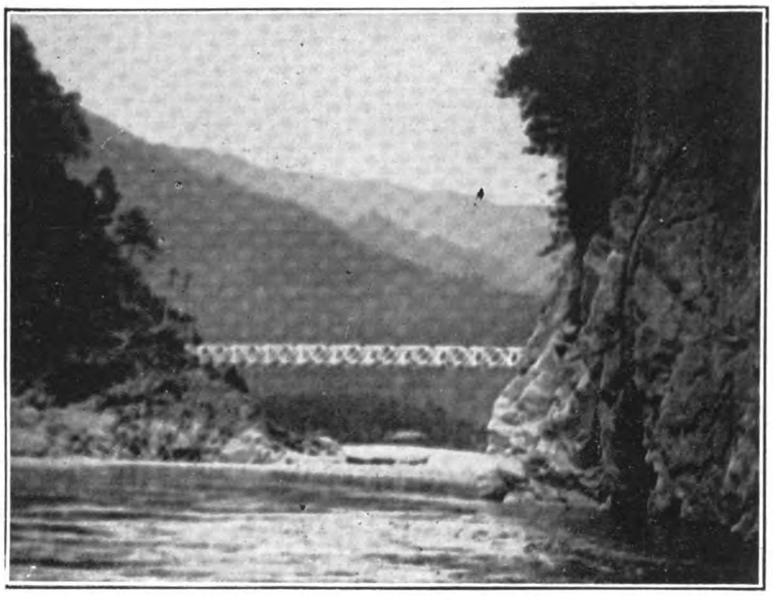




Intake and Sand Basin of the Kuretsubo Power Plant



Storage Reservoir of the Kuretsubo Power Plants.



The Toho Electric Power Company's Proposed 300-foot Dam Site on the Tenryu River to develop 100,000 k.w. of Power for Transmission to Tokyo

Sub-stations

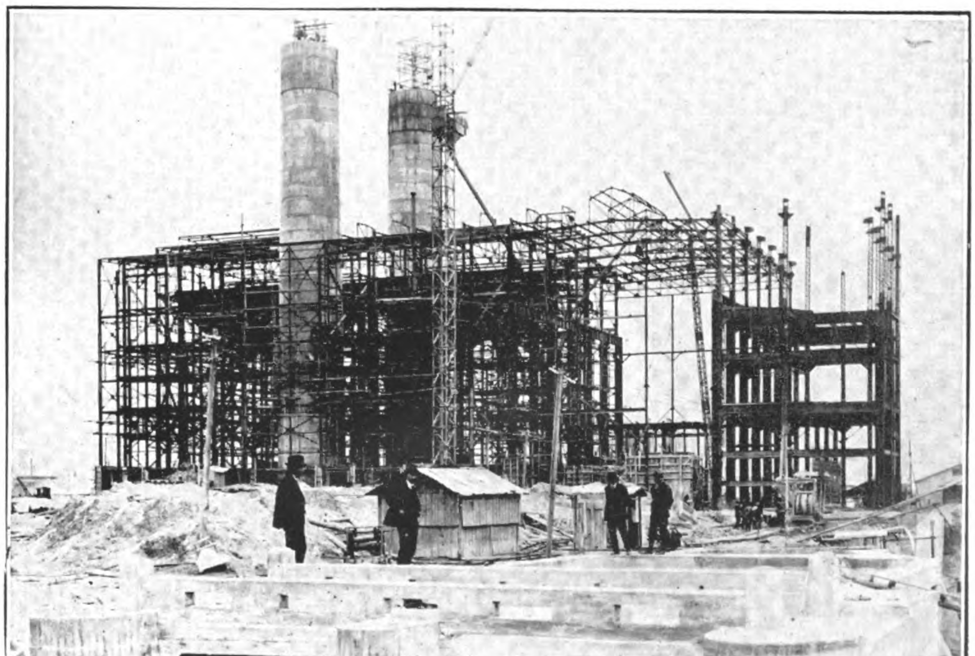
At present the company has 25 sub-stations which are interconnected and provided with protective and safety devices to insure safety to apparatus and continuity of operation.

The following table gives the operating capacity and spare capacity of the main transformers of the stations:

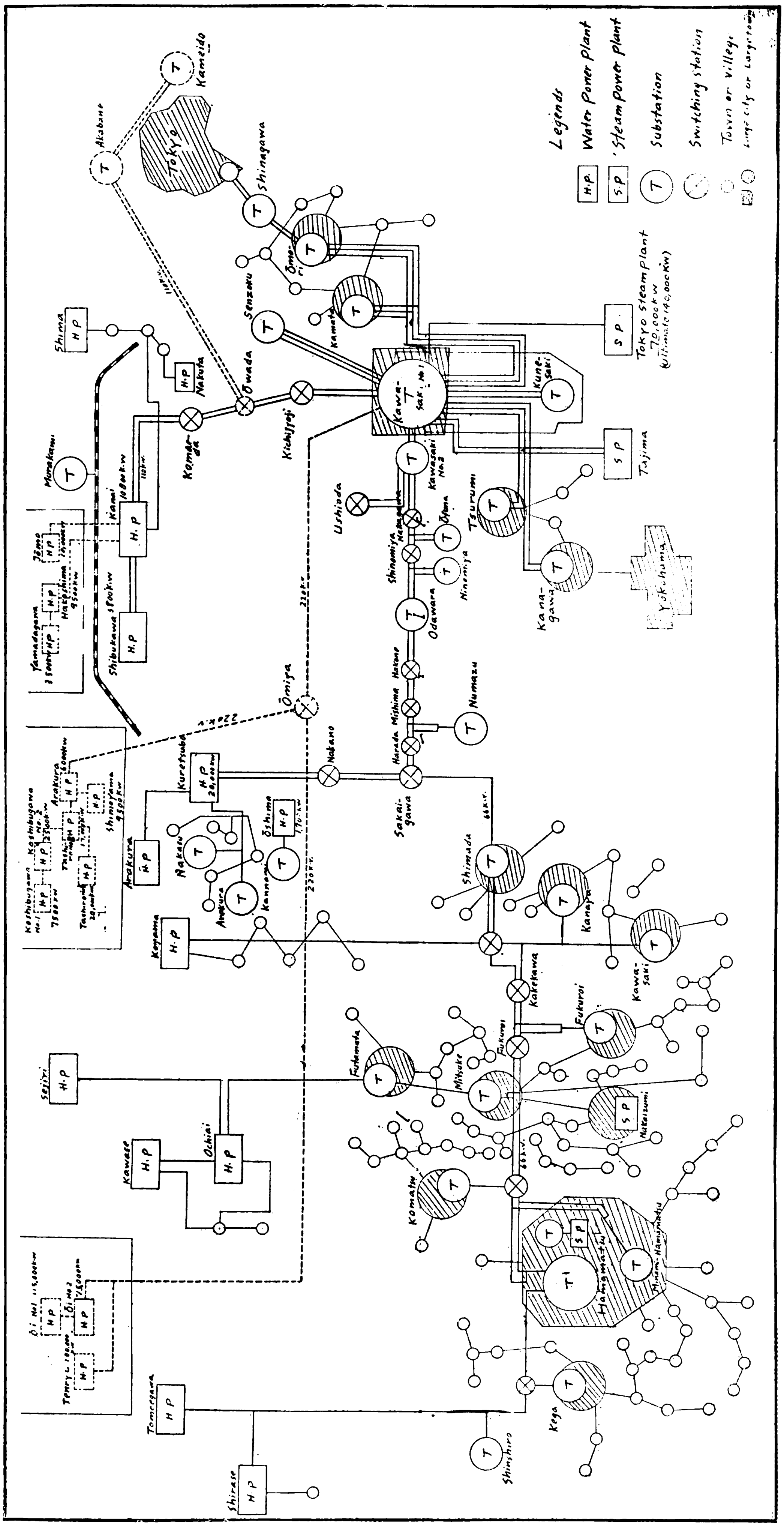
Sub-stations	Operating Transformer Capacity. K.V.A.	Spare Transformer Capacity. K.V.A.	Total Installed Transformer Capacity. K.V.A.
1. Hamamatsu	4,960	—	4,960
2. Minami-Hamamtsu	3,000	1,000	4,000
3. Carbide Factory	846	—	846
4. Kega ...	1,380	230	1,610
5. Komatsu ...	3,000	—	3,000
6. Fukuroi ...	1,500	—	1,500
7. Toen ...	870	—	870
8. Kanaya ...	900	—	900
9. Shinshiro ...	450	150	600
10. Mitsuke ...	1,860	—	1,860
11. Shimada ...	9,000	3,000	12,000
12. Futamata ...	360	—	360
13. Numazu ...	1,390	—	1,390
14. Kawasaki No. 1	39,000	16,500	55,500
15. Kawasaki No. 2	15,000	7,500	22,500
16. Kunezaki ...	3,000	1,000	4,000
17. Kamata ...	3,000	1,000	4,000
18. Omori ...	3,000	500	3,500
19. Tsurumi ...	4,500	1,500	6,000
20. Kanagawa	3,000	1,000	4,000
21. Senzoku ...	3,000	1,000	4,000
22. Shinagawa	3,000	1,000	4,000
23. Arakura ...	450	150	600
24. Nakazu ...	120	—	120
25. Odawara ...	7,500	2,500	10,000
Total ...	1140,86	38,030	152,116

Future Power Development

The Tokyo Electric Power Company has valuable water rights in the Tashiro and Oi rivers capable of economical development.



Nagoya Stoam Power Plant. 70,000 k.w. (ultimate capacity, 105,000 k.w.); Under Construction for the Toho Electric Power Co., Ltd.



Power Systems of the Tokyo Electric Power Co., Ltd.

In the next seven to ten years the Company intends to obtain approximately 100,000 k.w. from the Tashiro river and about 200,000 k.w. from the Oi and its tributaries. The interesting feature of the Tashiro river development is the available high heads. According to the present plan, the effective head of Tashirogawa No. 1 plant is 1,800-ft., while that of No. 2 is 1,200-ft. These two plants may be combined into one 37,000 k.w. plant, having an effective head of 3,000-ft.

The Toho Electric Power Company will start work on the construction of a dam approximately 300-ft. high at Sakuma on the Tenryu river. The generating capacity of this plant will be over 100,000 k.w.

Thus in the next seven to ten years approximately 400,000 k.w. of water power will be developed by the Toho and Tokyo Electric Power Companies. The company also has a plan to purchase approximately 100,000 k.w. from Toho's sister companies, giving Tokyo and Toho approximately 500,000 k.w. available for the raipidly increasing demands of their customers in Tokyo district.

In order to transmit 500,000 k.w. of power to the Tokyo district, Toho and Tokyo Electric Power will build two double circuit transmission lines through the Tokaido, the center of Japan. These transmission lines will be at first 110,000 volts, and the main lines raised to 220,000 volts as the amount of power to be transmitted increases.

The following table gives some of the more important water power plants of the Tokyo Electric Power Company under projection:

Hydro-Electric Plants Under Projection

Name of Plant	Year to be Completed	Capacity. K.W.
Tashirogawa No. 2	1927	17,000
Yamadagawa ...	1927	3,500
Tashirogawa No. 2	1928	20,000
Hakoshima ...	1928	10,000
Shimoyama ...		9,500
Oigawa No. 1 ...		115,000
Oigawa No. 2 ...		75,000
Koshibukawa No. 1		7,500
Koshibukawa No. 2		2,500
Total ...		260,000

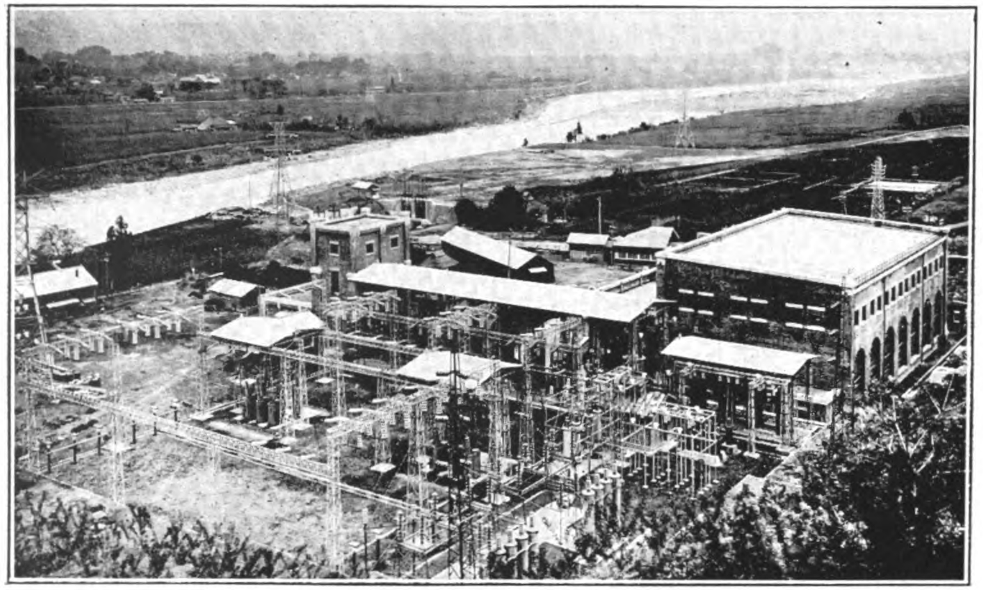
Market for 500,000 k.w. of Hydro-Electric Power.

Markets for half million k.w. of power to be obtained from the Tashiro, Oi, Tenryu, and other rivers in the central part of Japan will be as follows:—

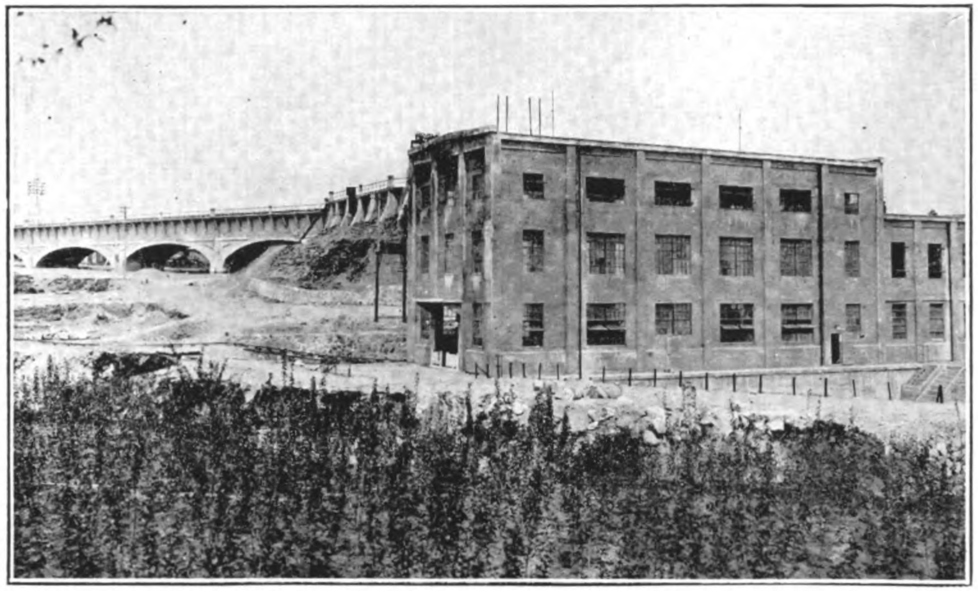
(1) 100,000 k.w. Tokaido Railway. The electrification of this line is an urgent necessity to relieve congestion.
(2) 100,000 k.w. For the electrification of military arsenals and naval dockyards, etc.
(3) 300,000 k.w. For the demands of customers in Tokyo district and along the Tokaido railways.

The company's territory in Tokyo district, as well as along the Tokaido railway, is more densely populated than anywhere else in Japan, and consequently the demand for electrical energy in the territory lying between Nagoya and Tokyo is limited only by the ability of power companies to make additional generating and

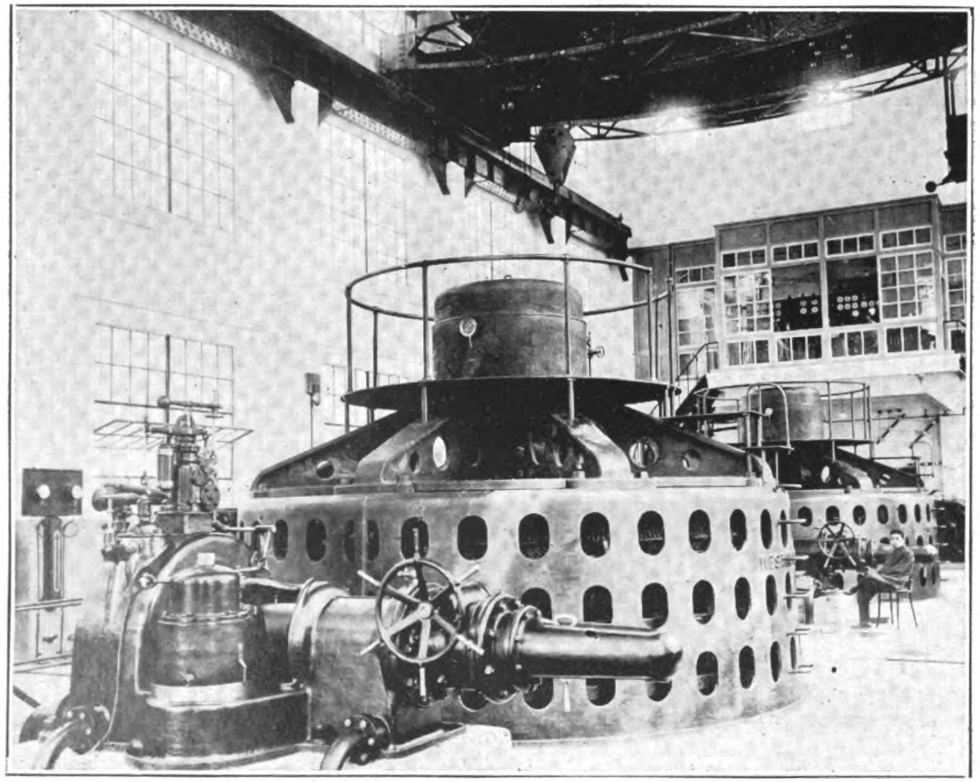
GENERATING PLANTS OF THE TOKYO ELECTRIC POWER COMPANY, LTD.



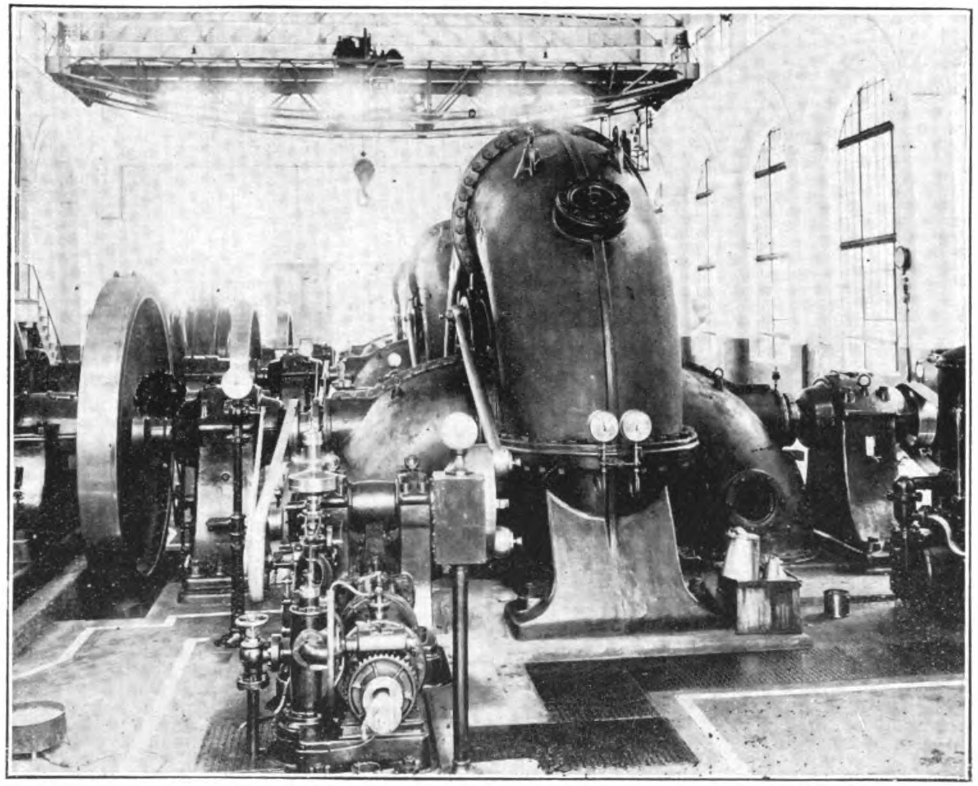
General View of the Kanai Power Plant, 10,800 k.w.



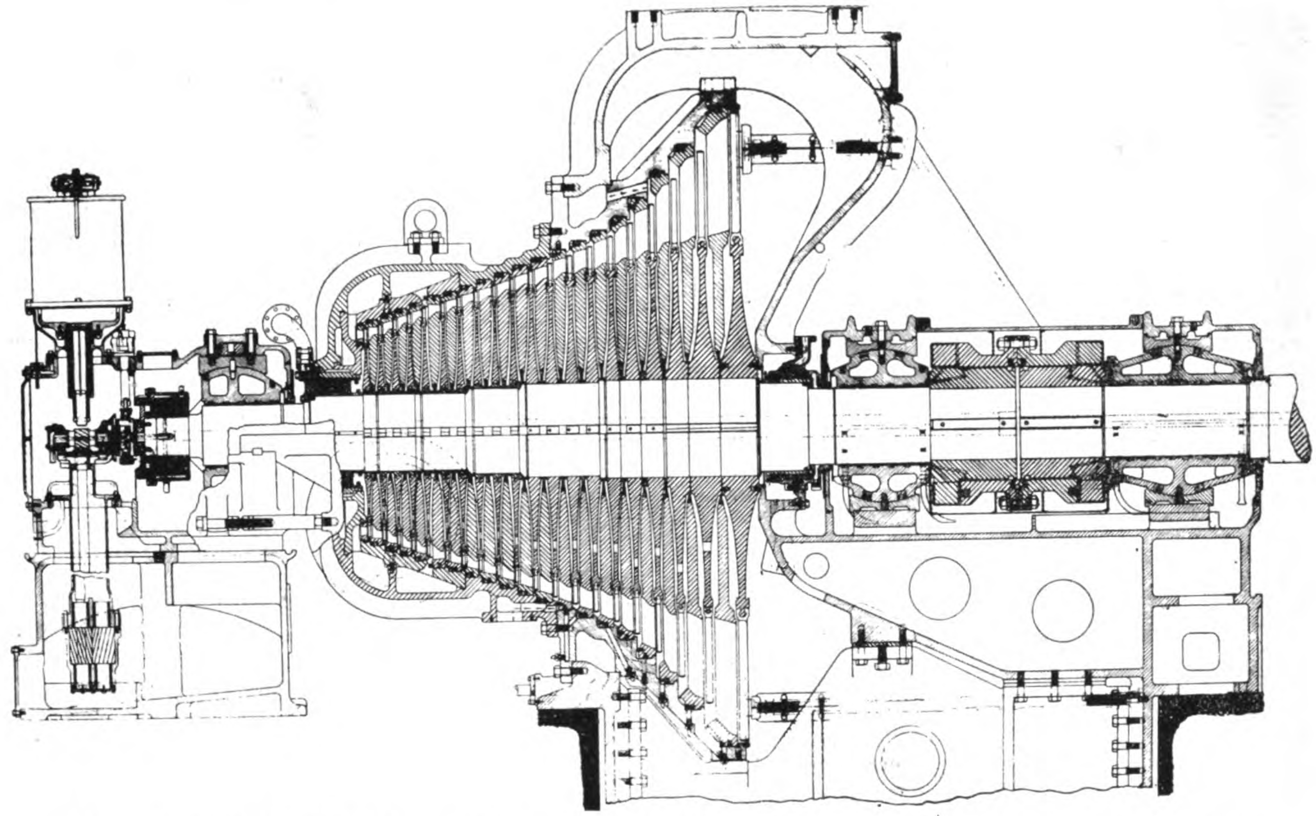
Shibukawa Power Plant; 6,000 k.w.



Generating Room of Shibukawa Power Plant; Two 4,250 k.v.a. Westinghouse Generators driven by Escher, Wyss Water Wheels.



Generating Room of Kanai Power Plant; Three 3,600 k.w., 3-phase, 50 cycle, 6,600v. Shibaura Generators driven by Dengyosha Water Wheels.



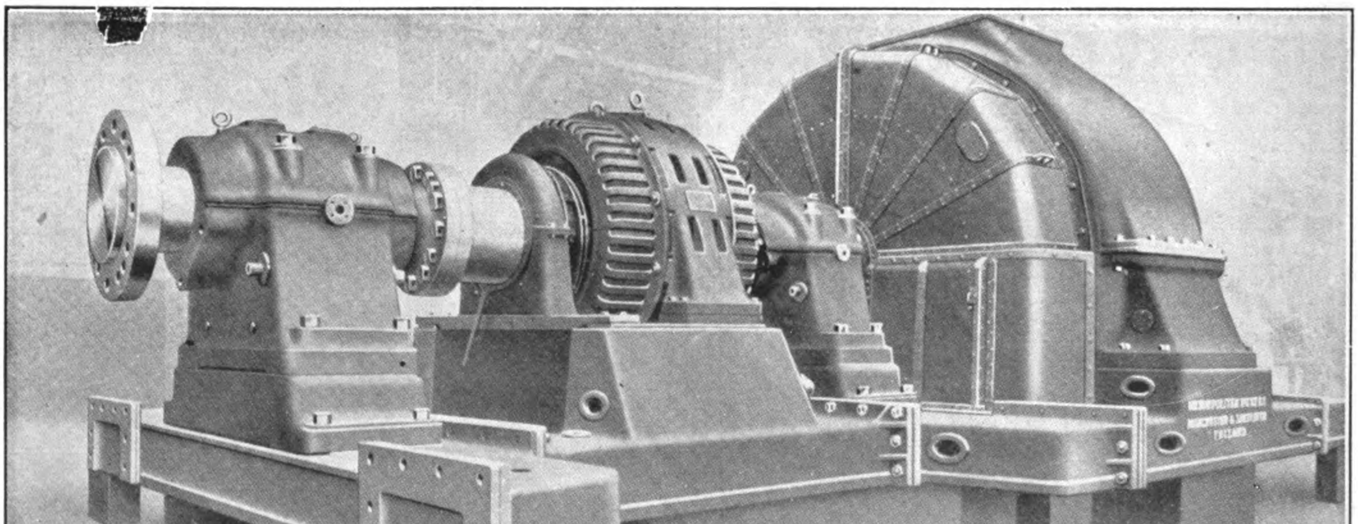
Assembly of 35,000 K.W.-1,500 r.p.m.-20 Stage Horizontal General Electric Curtis Steam Turbine for the Tokyo Electric Power Company's Kawaskai Steam Plant.

distributing facilities. Proposed 220 k.v. transmission lines connecting various water power plants of Toho and Tokyo with Tokyo steam power plant (140,000 k.w.) and Nagoya steam power plant (105,000 k.w.) of Toho Electric Power Company, customers will be assured of good service all the year around, disregarding weather conditions.

The following table gives some of the present power customers of the Tokyo Electric Power Company :

SOME OF POWER CUSTOMERS

Imperial Government Railway (for electrification of Tokaido Line)	10,000 k.w.
Tokyo Bay Reclamation Co.	3,000 ,,
Tokyo Municipal Railway	5,000 ,, (10,000 k.w. in near future)
Keihin Electric Railway	2,500 k.w.
Fuji Gas Spinning Co.	2,000 ,,
Fuji Hydro-Electric Company	800 ,,
Tokyo Electric Light Company	2,000 ,,
Total Light and Power Demand in Hamamatsu District	10,000 ,,
Total Light and Power Demand in Suburb of Tokyo...	15,000 ,,



Metropolitan Vickers Frequency Changer with an Output of 16,000 k.v.a. for Momoyama Power Station, Japan. This machine weighs 208 tons and its overall length is 50 ft. 6 in.

An Engineering Triumph

Restoration of the State Railways in Record Time

I. Extent of Damages due to the Earthquake.

(1) Mileage of damaged tracks	418 miles
(2) Length of damaged embankments ..	45 „
(3) Land slide of cuttings	33,000 cubic *tsubo*
(4) Falling of stone works on the cuttings	2,500 *tsubo*
(5) Number of damages on bridges and arch bridges	223
of which, number of falling girders ..	12
Total length of damages ..	7,250 feet
(6) Total length of damaged or collapsed tunnels	1,000 „
(7) Number of stations damaged to considerable extent	75

II. Progress of the Restoration Works.

Although there were great number of those serving in the maintenance of way who had been sufferers themselves from the earthquake, their families receiving injuries to more or less extent and their houses and properties burning in the fire following the quake, they had no time to look for their own private affairs, and they went out without delay on the call of their duties. With the aid of those working in neighborhood and of other railway employees, they fought sternly to put out the fire and save the lives, doing their best to communicate the news to proper authorities despite the fact that all means of communication have ceased, and provide emergency measures for the restoration of traffic. Those in regional offices and other men in executive staff had without delay formed an emergency relief organization, giving orders to general employees and asking speedy aid to various quarters, and decided for the execution of the emergency measures. Maintenance of way staff from the neighboring districts also came out to aid on immediate notice. All these men concentrated their utmost efforts continuously for days and nights to the end that works of restoration should be speedily carried on. As the result of the efforts traffics were re-opened as follows :

(1) *The Tokaido Line (principal trunk line).*—After the disastrous quake, a small section of the line was re-opened for traffic in 3 days and that portion extending from Tokyo to Yokohama was restored in 5 days.

Re-opening was done section by section until a connection over the Hakone pass (about 1 mile) was effected by foot on September 17 and the connection over the Banyu River by ferries on the following day, thus making complete connection over the whole of the Tokaido line. The emergency works having been subsequently completed, connection by foot was abandoned on December 14, thus restoring the usual through train service.

(2) The Yokosuka Line.—The emergency work was started on September 5 and the section between Ofuna and Kamakura was opened on September 7, the through train service on this line having been resumed on September 30.

(3) The Atami Line.—Considerable damages had been brought on the line. The emergency work was started on September 12 and a portion of the line re-opened on October 15, the through service of the trains having been resumed on October 1 this year.

(4) *The Chuo and Yamate Lines (suburban lines of the city of Tokyo).*—The whole of these lines except a small section was restored and opened for traffic in 3 days after the quake.

(5) *The Sobu and Hojo Lines.*—The emergency work on these lines was started on the very day of the disaster ; those sections receiving only slight damages were opened a few days after and the whole lines re-opened for traffic on November 20.

(6) *The Tohoku, Joban and Yokohama Lines and their branches.*—These received comparatively slight damage, so that within from 2 to 10 days after the emergency work was started they were opened section by section until the through service of trains was resumed at the end of September last year.

In executing emergency works mentioned above, efforts were concentrated on the principal trunk lines, urgency of the work having been determined by the extent of the damage and the condition of the tracks ; and the work has been carried on step by step.

These emergency works had been done in the main on the exact position where previous rails were, or an entirely new spot was selected for re-laying of rails.

In cases of bridges, the same steel girders as had been used prior to the quake were again used ; those girders found unfit for use were replaced with those brought from other lines in course of construction, with piers and abutments made of wood.

For cracks of tunnels centres were constructed with bend rails to support the cracked portions.

At the fallen embankments, grade was temporarily changed, for instance from 1/100 to 1/80.

Thus emergency works have been executed to the extent to have the trains operated without hindrance.

The permanent restoration works aiming to re-model on permanent basis what had been accomplished by the emergency works mentioned above are to be done on a general plan existing before the quake ; there have been found, however, some 40 sections where changing of track location has been considered advantageous.

The program of permanent restoration works are to be carried on completion till the fiscal year of 1926. These works so far accomplished reach to about one third (about Y.12,000,000 has been spent for the purpose).

Restoration Expenses and Financial Condition of the State Railways

The great earthquake and fire of 1923 caused damage to the railway tracks and buildings, amounting to about Y.28,800,000. In addition to this, loss estimated on the burnt materials for railway operation was considerable, making the total loss some Y.34,500,000. The sum refers only to the value of properties lost as shown in accounting books. There is still further loss encountered in connection with railway operation. The emergency works on the permanent way and structures destroyed, and the reinforcement works on the various structures that have been saved from collapse have also been required. For these purposes a sum of Y.19,320,000 had to be paid out from the Revenue Account in 1923. Thus various providences have been reinstalled to the extent that passenger and freight traffic could be carried on without much difficulties, and at present the train operation has practically resumed its normality.

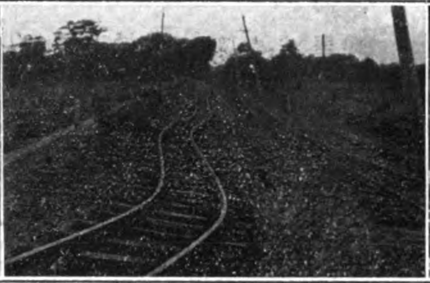
Although it had been anticipated that all restoration works could be completed within four years—from the fiscal year 1923 to 1926—with the expenditure of about Y.50,000,000, the budget to cover the works has been arranged, after taking into consideration the fact that in view of the quake more security should be obtained in the works and that the design hitherto prevailed on various equipments would be altered as the reconstruction of the Capital progresses. The budget is for continuous works extending over six years from 1923 to 1928. Although a supplementary budget was drawn subsequently for reconstruction expenses this failed to receive the legislative sanction owing to the dissolution of the Imperial Diet last year. The works, however, have been carried on as planned, the expenses having been met with the money provided for improvement works which have been temporarily postponed.

Following gives the detail of the budget.

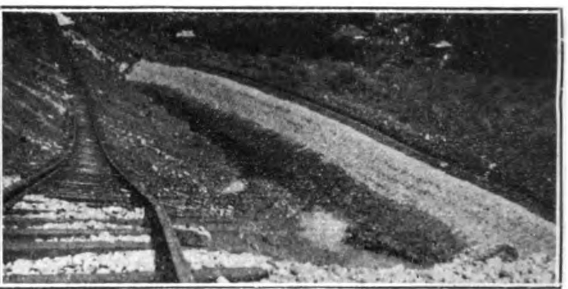
Year	Restoration budget	Reconstruction budget	Total
	Yen	Yen	Yen
1923	5,000,000	—	5,000,000
1924	21,162,000	13,838,000	35,000,000
1925	14,031,000	10,969,000	25,000,000
1926	9,686,000	10,314,000	20,000,000
1927	—	20,000,000	20,000,000
1928	—	20,000,000	20,000,000
Total	49,879,000	75,121,000	125,000,000

As to the financial condition of the Government Railways, the estimated Revenue Account for the fiscal year 1923 shows a revenue of Y.448,266,091; the expenditures Y.328,479,055 in connection with operation, leaving a net surplus of Y.119,919,036.

Falling of track and bending of rails between Chigasaki and Hiratsuka, Tokaido Line



Sinking of track and bending of rails between Tsujido and Chigasaki, Tokaido Line



Shifting of road bed, leaving the track in its original position, between Nebukawa and Manazuru, Atami Line

Bending of rails on the bridge over Minato River and sinking of embankment between Kazusa-Minato and Hama-Kanaya, Boso Line

Bending of rails on elevated line between Ryogokubashi and Kinshicho, Tokyo, after the earthquake and fire

Bending of track between Nakofunagata and Awahojo, Boso Line

Derailing and overturning of a passenger train near Oiso Station, Tokaido Line

Overturning of a freight train in the Chigasaki Station Yard, Tokaido Line

Manseibashi Station, Tokyo, as it looked after the quake and fire

Shimbashi Station, Tokyo, after the earthquake and fire have worked their way

Overturning of locomotives in engine shed and in the yard, Awahojo Station, Sobu Line

Cracking and sinking of platform and collapsing of its shed, Odawara Station, Atami Line

Skeleton of a burnt train in Hamamatsucho Station, Tokyo

As to the Capital Account, the profit to be transferred from the Revenue Account, Y.70,000,000 to be raised by a public loan, the miscellaneous receipt of Y.2,000,000 and the fund of Y.9,000,000 to be brought over from the preceding year were to be appropriated as the construction and improvement expenses. The revenues, however, as shown in the Revenue Account has fallen short of estimated owing to the unexpectedly big outlay (Y.19,320,000), temporary interruption of train operations on some lines in the devastated areas and transportation without charges or at reduced rates of freights and passengers. Consequently the profit has been reduced considerably.

The Government, as an emergency measure, has decided to suspend temporarily all the enterprises except those of urgent nature, the railway administration accordingly has had to alter so far as the Railway Capital Account is concerned, the schemes of construction and improvement works, some of which entirely suspended.

The brief statement of the budget on the Revenue and Capital Accounts for the fiscal year 1923 is as follows :

REVENUE ACCOUNT
(*Decrease)

Item	Original Annual Estimates	Settled	Increase on or Decrease from Estimates
Receipt :—	Yen	Yen	Yen
Traffic	442,294,195	436,466,521	*5,827,674
Miscellaneous	5,971,896	6,888,260	916,364
Total	448,266,091	443,354,781	*4,911,310
Expenses :—			
Operation	243,823,055	267,982,169	24,159,114
Interests and charges on loans	62,524,000	62,857,737	333,737
Subsidies to private local railways	2,000,000	2,218,875	218,875
Reserve	20,000,000	—	*20,000,000
Balance after deducting tentative receipts and advances paid in from overcharges refunded and advances ...	—	31,905	31,905
Total	328,347,055	333,090,686	4,743,631
Surplus (profit)	119,919,036	20,264,095	*9,654,941

CAPITAL ACCOUNT
(*Decrease)

Item	Original Annual Estimates	Settled	Increase on or Decrease from Estimates
Revenue :—	Yen	Yen	Yen
Net profit transferred	119,919,036	110,264,095	*9,654,941
Loans	70,000,000	39,690,000	*30,310,000
Miscellaneous	2,000,000	1,547,882	*452,118
Debentures	—	25,000,000	25,000,000
Brought over from the preceding year	9,000,000	9,000,000	—
Total	200,919,036	185,501,977	*15,417,059

Item	Estimates: Original Estimates	Brought over from the preceding year	Reduction due to postponement of works	Estimates after deducting the previous item	Settled	Balance
Expenses:—	Yen	Yen	Yen	Yen	Yen	Yen
Construction	70,000,000	1,744,378	6,759,000	64,985,378	64,496,320	489,058
Improvement	130,908,200	4,721,086	13,215,000	122,414,286	121,013,097	1,401,189
Redemption of national loans	10,836	—	—	10,836	10,835	1
Total	200,919,036	6,465,464	19,974,000	187,410,500	185,520,252	1,890,248

The settled revenues and expenses on the Revenue Account for the fiscal year 1923 ending March 31, 1925 cannot be definitely given as it is still unable to secure the operating result owing to the fact that it has come only to half the fiscal year. However, we can give the following figures as taking from the statement of the budget.

Revenue	Traffic	Y.487,380,942
	Miscellaneous	6,079,056
	Total	Y.493,459,998
Expenses	Working	Y.274,004,330
	Interest & charges on loans...	65,504,668
	Subsidies to private local railways	3,000,000
	Reserve	20,000,000
	Total	Y.362,508,998
Surplus (profit)		Y.130,951,000

With regard to the Capital Account for the fiscal year 1924, as the budget that has not been approved in the last session of Diet, it has been decided to follow the basis of the proposed budget. The reconstruction works, however, are being carried on as planned inasmuch as the supplementary reconstruction budget has been approved in the last session of Diet. This budget is as follows :

Construction Expenses	Y. 57,750,000
Improvement Expenses	138,547,000
For Improvement works	103,547,000
For Reconstruction works	35,000,000

The financial sources for the above comprise net profit, loans, fund brought over from the preceding year and the miscellaneous revenues belonging to the Capital Account.

Railway Operating Result During the Year 1924

As regard to the latest result of the year 1924, there are not definite figures obtainable, but the rough figures from January to December obtained from the number of passengers and tonnage of freights and the revenue from passengers and freights in each month may be compared with those of the corresponding months of the last year. The following table gives such result, showing an increase every month compared with the corresponding periods of the previous year. (Considerable increase in September is due to the great earthquake encountered the same month of last year which caused great interruption of traffic and consequent decrease of revenue.)

TRAFFIC STATISTICS for the Year 1924.
(I)

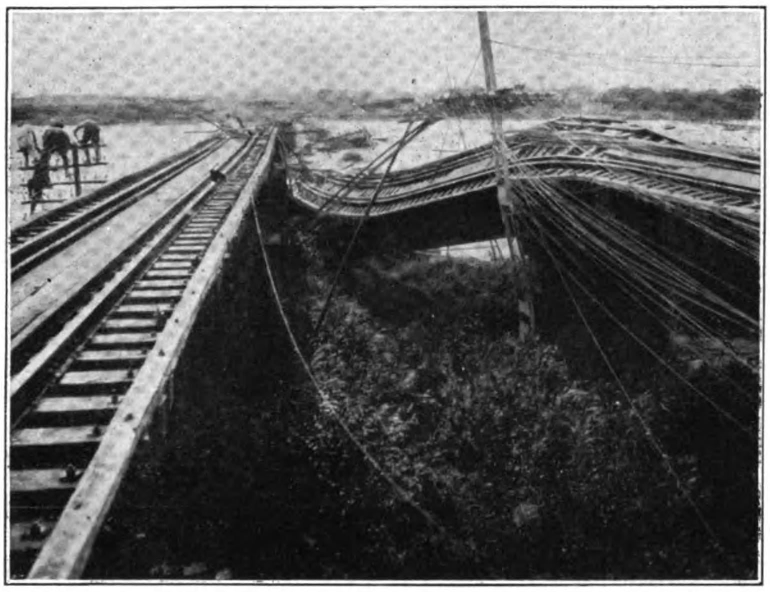
Month	Miles Open 1924	Inc. over 1923	No. of Passenger Journeys 1924	Inc. or Dec.	Freight Traffic (tons) 1924	Inc. or Dec.
January ..	7,247	262	48,738,519	10,530,291	4,959,257	463,535
February ..	7,251	264	41,576,254	9,418,593	4,961,957	382,389
March	7,277	282	46,466,960	5,073,502	5,789,708	375,637
April	7,348	310	104,671,608	13,205,206	5,643,441	451,607
May	7,366	310	54,145,047	8,756,455	5,658,453	255,780
June	7,370	303	42,843,218	6,649,565	5,219,378	181,318
July	7,387	312	44,833,150	5,166,265	5,081,879	347,607
August ..	7,415	332	46,121,179	4,331,441	4,751,517	*45,863
September ..	7,416	296	51,209,636	20,283,252	5,155,631	1,386,284
October ..	7,430	283	52,744,708	1,888,481	5,508,038	767,290
November ..	7,484	298	44,283,784	*588,168	5,343,292	592,806
December ..	7,517	290	42,445,391	*127,895	5,645,095	389,699
Total			620,079,454	84,586,988	63,717,646	5,548,089

TRAFFIC RECEIPTS for the Year 1924.
(II)

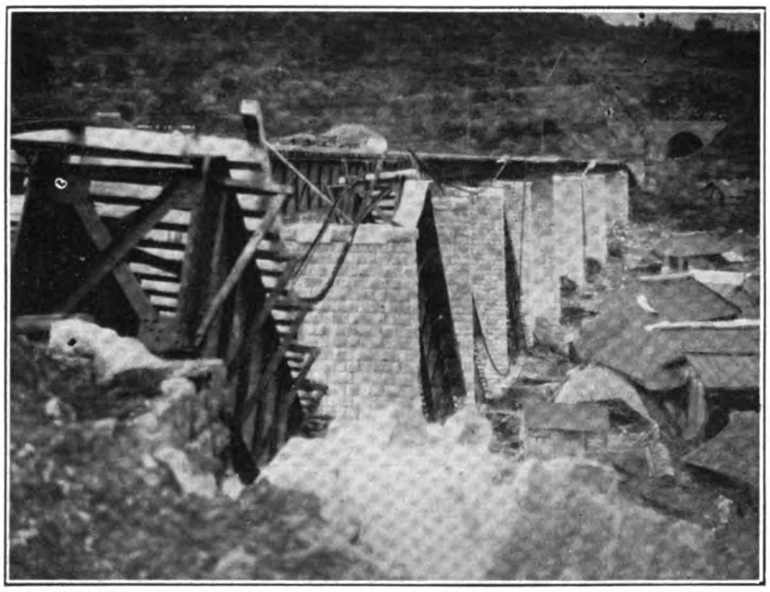
Month	Passenger Traffic Receipts 1924	Inc. or Dec.	Freight Traffic Receipts 1924	Inc. or Dec.	Total 1924	Inc. or Dec.	Receipts per mile per day
	Yen	Yen	Yen	Yen	Yen	Yen	Yen
Jan.	20,839,628	3,621,358	14,547,777	1,600,495	35,387,405	5,221,853	158
Feb.	18,817,096	3,315,548	14,941,749	1,534,204	33,758,845	4,849,752	161
Mar.	23,441,856	2,125,860	17,341,987	1,145,272	40,783,843	3,271,132	181
Apr.	28,788,448	1,914,227	16,851,898	1,321,269	45,640,346	3,235,496	207
May	24,164,820	2,013,578	16,663,741	701,516	40,828,561	2,715,094	179
June	19,166,787	1,831,502	15,486,281	582,928	34,653,068	2,414,430	157
July	20,221,241	1,013,775	14,822,364	853,028	35,043 605	1,866,803	153
Aug.	23,681,666	1,057,009	14,369,167	93,903	38,050,833	1,150,912	166
Sept.	20,029,845	3,868,438	15,889,758	5,992,956	35,919,603	9,861,394	161
Oct.	23,113,306	809,937	17,039,308	4,042,344	40,152,614	4,852,281	174
Nov.	20,129,528	*290,818	16,420,314	2,514,605	36,549,842	2,223,787	163
Dec.	19,716,284	*1,119,433	17,226,909	959,491	36,943,193	*159,942	164
Total	262,110,505	21,280,414	191,601,253	21,342,011	453,711,758	45,502,992	

Rates and Charges of the State Railways

Rates on the State Railways of Japan have had to be advanced on the rates uniformly fixed since the nationalization of the railways, owing to the considerable rise of commodity price and wages and also operating expenses accompanying the abrupt booming in the economic world as a result of the great war. Twenty per cent. advance in passenger fares in July, 1918 and twenty per cent. advance in freight rates in October of the same year were made so as to keep the balance of revenues and expenditures. The rise of commodity price has still continued ; nevertheless, in view of the fact that further advance in railway rates would only help to make the price still higher, further advance in rates has been considered unwise. On the other hand there was an urgent need for better equipment of railway facilities and improvement, at the same time general rise of the cost of materials. Financial resources in consequence suffered greatly ; and even stringent economies effected in operation expenses finally became futile, unless some positive measure such as increase in revenue is considered. This led to further advance of railway rates—25 per cent. in passenger fares in February, 1920 and 28 per cent. in freight rates in January the

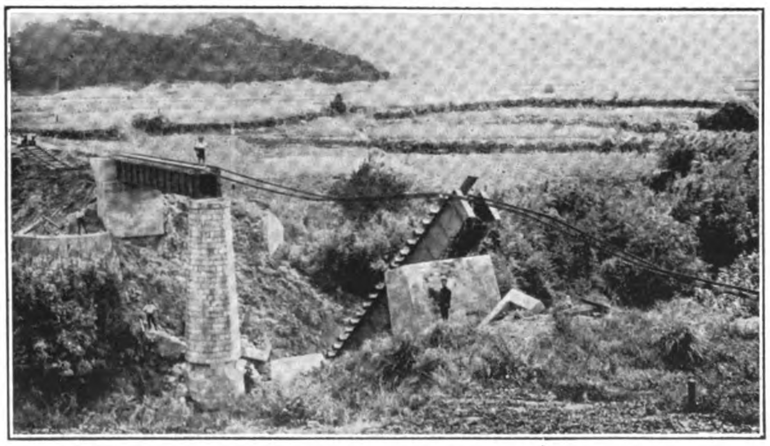


Collapse of the Banyu River Bridge, between Chigasaki and Hiratsuka, on the Tokaido Line

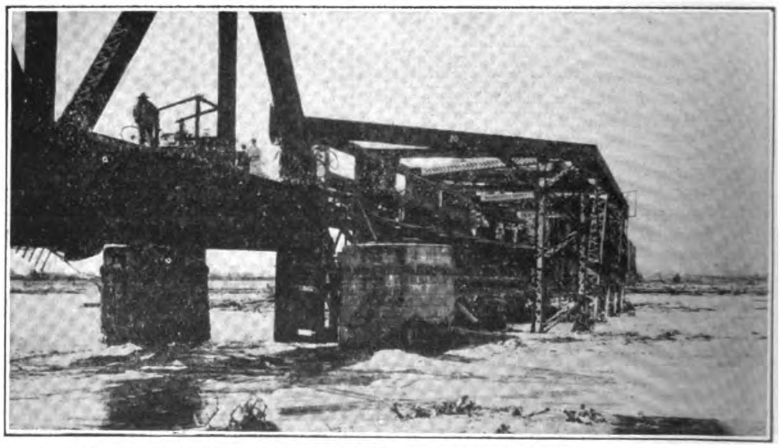


Falling of girders of bridge, between Hayakawa and Nebukawa, Atami Line

Cracking and shifting of Piers of the Minato River Bridge and an Emergency Repair Gang between Kazusa-Minato and Hama-Kanaya, Boso Line



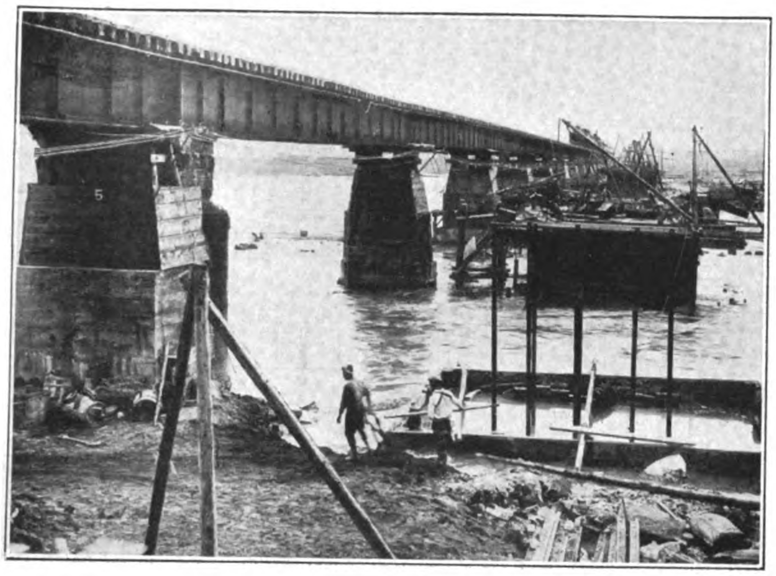
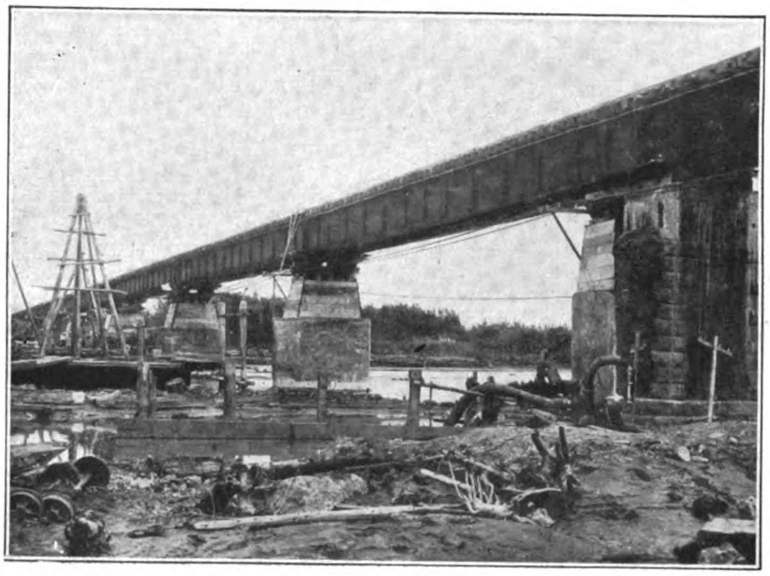
Falling of first Setogaya Bridge, between Kokonoe and Chikura, Sobu Line



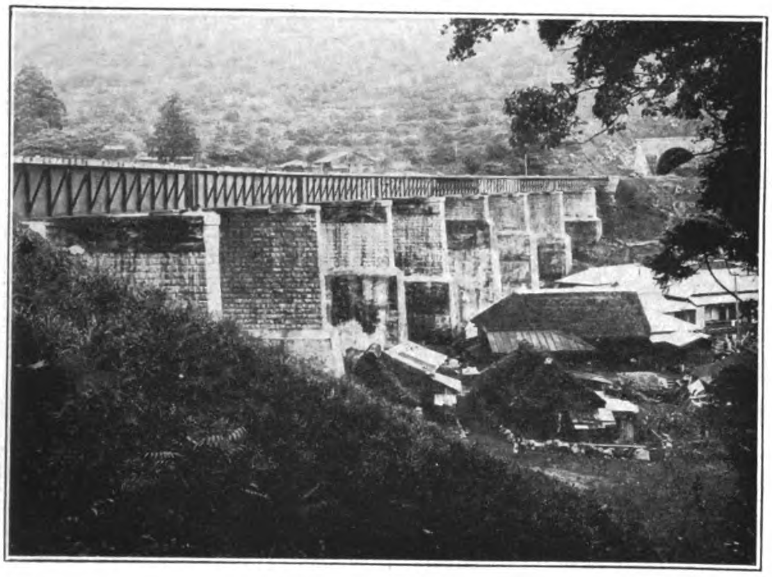
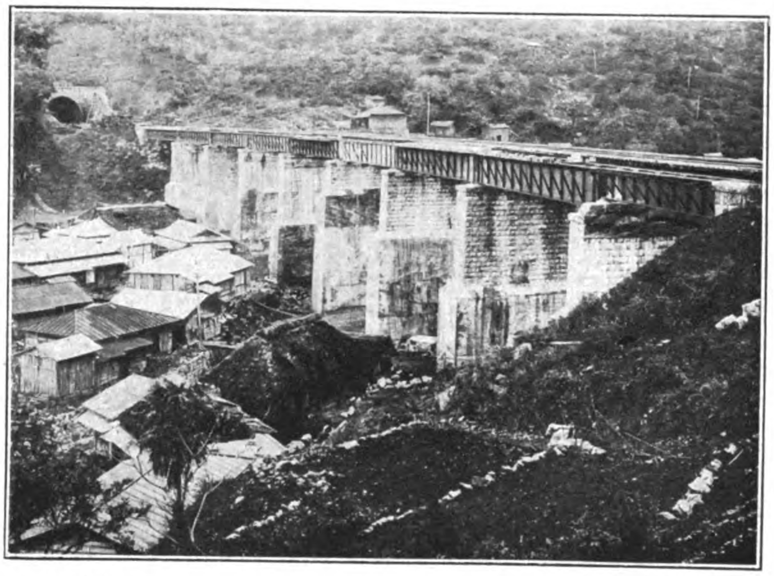
Falling of Sakawa River Bridge, between Kamomiyama and Odawara, Atami Line

following year were put in force, revising at the same time the classification of freights in order to secure more equitable rates on various commodities. The following gives a comparison of the new rates and those of the past.

(*a*) *Passenger Fares.*—Passenger fares now in force were revised in February, 1920; charges are made according to the principle of "differential system," that is diminishing by steps as the distance increases; classes comprise first, second and third, first class cars are attached only to the principal trains on the main lines, on the rest of the lines these are not run, so that on the majority of lines and largest number of trains only two classes of cars, second and third, are attached.

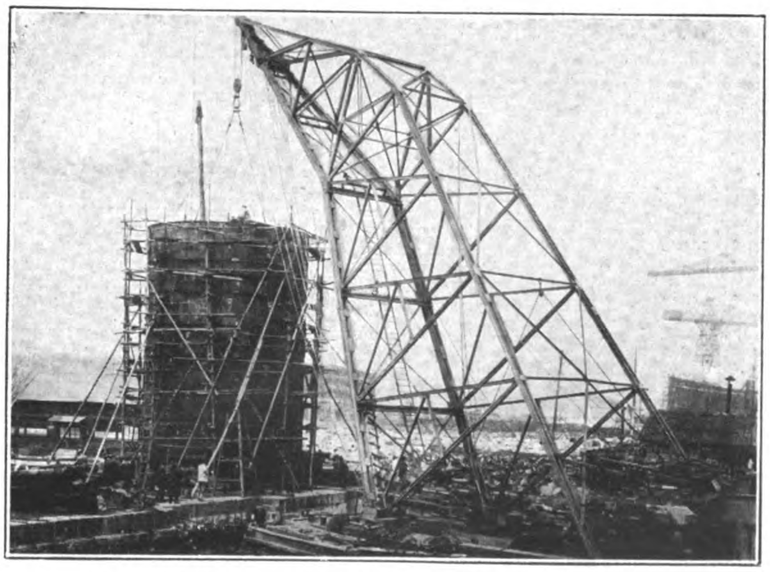



The Repaired Banyu River Bridge

The Repaired Tamagawa Bridge

The Sakawa Bridge undergoing repairs: Second Span as shown on preceding page fell into water. Beams were raised by "Goliath" crane and used in new span



Erecting Caissons at Yokohama Dockyard for repairing Bridge Piers

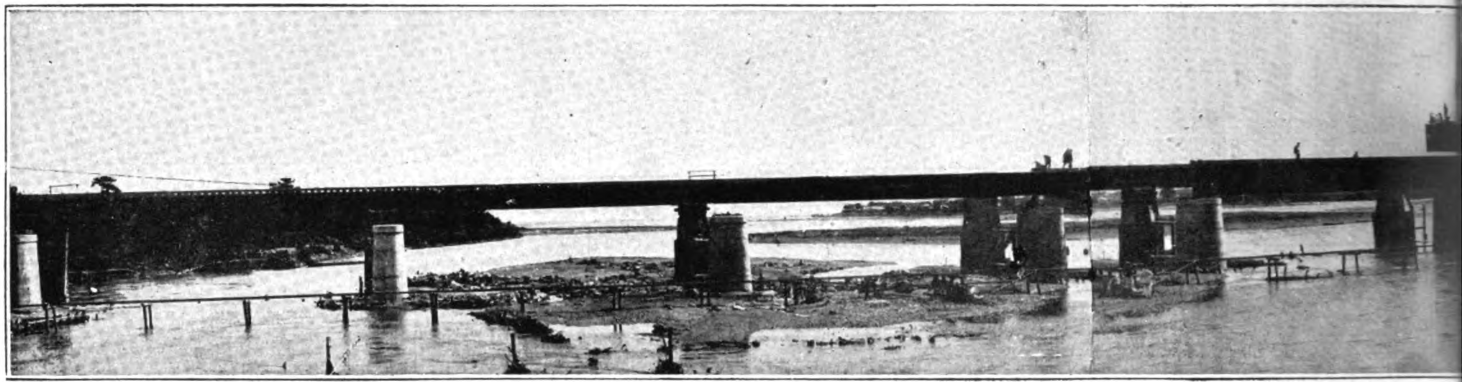


Fig. 1

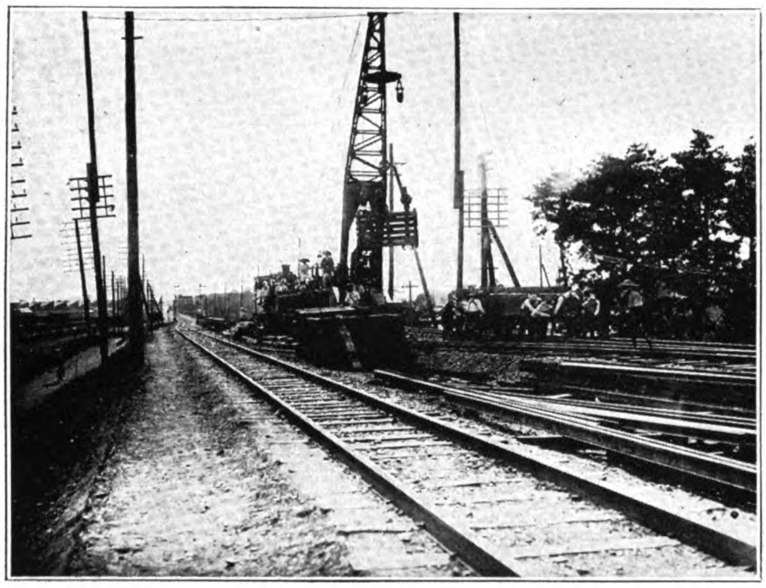


Fig. 2

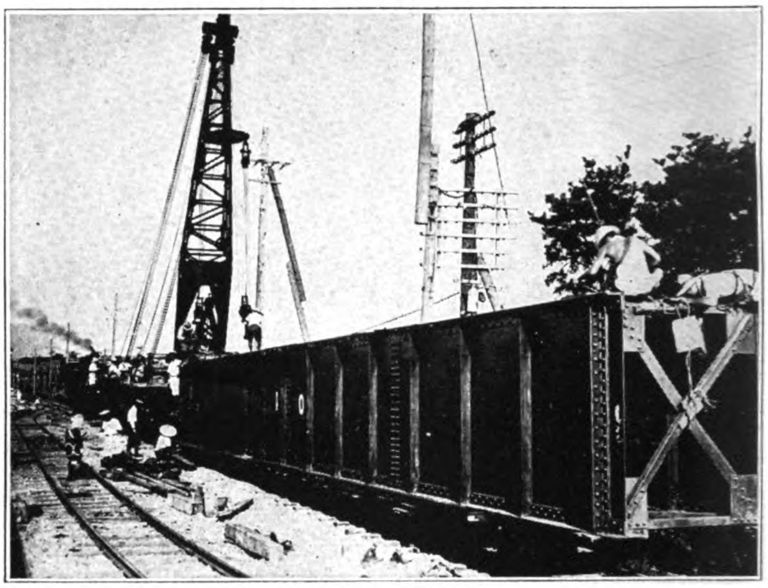


Fig. 3

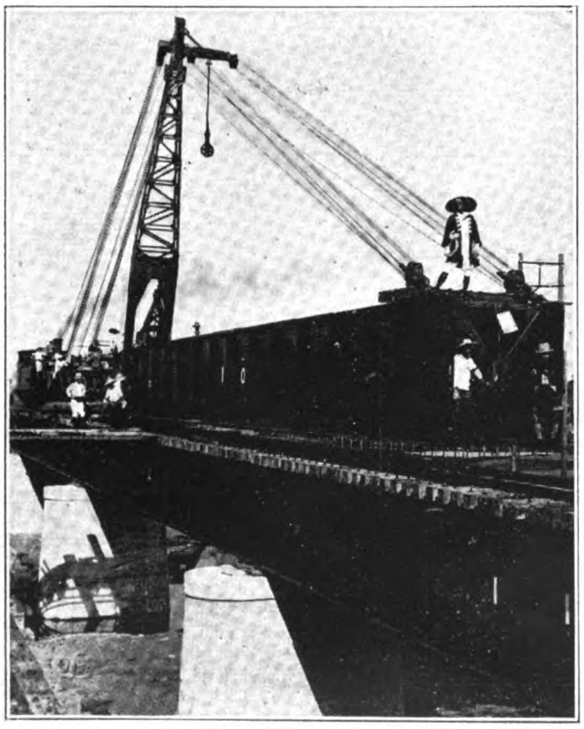


Fig. 4

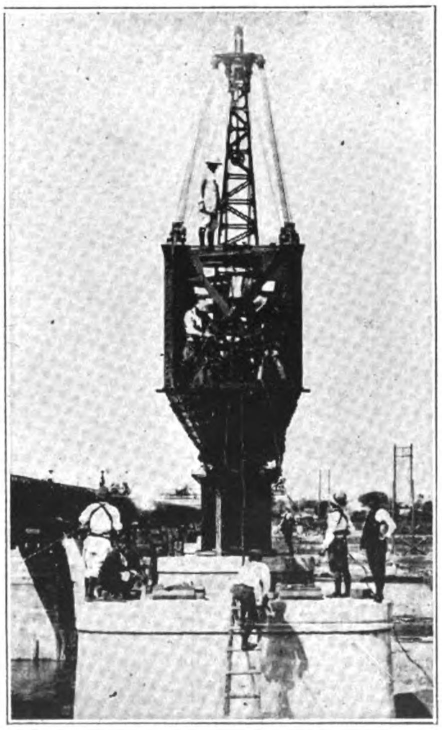


Fig. 5

Fig. 6

RECONSTRUCTION OF THE BANYU RIVER BRIDGE NEAR YOKOHAMA

Showing the Various Stages of the Work as shown in Figures 1 to 10, carried through successfully by the Engineers of the Imperial Government Railways

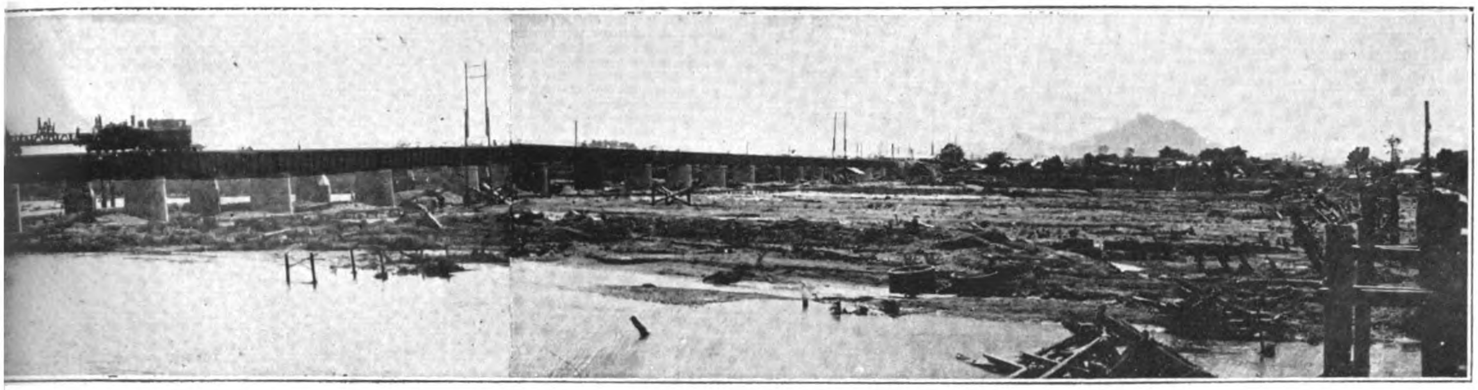


Fig. 1

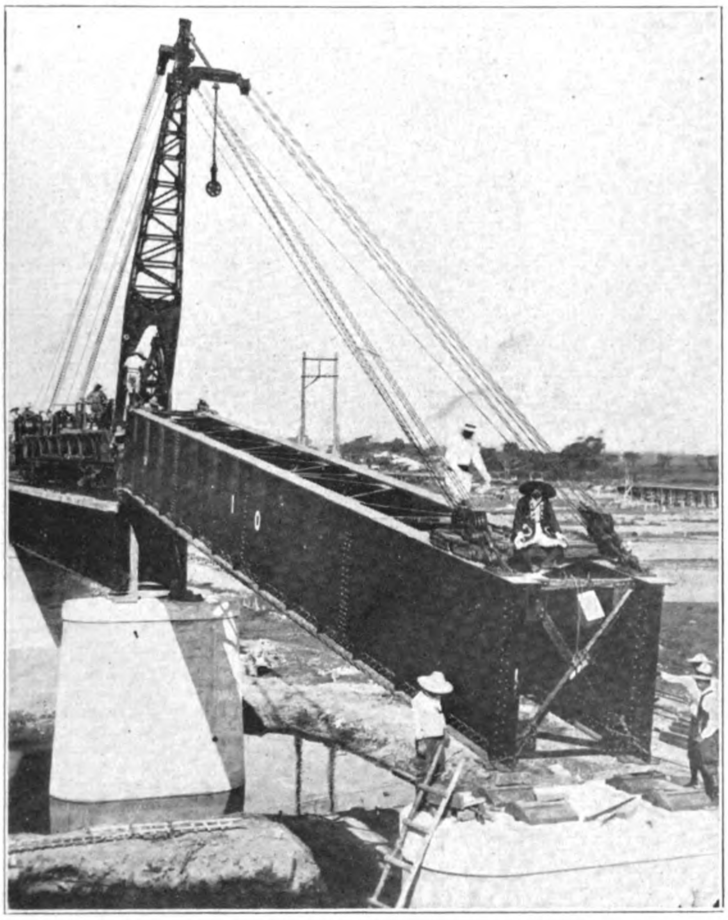


Fig. 7

Fig. 8

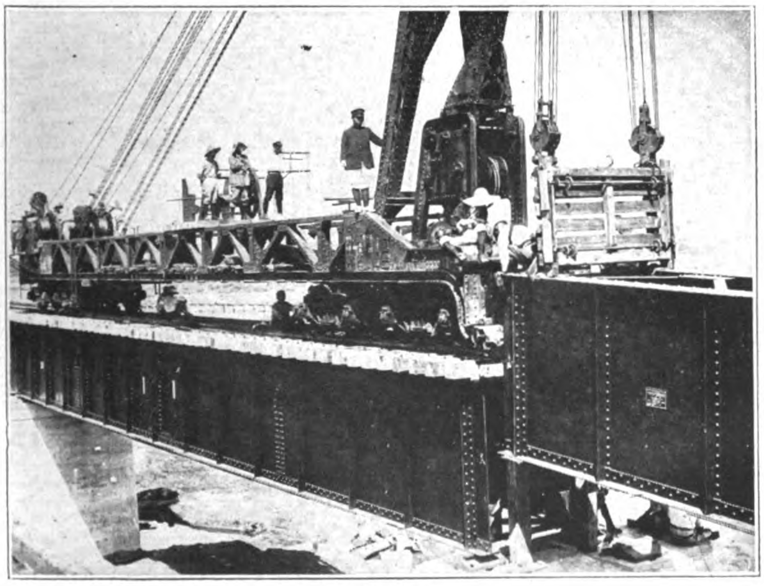


Fig. 9

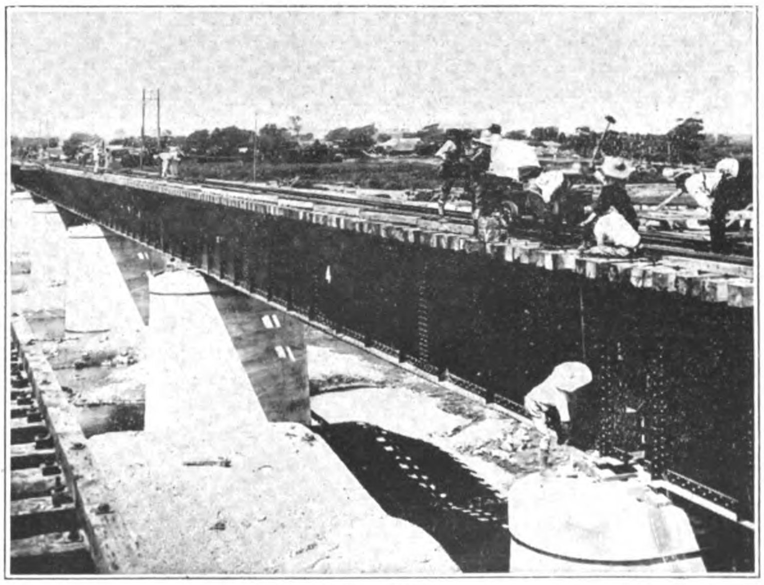


Fig. 10

THIRD CLASS PASSENGER FARES PER MILE.

Present (revised in February) 1920		Old (revised in July) 1918		Old (prior to July) 1918	
	Yen		Yen		Yen
up to 50 m.	0.025	up to 50 m.	0.020	up to 50 m.	0.0165
„ 100 m.	0.021	„ 100 m.	0.016	„ 100 m.	0.013
„ 200 m.	0.017	„ 200 m.	1.013	„ 200 m.	0.010
„ 300 m.	0.014	„ 300 m.	0.010	„ 300 m.	0.008
„ 400 m.	0.012	over 301 m.	0.008	over 301 m.	0.007
„ 500 m.	0.011				
over 501 m.	0.010				
2nd class increase	100%	2nd class increase	75%	2nd class increase	50%
1st class increase	200%	1st class increase	175%	1st class increase	150%

Passengers taking express trains are charged express charges in addition to ordinary fares; express charges are of two kinds, Limited and Ordinary. These charges had also been revised twice, once in 1918 and for the second time in 1920. The following are the present charges.

Kinds	Class	Up to 250 miles	Up to 500 miles	Over 500 miles
Limited express	3	Y.1.300	Y.2.000	Y.2.500
	2	2.500	4.000	5.000
	1	4.000	6.000	7.500
Ordinary express	3	Y.0.650	Y.1.000	Y.1.250
	2	1.300	2.000	2.500
	1	2.000	3.000	3.750

(*b*) *Parcels Rates.*—Small goods requiring speedy transportation which can be carried on the luggage cars attached to passenger trains are generally handled as parcels on rates which are comparatively higher than those charges on freights. The consignment as parcels has recently increased considerably, so that the revenue from these sources has come to comprise about 5 per cent. of the total traffic revenue of railways. Parcels rates, as well as passenger and freight rates, had also been advanced twice, once in October, 1919 and for the second time in January, 1921, as follows :—

PARCELS RATES (1 kin—1.32 lbs.)

Miles / Weight	Up to 2 kin	Up to 4 kin	Up to 7 kin	Up to 10 kin	Up to 15 kin	Up to 20 kin	Additional charges every 10 kin increase
	Yen	Yen	Yen	Yen	Yen	Yen	Yen
Up to 50 miles ...	0.150	0.200	0.250	0.300	0.350	0.400	0.100
„ 150 „ ...	0.150	0.200	0.250	0.350	0.450	0.550	0.200
„ 300 „ ...	0.150	0.250	0.250	0.450	0.600	0.750	0.300
„ 500 „ ...	0.150	0.250	0.400	0.550	0.750	0.950	0.400
Above 500 miles additional charges every 300 miles	0.050	0.100	0.150	0.200	0.250	0.300	0.100

(*c*) *Freight Rates.*—Freight rates are fixed according to " differential system " combined " zone system." Zones are widened as the distance increases; zones are gradually increased from the minimum of 2 miles within 50 miles up to the maximum of 30 miles over 1,000 miles, these intervening miles being divided into eight different grades. Freights were formally classified into five classes, namely, 1st, 2nd, 3rd, 4th (high class) and special. The present classification comprises six classes which was revised in January, 1921, *i.e.*, 5th, 4th, 3rd, 2nd, 1st and special.

Service Condition of Employees

I.—THE SCOPE AND NATURE OF THE EMPLOYEES.—The employees in the State Railways, strictly speaking, cover all ranks and classes of employees from the Minister of Railways to a humblest station employee.

They numbered 189,282 at the end of March, 1924. Classes of employees to be mentioned here, however, are only those for actually engaging in works connected with actual service; their number as estimated at the end of March this year was 159,157, divided as follows :

Station employees	58,986
Train service men	14,536
Locomotive engineers and firemen	16,252
Locomotive shed men and car inspectors ..	20,516
Permanent way men	22,633
Shop men and others	26,234

II.—CONDITIONS AND HOURS OF MEN ENGAGED IN ACTUAL SERVICE.—They may conveniently be given according to different kinds of service.

(*a*) *Station employees.*—Service method of these employees according to the nature of service and thickness of works may be briefly described as follows :

Day service.—They are to report every day at a fixed time (in most cases 8 a.m.), serving for a fixed number of hours a day, with holidays four times a month or once in a week. The average working hours a day of those employees are 9 hours and 16 minutes.

Day-and-night through service.—They are to serve continually for 24 hours, followed by a rest of 24 hours, this to be repeated. During night service they have a sleeping time from 2 to 4 hours. They are given a holiday of one day every month. Their average working hours a day are about 10 hours.

Shift service.—This is a method of having day service followed by day-and-night through service so that it requires at least three men to shift. Their average working hours a day are 10 hours 38 minutes.

Three shift service.—24 hours are equally by this method divided and shifted by three men with an average working hours per day per night for each (including time spent in transferring works) of 8 hours 16 minutes. This three shift system is applied for places requiring comparatively thick work.

(*b*) *Locomotive and train men.*—Locomotive men include engineers and assistant engineers (fire-men); train men include conductors, and brake-men, etc. Their service is on shifting system. Number of days required one round of shift is 2 days at least and 20 days at most, most prevalent shift is 10 days.

The working hours per day for each man, which is obtained by dividing the total working hours during shifts by the number of days of shift are as follows :

	Locomotive engineers	Firemen	Train men
Minimum	7 hrs. 48 min.	7 hrs. 48 min.	8 hrs. 30 min.
Maximum	8 „ 18 „	8 „ 24 „	9 „ 21 „
Average	8 „ 6 „	8 „ 6 „	8 „ 50 „

These averages include hours spent on either locomotives or trains, in cleaning boilers (by engineers or by firemen), changing one train for another, preparing for duty aboard and straightening up matters after the finish of works.

(*c*) *Locomotive shed men and car inspectors.*—They include those serving in the locomotive sheds, car inspectors so forth, and their manner of service and working hours are the same as prescribed for station employees.

(*d*) *Permanent way men.*—The working hours of permanent way men are fixed as follows, taking into consideration variation in season :—

From November to February, following year	9 hours per day
From March to April and from September to October	10 „ „ „
From May to August	11 „ „ „

Averaged in one year (365 days) this becomes 10 hours per day.

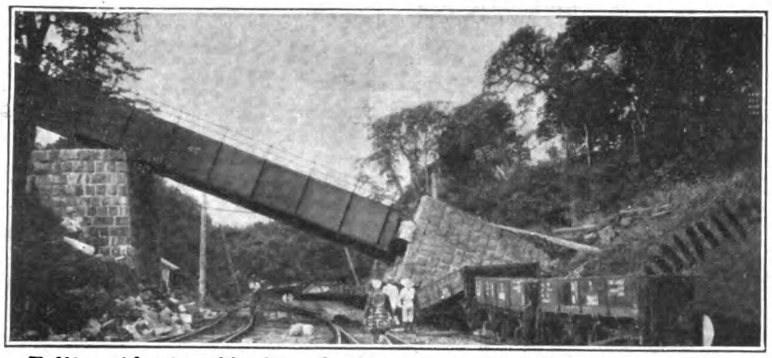
In cases of those working in tunnels, 8 hours are prescribed for each day.

2 holidays are given each ordinary month and 4 times during each of the special months, December and January.

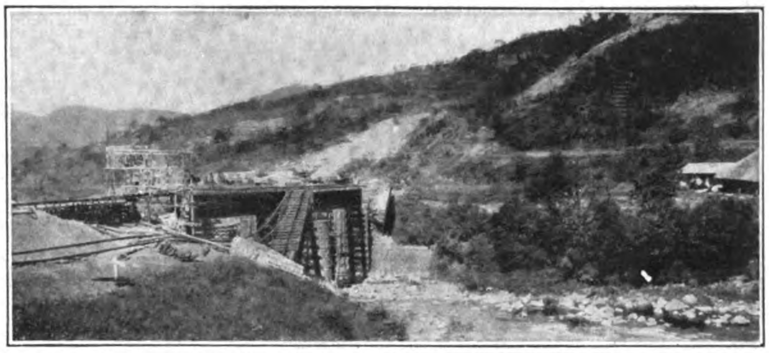
(*e*) *Shop men.*—There are the workers in car-building and repairing shops, their service hours are 10 hours per day, but the actual working hours are 9 hours. They are given at least 2 holidays in a month; they are actually having at present 4 holidays each month.

III. EXTRA HOLIDAYS.—In addition to the regular holidays mentioned above, from 3 to 9 continuous holidays are given all employees who have a clear record of attendance for 6 months.

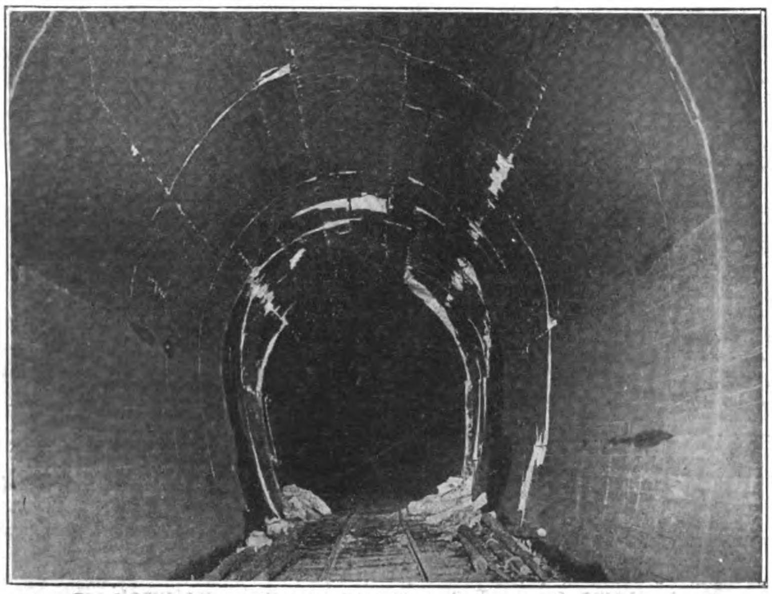
IV. SALARIES AND WAGES.—(*a*) Following are the wage scales in percentage paid to the employees below the rank of foremen (the rest being accorded the treatment of the civil officials) :—



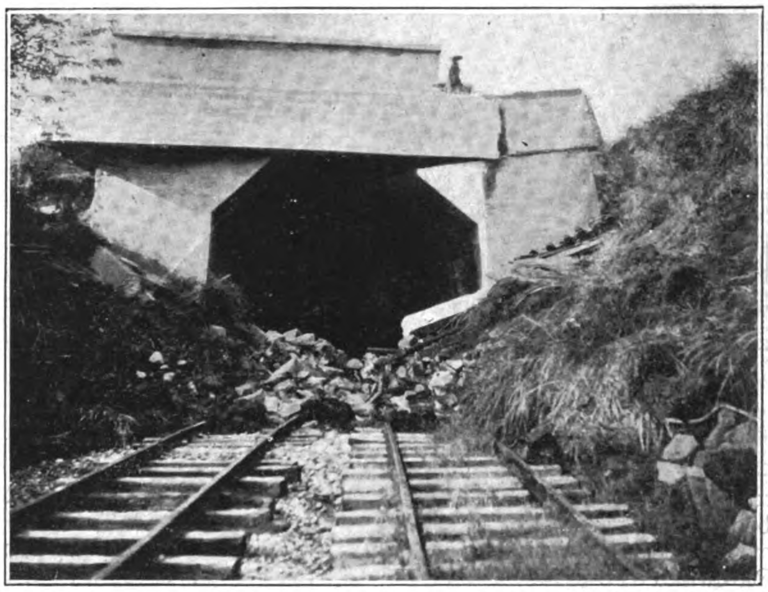
Falling sidewise of highway bridge pier upon a freight train, crushing and overturning some cars, near Odawara, on the Atami Line



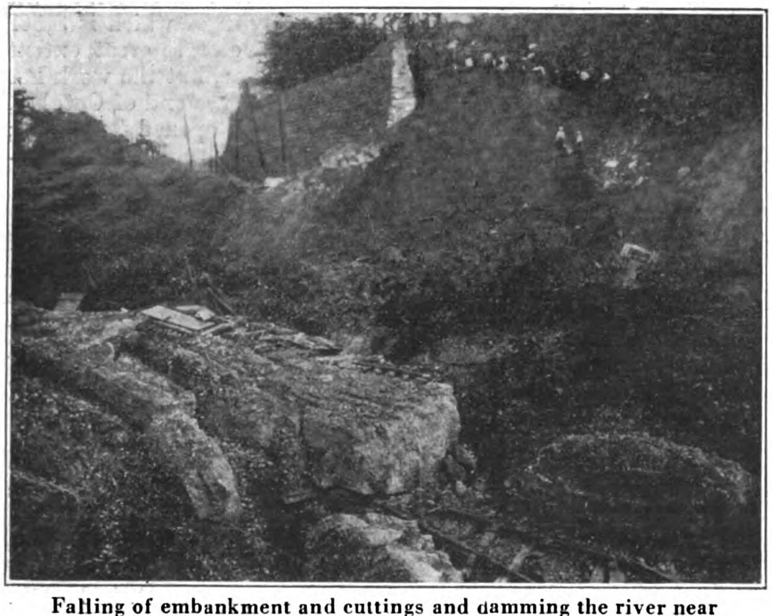
Falling of girders of Aizawa bridge, between Suruga and Ashigara, Tokaido Line



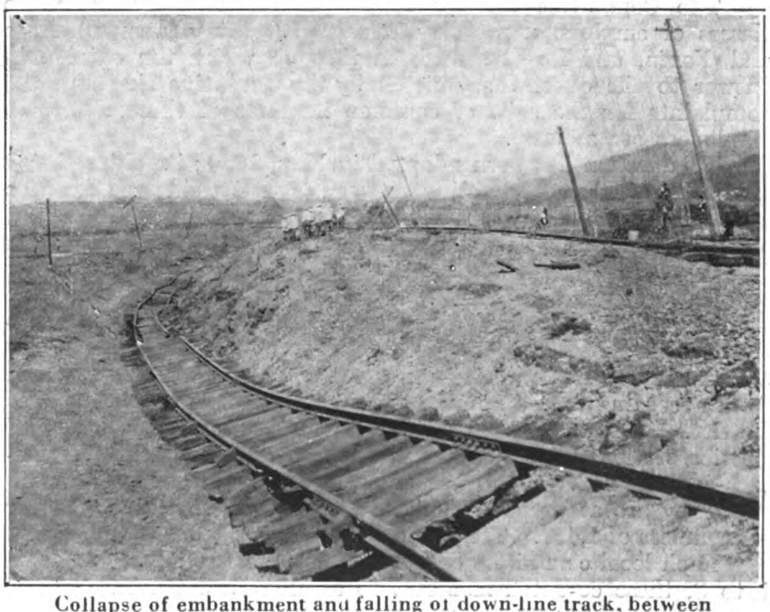
Cracking and partial falling of Nokogiriyama tunnel, between Hamakanaya and Hota, Boso Line



Eastern entrance of Komine tunnel as it looked after the quake



Falling of embankment and cuttings and damming the river near Ochanomizu Station, Tokyo

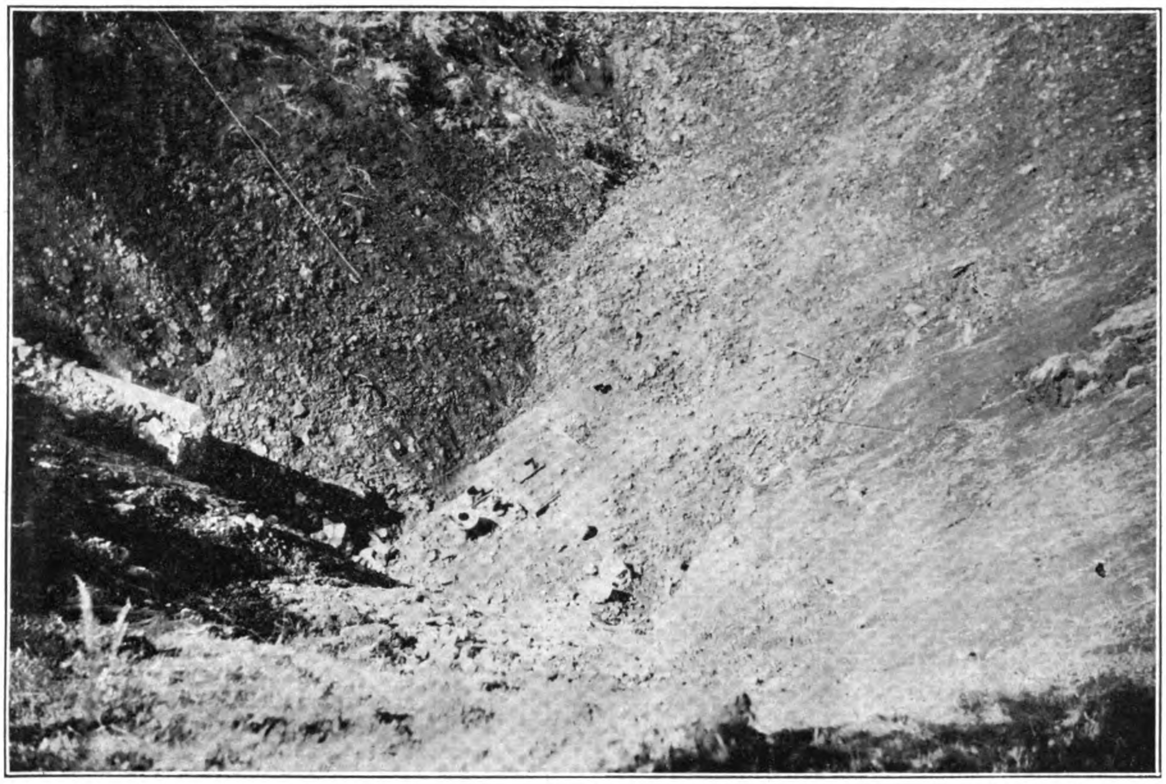


Collapse of embankment and falling of down-line track, between Kozu and Shimosoga, Tokaido Line

Year	Foremen	Employees of *koin* class	Employees of *yonin* class
1912	100	100	100
1913	100	101	101
1914	103	103	105
1915	109	99	106
1916	116	100	106
1917	113	104	115
1918	120	123	130
1919	126	134	145
1920	179	214	234
1921	243	266	302
1922	243	275	294
1923	240	274	290

(*b*) *Long service bonus.*—A system of 'long service bonus' has been established since September, 1919 as an incentive to long and continuous service, by which Y.2 are added to monthly wages for those serving continuously over five years, Y.3 for those serving continuously over 10 years, Y.4 for over 15 years, Y.5 for over 20 years, Y.6 for over 25 years.

(*c*) *Other bonuses.*—In addition to the above wages and long service bonus, a bonus is given to every employee twice a year, that is, June and December, varying in amount from one month's to 1½ month's wages each time. Further, night service pay for working in night, or train service pay for those serving aboard



Collapse of Samunomeyama Tunnel between Nebukawa and Manazuru, Atami Line, seen from the eastern entrance. Stone column-like object lying at the left-hand side is the top of the entrance arch of the tunnel; a passenger train was just passing through and was about to emerge from the tunnel when it met the disastrous earthquake. The top of the locomotive is just seen, the rest being buried; the whole of the passenger cars were completely swallowed up under tons of earth and gravel within the tunnel

trains, couplers extra pay for couplers and an extra pay to the ticket booking clerks are also allowed.

V. EMPLOYEES' REPRESENTATIVE SYSTEM OF THE STATE RAILWAYS OF JAPAN.—The representative system is covered by the Employees' Committee representing men engaging in the work directly connected with the operation of the railways.

The Committee consists of members elected by the three classes of employees, namely *Tetsudoshu* (railway foremen), *Koin* and *Yonin*, and forms a medium through which the opinion in answer to the queries submitted by the executive side and the complaints for the sake of common interests of these classes of employees are secured.

This system has been adopted in May, 1920; its object being to effect mutual understanding between executive side and common employees in order to promote smooth and cheerful spirit in pursuit of their works and raise the efficiency of operation of the State Railways.

This organization, briefly stated, embraces 136 districts, in each of which an Employees' Committee is formed (this is conveniently called a Local Committee). Number of members comprising a Local Committee ranges from 5 to 30, the exact number to be fixed according to the number of employees within the prescribed district. Each committee district is further divided into several election sections for each of which number of the committee members are assigned.

They are at present 136 local committees with total number of members of 1,439. Term of committee members are 2 years.

Each local committee co-opts representatives numbering from 1 to 3, these co-opted members to organize a Joint Employees' Committee for each Regional Office. The position of the chairman of the Local Committee is filled by either the Chief of the District Traffic Office or the Chief of the District Maintenance Office or the Superintendent of Workshops and that of the Joint Committee by the Chief of General Affairs Section of the Regional Office. Officers of the Committee who have actual experiences with the services directly connected with the operation are also permitted to participate in the employees' meeting and make proper explanation and response. Decision on the bills submitted for discussion, however is reached by the elected members of the committee alone, the chairman and others, not members of the committee, having no power to cast vote beyond offering their explanation.

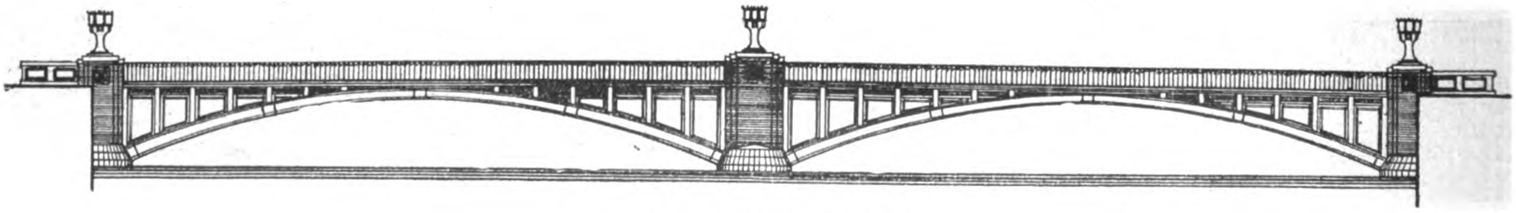
The Committee meetings are to be held twice a year. The 8th meeting has been held. The opinions submitted at the meeting by the Committee have made a valuable contribution towards better planning, and for the future of the State Railways; the decision secured at the meetings, resulting in their adoption promoted not to a little extent general welfare of the employees.

Summary of Lines Planned for Construction

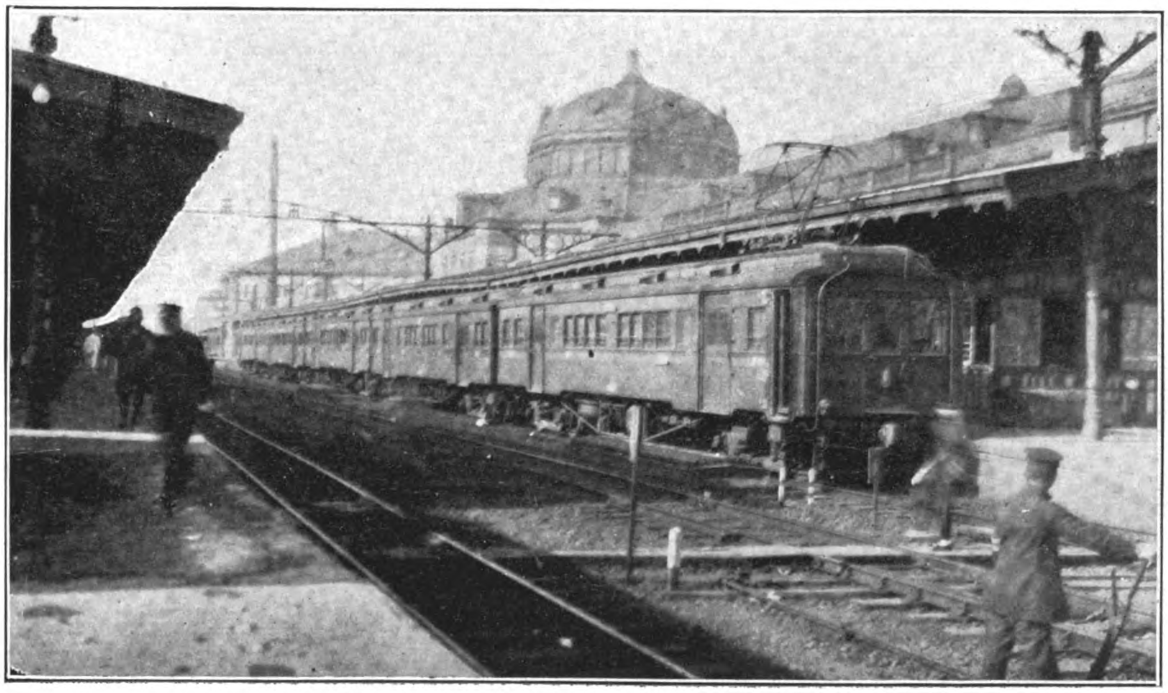
There are 87 lines planned for construction or extension by the Railway Department of Japan, the total length of which is 3,562 miles. The construction work has been hindered to great extent owing to the earthquake of September, last year, but the work has been gradually restored to normalty so that at the end of October, 1924, 525 miles of line have been completed and opened for traffic; and 557 miles are being built of which 165 miles are to be completed and opened at the end of this year.

A part of work being executed under contract and the rest being under direct supervision of the Department; the number of the sections of the former is 54 with the estimated expenditure of more than Y.24,710,000 and that of the latter is 15 with an estimate of more than Y.40,530,000, making the aggregate more than Y.65,-240,000. The completion of the remaining will have to be postponed for some period on account of the earthquake. We, however, expect the whole lines planned will be completed and opened for traffic in ten years or so.

As most of the lines now under construction are in mountainous regions and country districts, we must bore many tunnels and consequently encounter many difficulties in pushing our works. The number of tunnels which are more than 2,000-ft. in length on those lines under construction is 24, totaling 154,900-ft.; and that of bridges now under construction is 74, totaling 33,600-ft. in length.



The New Edo Bashi in Tokyo



Multiple Unit Train Standing at Tokyo Central Station

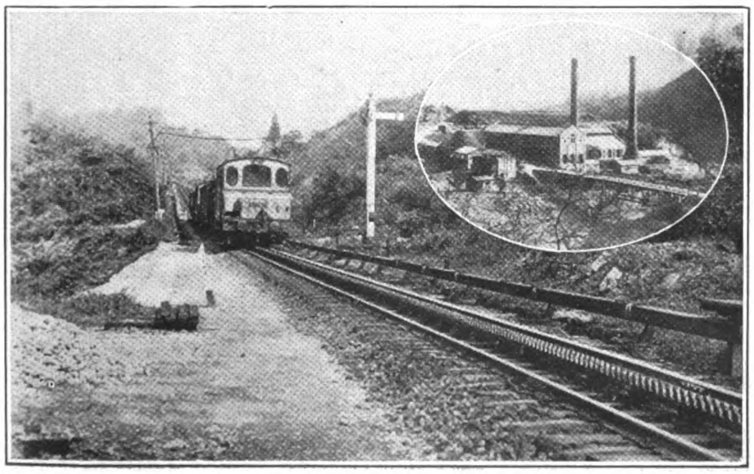
Japan's Railway Electrification Program

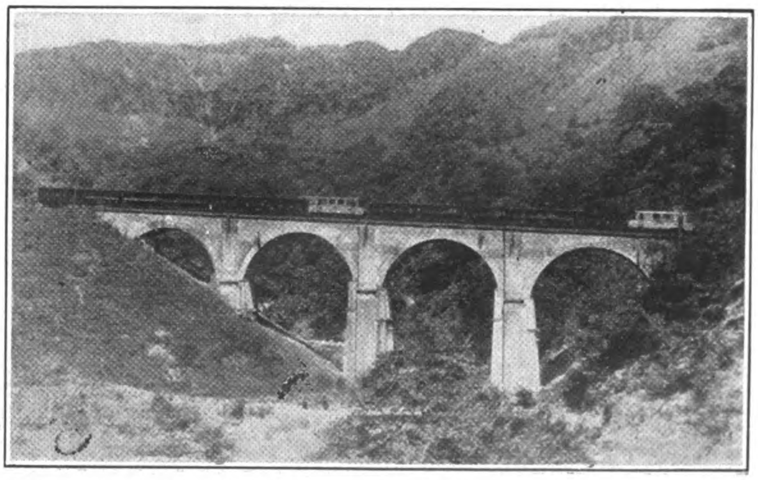
A Huge Scheme Held Up Awaiting Adequate Power Development

THE vast program of electrifying the State railways of Japan has received a temporary set-back owing to the attitude of Dr. Senjoku, the new Minister of Railways, who holds the belief that the supply of electric power is inadequate to insure steady and efficient operation of the train services. Although heartily approving the completion of the program for electrifying the Tokyo district and those sections of the main line on which work has been commenced, in order to show the public how valuable the electric train service can be made if properly managed and supplied at all times with an adequate amount of power, the new Minister is opposed to any extension of the scheme that will compromise the main Tokkaido line to the use of electricity until it can be demonstrated that ample power will be available for the uninterrupted operation of this vital artery of communication.

The problem which he has been called upon to face is one created by the long dry seasons in Japan, when the generating capacity of the waterpower plants is either materially curtailed or cut off altogether for lack of sufficient water. The necessity of an assured power supply to meet the rapidly increasing industrial demands and the more vital requirements of the railway electrification scheme can only be met by creating enormous impounding reservoirs in the mountain districts, or by erecting steam generating plants near the center of demand. The cost per kilowatt to install and equip a high-power hydro-electric station in Japan with its long-distance transmission lines, sub-stations and other requirements, ranges from Y.600 to Y.1,200, while that for steam generating plants erected at strategic centers in the industrial districts is about Y.150 per kilowatt.

As a consequence of these mounting costs for hydro-electric installations and the equally large sums required to build the storage reservoirs that will guarantee their continuous operation the year round, there is a growing tendency to regard the centrally located steam plant as the more dependable source of power for such enterprises like the State railways, where any suspension of the service would seriously menace the economical life of the nation. These considerations seemed weighty enough to influence Dr. Sengoku to call a halt to the electrification program in order to make certain





Over the Usui Pass: The First Electrified Railway Line in Japan

Train Approaching a Station. (Inset) Steam Power Plant at Yokogawa

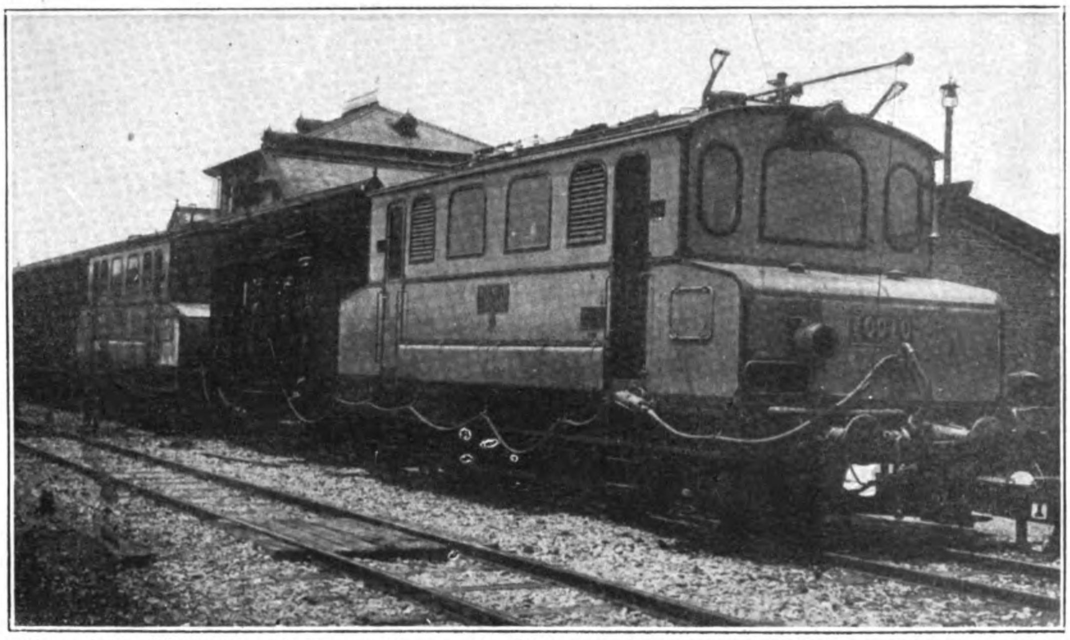
Crossing a Valley

in advance that nothing would occur to interfere with the steady operation of the railways.

This decision threw a wet blanket over the hopes of the hydro-electric power companies and has spurred them to renewed activities to increase their water-power output and erect steam-power reserve plants of such capacity as will meet at all times the demand for current. Desiring to be independent as far as possible of the private power producers, the railway authorities obtained water rights on the Shinano River and approved the plans for the erection at that point of a 160,000-kilowatt power station, the power to be transmitted to sub-stations and there transformed to 1,500 volt direct current for the operation of the various sections of the main Tokkaido railway. Considerable progress had been made in preparing the site for the erection of the plant when the order was issued to suspend further construction. This was influenced by the uncertainty surrounding the storage capacity of the ponds on which the plant would be dependent for a continuous supply of power. This and other considerations will determine whether two plants of 80,000 k.w. each, or a single plant of 160,000 k.w., will be erected.

However, these set-backs appear to be only temporary, as the larger power producers, like the Tokyo, Daido, Toho and their subsidiaries, are forging ahead with plans for the erection of several large steam plants to meet the demand for power. The day is not far distant when electrification of the main railways can be taken up anew and pushed forward to completion with the full assurance that power in ample quantity will never be lacking.

The first section of Japan's State Railways to be electrified was that part of the Shin-yetsu Line crossing the Usui Pass (one of the steepest in Japan), the highest point reaching 3,086-ft. above sea-level. This work was carried out in 1912, and covers that part of the line between Yokogawa and Karuizawa, where the difference in level is 1,817-ft. in seven miles, a gradient of 6.7 per cent. No less than 26 tunnels, aggregating 2.8 miles in length, had to be driven in this short distance, and for a matter of 5.2 miles the rack rail system had to be applied.



One of the A.E.G. Electric Locomotives on the Yokogawa-Karuizawa Section of the Shin-yetsu Line

Power for this section is derived from a steam power plant erected at Yokogawa, equipped with three 1,000 k.w. General Electric (U.S.A.) turbo generators which furnish current at 6,600 volts 25 cycles. Two sub-stations, located at the highest and lowest points of the line, transform the current to 240 volts, 6-phase, and two 450 k.w. rotary converters convert it to 650 volts direct current. They are also equipped with 312 storage batteries having a capacity of 1,320 ampere hours, designed to buffer the fluctuations of the load in connection with a k.w. 100 Pirelli automatic reversible booster.

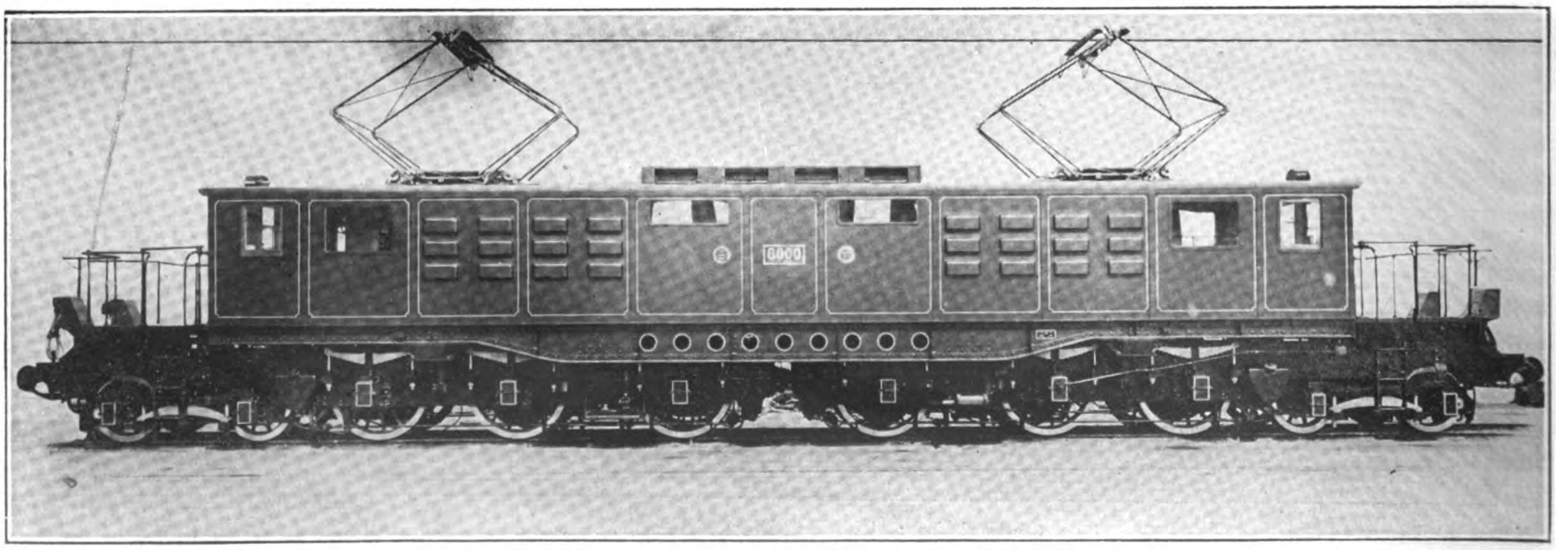
The rack locomotives, made by the A. E. G. of Berlin, weigh 42½ tons each and are capable of drawing eight cars at 11 miles per hour up the 6.7 per cent. grade. Each locomotive is equipped with two 330 h.p. direct current motors. Several similar electric locomotives were subsequently built for this service at the Oimachi shops of the Government Railways.

From this initial step towards electrification to the present day, many plans for the expansion of electric operation have been presented and discarded until a definite scheme received approval and was partially carried out when held up because of the uncertainty of acquiring a steady supply of power.

The history of the decision to make the change from steam to electricity is interesting. Far-sighted engineers and officials of the Imperial Government Railways sought to find a way to increase the traffic facilities and to reduce the cost of operation to take care of the ever-increasing traffic which obviously would be, within the period of a few years, beyond the capacity of the available equipment.

The capacity of Japanese railways is limited greatly by the narrow 42-in. gauge which had been adopted as standard. One of the most natural changes to consider was the widening of this gauge to 4-ft. 8½-in. or even 5-ft.

This change was advocated very strongly by one group of engineers, but it was found to be an almost impossible and extremely costly undertaking. Besides the actual increasing of the distance



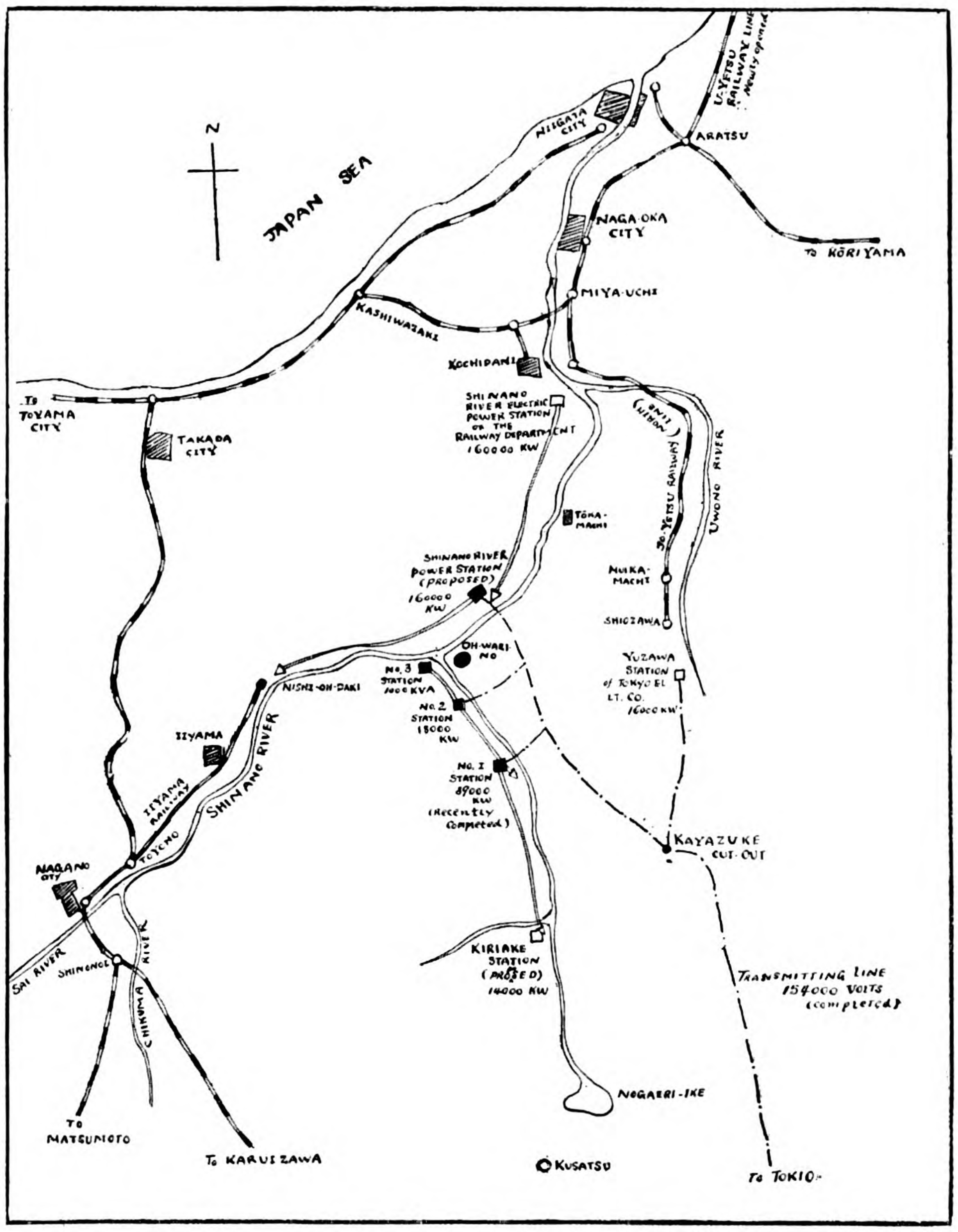
One of the 100-ton English Electric Locomotives for the Imperial Japanese Railways

between the rails, this change would involve the widening of tunnels and of all right-of-way, changing bridges, stations, and, most important of all, the discarding or altering of all rolling stock. Furthermore, the period of transition, which would of necessity be of long duration, would so upset the movement of trains as practically to paralyze business.

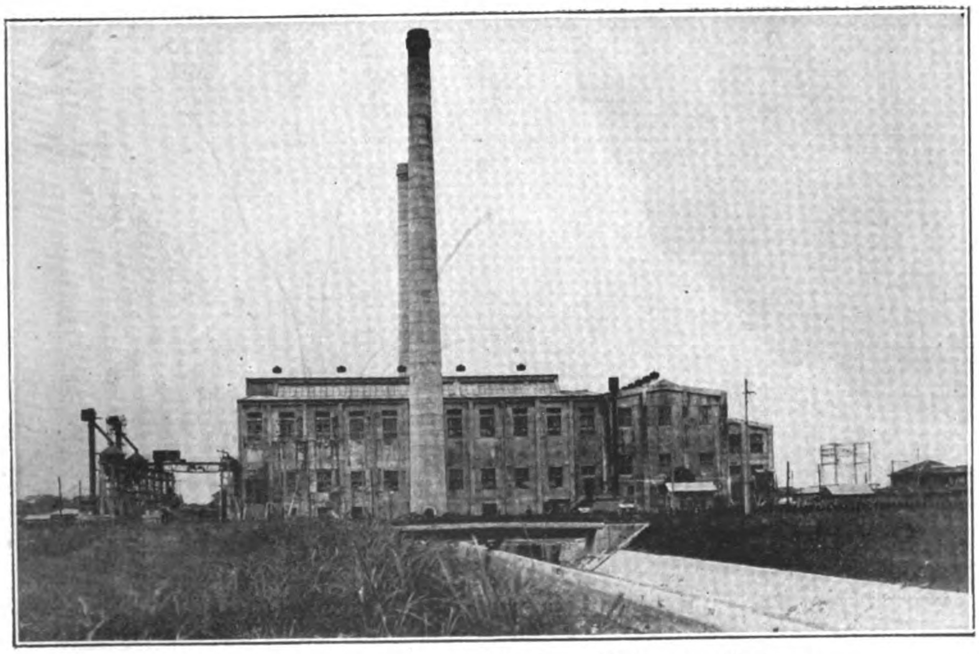
The electrification of railroads in other parts of the world and the glowing reports of their success drew the interest of these engineers, and an American engineer, Mr. H. K. Smith, of the Westinghouse Electric and Manufacturing Co. (U.S.A.), who had been actively associated with many of the extensive developments in the United States, was engaged as consulting engineer for the Imperial Government Railways. He studied the matter of electrification and made complete and detailed recommendations for equipment adequate to handle the prospective growth in traffic for many years in the future.

A systematic plan covering a number of years was laid out which, with one or two exceptions, has been followed. This plan consisted roughly and briefly in the purchase of a few experimental locomotives which could be tested, inspected and used as a basis of study. After having these concrete examples, definite and unbiassed decisions could be reached covering the requirements for future needs. At this point an order was placed with the English Electric Company for 36 locomotives and other orders for sub-station equipment placed with various manufacturers. Progress of the electrification plans was materially checked by the earthquake of 1923, which caused such damage to the railway property that all attention was centered on rehabilitation. However, the culmination of all these plans has been the ordering of light passenger locomotives and a large amount of sub-station apparatus with automatic switching equipment from the Westinghouse Electric and Manufacturing Co., four freight locomotive and other important equipment from the General Electric Co., and two local passenger locomotives and sub-station appliances from the Brown-Boverie Co.

The scheme for electrifying the railways follows the normal development of the metropolitan transportation lines, starting with the



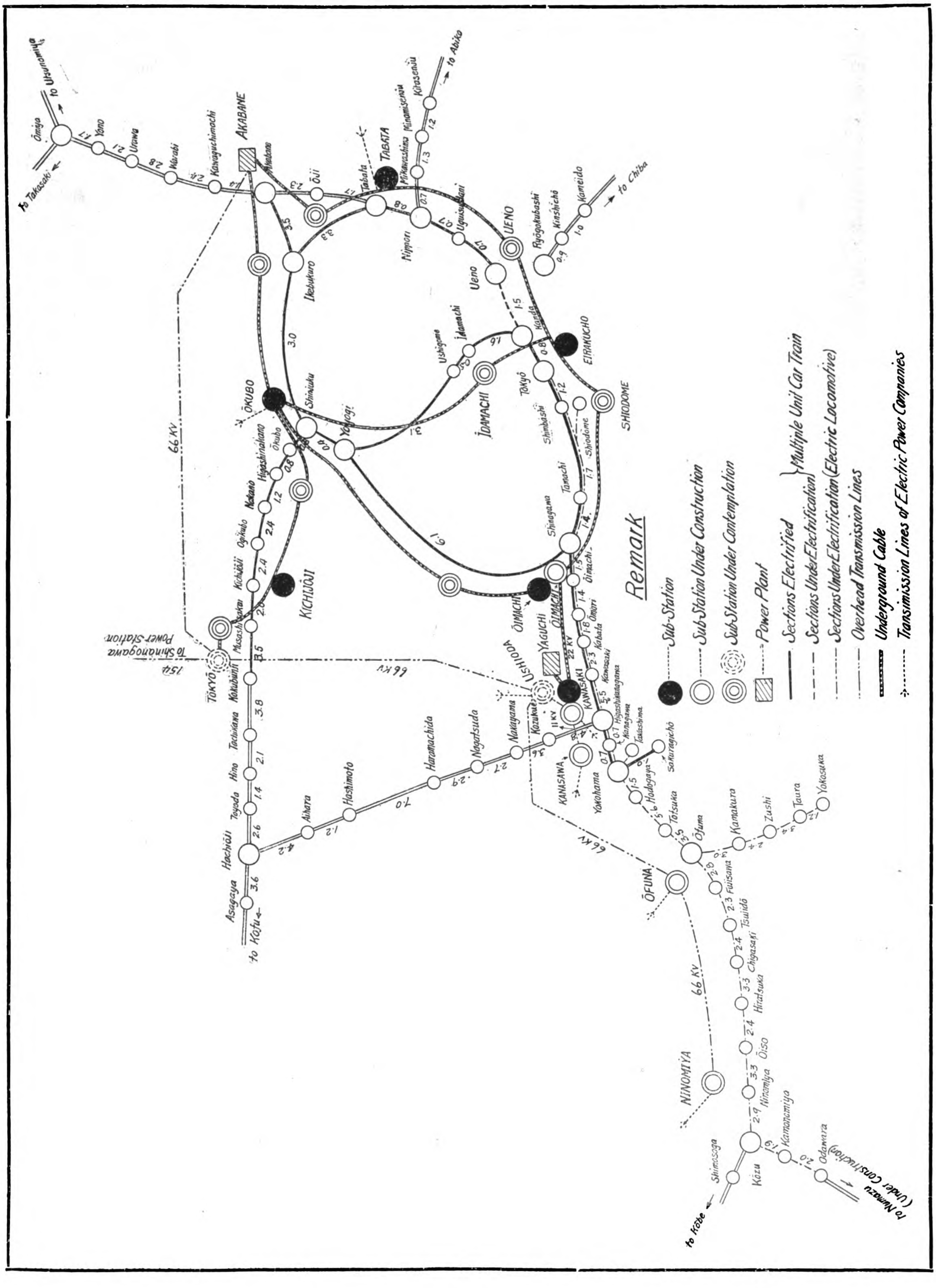
Map of the Shinano and Nakatsu River District, showing the Power-house Sites of the Shinyetsu Electric Power Company feeding into the Joetsu Tramsmission Line of the Tokyo Electric Light Company, and the Site for the projected 160.000 k.w. Power Plant for the Imperial Japanese Railways.



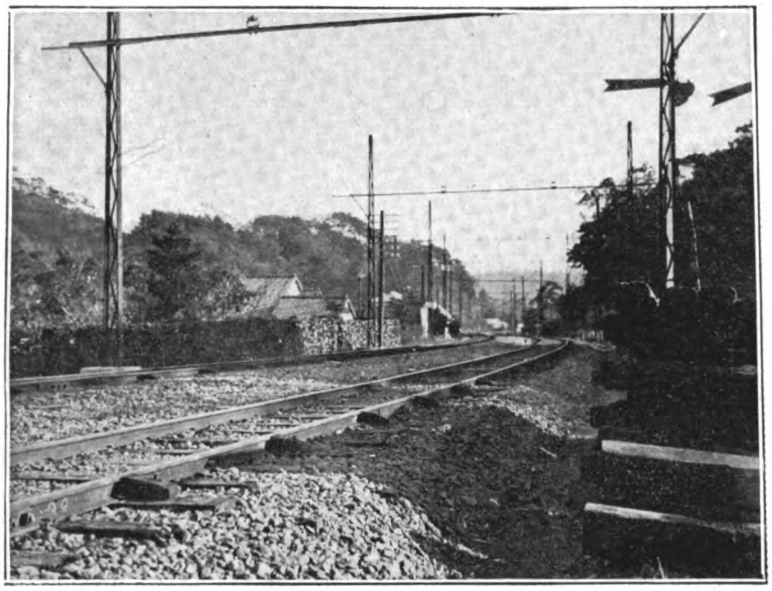
Akabane Steam Power Plant of the Imperial Japanese Railways

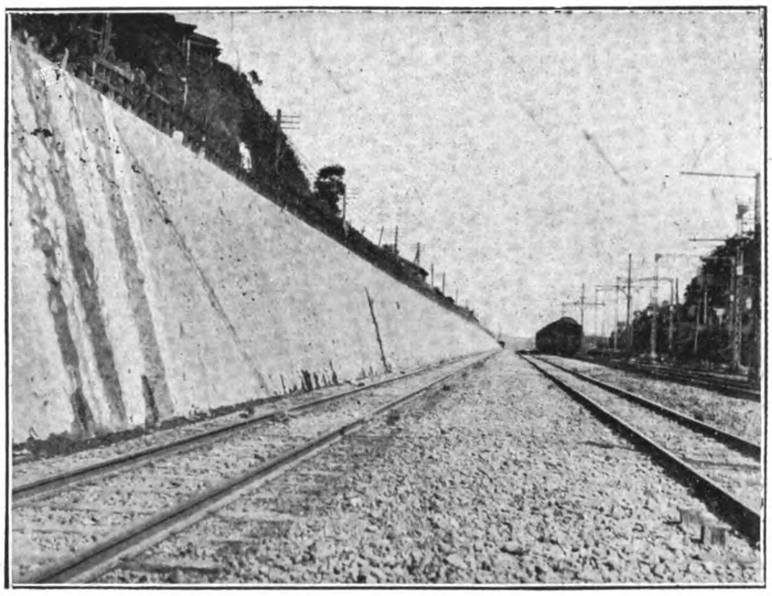
defunct Kobu Railway, which in 1905 electrified the city portion of its line from Manseibashi to Nakana, a distance of eight miles. The railway authorities, in order to cope with the rapidly increasing transportation needs of the metropolis, then took up the investigation of electrification and applied it to the Yamate and Tokyo-Yokohama lines. The Yamate line, so-called, is that part of the State railway service which branches off the main Tokaido line at Shinagawa and encircles the city of Tokyo, bifurcating at Ikebukuro, one branch leading to Uyeno and the other proceeding to Akabane, 6.2 miles north of Uyeno. This belt line, constituting the present rapid transit system for the capital, is carried for the most part on elevated tracks.

The line between Tokyo and Yokohama was then electrified and a new double track laid alongside the existing steam lines. This work was completed in May 1915, and the plans then extended to electrify the main Tokaido line as far as Odawara, with a branch from Ofuna to Yokosuka. Since then, other extensions have been added, so that at the present time (July 1925)



Map Showing the Electrification Scheme of the Imperial Japanese Government Railways in the Tokyo-Yokohama District.





Road Bed and Overhead Construction

Ofuna-Yokosuka Section, near Kamakura

Between Higashi Kanagawa and Kanagawa

the following sections of the urban and inter-urban lines of Tokyo are being operated with four and five-car electric trains hauled by motor cars:

Tokyo-Sakuragicho (Yokohama)	19.2 miles
Shinagawa-Uyeno	15.00 ,,
Ikebukuro-Akabane	3.5 ,,
Tokyo-Kokubunji	19.5 ,,
Total	57.2 miles

During the rush hours of morning and evening, multiple unit car trains, each composed of five bogie cars, are run at intervals of three minutes, with a maximum speed of 54 miles per hour or a schedule speed of 24.5 miles per hour.

The power required for operating these State-owned electric lines in the Tokyo district is derived from two Government plants, one at Yaguchi and the other at Akabane, supplying a total of 24,000 k.w. In the event outside power is necessary, it is purchased from the Tokyo Electric Light Company and the Tokyo Municipal Electric Bureau.

The Yaguchi Power Plant, of 6,000 k.w. capacity, is located about half-way between Tokyo and Yokohama, about a mile off the railway, and is the only gas producer power station in Japan. The generators, four in number, are from the English Electric Company, each 1,500 k.v.a., 3-phase, 11,000 volts, 25 cycles, 94 r.p.m. direct connected to four Lilleshall gas engines capable of developing 2,163 effective h.p. Gas is supplied from four sets of Mond gas producers with ammonium sulphate recovery apparatus.

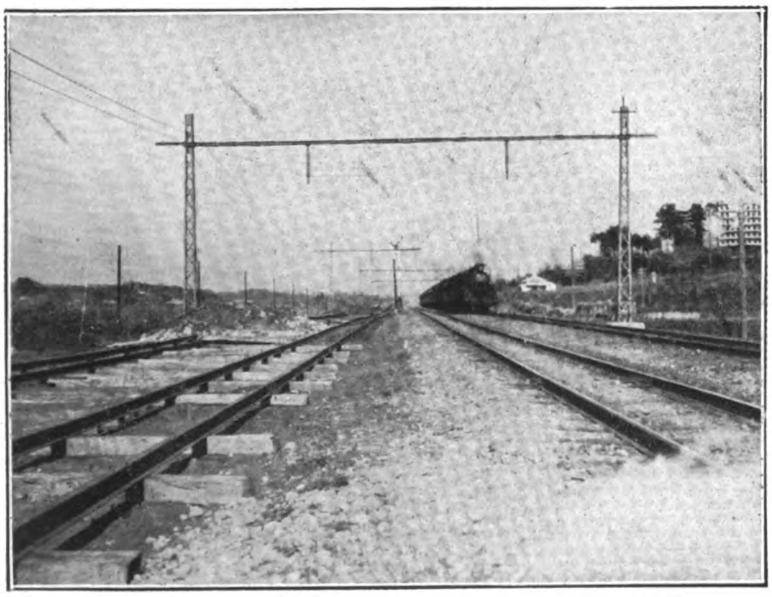
The Akabane Power Station, located to the north of Tokyo, has a total capacity of 18,000 k.w. and is equipped with three Westinghouse 6,000 k.w. turbines and Babcock and Wilcox boilers.

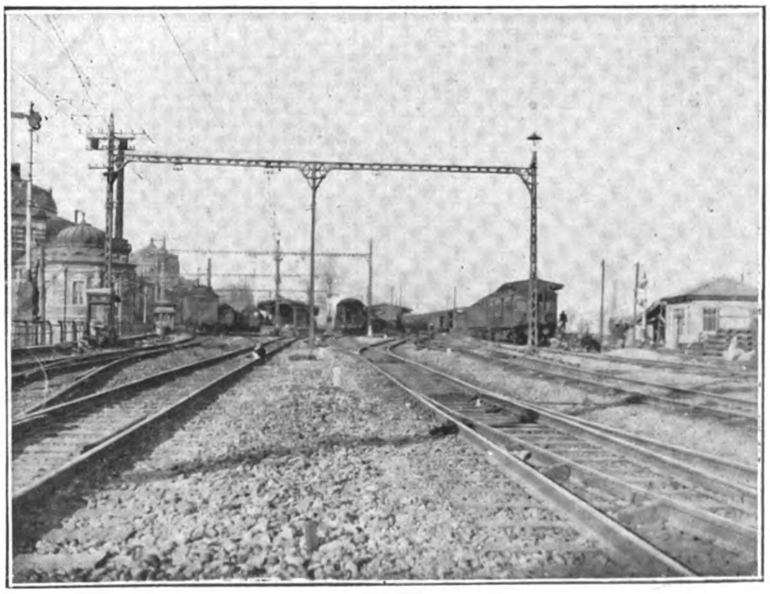
The 11,000 volt high pressure transmission between power stations and sub-stations is carried by underground cables.

The next step on the part of the railway authorities was to extend the electrification to the main Tokaido Line running between Tokyo and Kobe. This is a distance of 353.2 miles by rail, and serves the most important commercial, industrial and agricultural sections.

The first phase of this plan will be the electric operation from Tokyo to Odawara, to be completed by the summer of this year, at first by the operation of all local passenger trains and later to include all train movements in this zone. This will also include the branch line from Ofuna to Yokosuka, a distance of 10 miles. Multiple unit trains will be used as at present between Tokyo and Yokohama.

The mainTokaido line is double track throughout, well ballasted, and in excellent state of repair. The track is 42 in., a gauge that has required the construction of much new electrical equipment. The Tokaido steam line is supplemented between Tokyo and Yokohama by the double track electric line on which high speed multiple unit trains have been operated at 1,200 volts since 1914. The new electrification will all be at 1,500 volts D.C., and the present installations will be changed over accordingly.

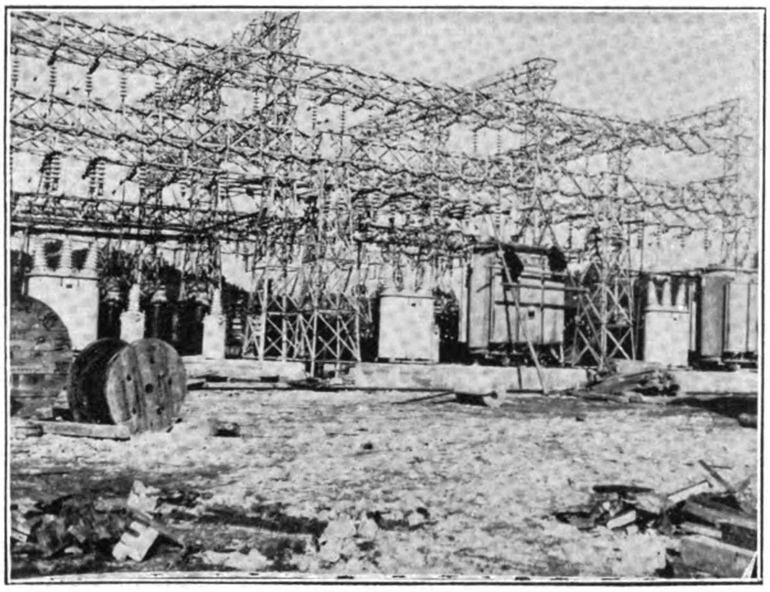
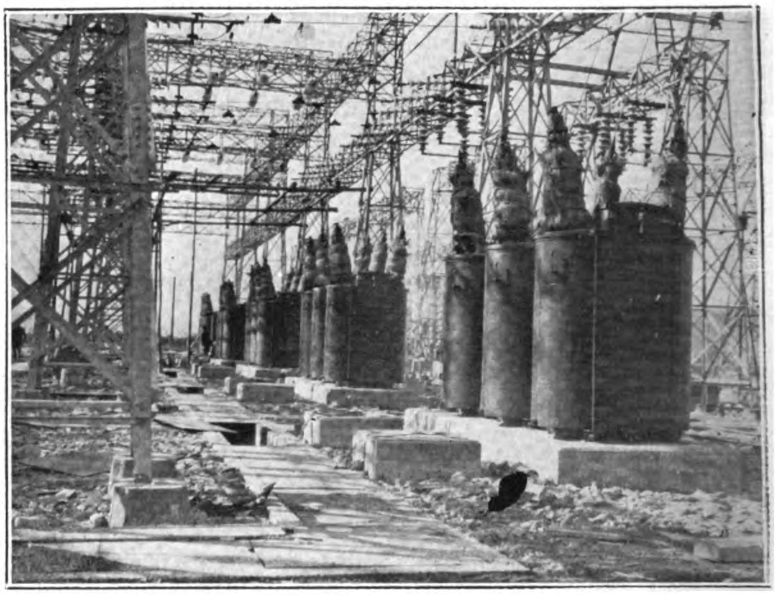




Road Bed and Overhead Construction

Between Totsuka and Ofuna

Entering Tokyo Central Station

Ofuna Transformer Station

A very important part of this electrification plan is the rejuvenation of the local belt line service of the Government railways around Tokyo. Until early this year this entire loop system had been operated at 600 volts D.C. There is now under way, however, a transition which will ultimately place all of these lines in 1,500 volt operation. The transition is being carried out as follows:

All new motor equipments are being purchased for 1,500 volt operation. The old 1,200 volt cars which were in operation between Tokyo and Yokohama are arranged for full speed operation on both 1,200 volts and 600 volts. These cars were transferred to operation on the belt line from Tokyo Station to Shinagawa to Uyeno, which was changed to 1,200 volts. The cars which were formerly in service on all the belt lines at 600 volts only were transferred to the cross city line between Tokyo, Shinjuku and Kokubunji.

This is the present status of operation. When the Tokaido line is opened for electrical operation at 1,500 volts the Tokyo-Yokohama line will also be changed to 1,500 volts. At such time as the condition of the old 600-1,200 volt and 600-volt cars will warrant their being discarded, the entire system will be changed to 1,500 volt operation. This scheme of transition will make it possible to use all of the present equipment to the full extent of its usefulness, and will eventually secure a homogeneous and unified system.

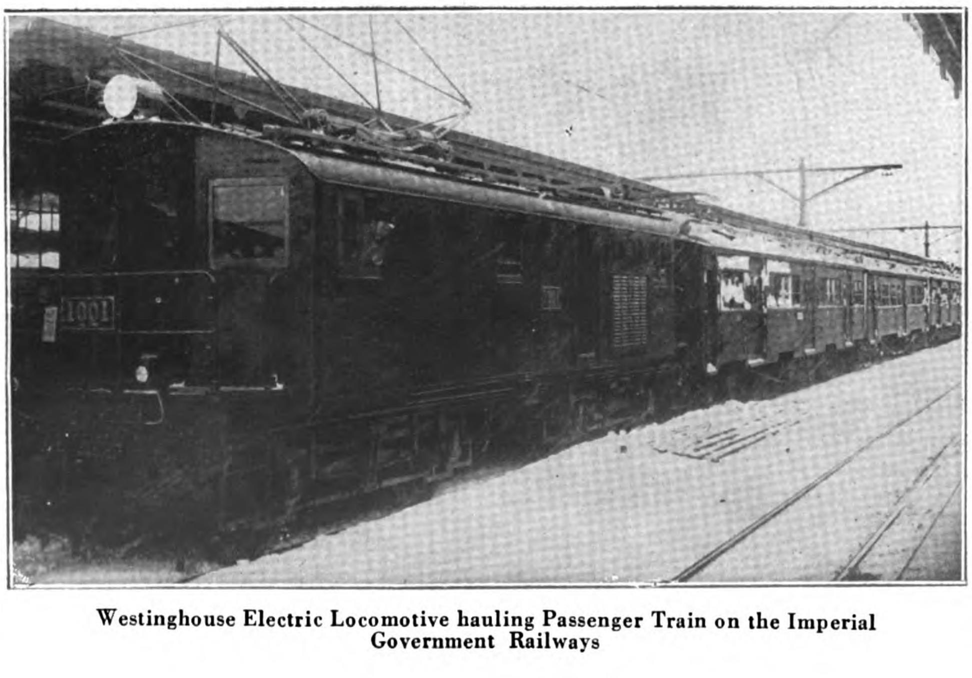
The extension of the electrification between Tokyo andOdawara, 52.1 miles, and the ten-mile Ofuna-Yokosuka branch adds another 62.1 miles to the 57 already in operation. This work was started in August 1922 and is scheduled to be completed in June of this year. To provide for this expansion, the Government proposes to increase its own power supply by the erection of a new 50,000, k.w. steam plant to be located at some suitable point along the Tokyo-Yokohama section. The plans for this station have been prepared, but tenders have been postponed in accordance with the general retrenchment program for the present year.

For the first 57 miles of electrified sections, six sub-stations had been erected at Tabata, Eirakucho, Okubo, Kichijoji, Oimachi and Kawasaki, but to meet the requirements of the new extension to Odawara and Yokosuka, eight new sub-stations are being constructed at Oimachi, Kawasaki, Kanagawa, Ofuna, Ninomiya, Uyeno, Iidamachi and Shiodome, with six more projected as shown on the map accompanying this article. The greater part of this machinery has already been ordered and installed. The total capacity of all these sub-stations is as follows:

Eirakucho, 6,000 k.w.: Shiodome, 8,000 k.w.: Oimachi, 6,000: New Oimachi, 8,800: Okubo, 6,000: Uyeno, 6,000: Tabata, 4,000: Iidamachi, 6,000: Kichijoji, 2,000: Kawasaki, 3,000: New Kawasaki, 8,000: Kanagawa, 8,000: Ofuna, 8,000; and Ninomiya, 6,000, a total of 85,800 kilowatts. In addition to this, another station of 4,000 k.w. capacity is to be installed at Yugawara, on the Atami cut-off. The equipment for this station has been ordered from the Westinghouse Electric and Manufacturing Co.

The equipment of five of these new sub-stations is as follows:

Oimachi: Capacity 8,800 k.w.; receiving voltage, 11,000, 50 cycles. Five Westinghouse 1,000 k.w. 6-phase compound wound rotary converters operating at 750 r.p.m. and delivering current at 750 volts, with two Westinghouse 2,100 k.v.a. transformers, three phase delta connected in the primary winding and six phase diametrical connections in the secondary. The primary voltage is 11,000 and secondary 530. There are also six 800 k.w. Brown-Boveri mercury rectifiers with 1,500 d.c. voltage output, receiving power from three 2,000 k.v.a. transformers, three phase with connections in the primary and double-six phase and double Y connections in the secondary. The primary voltage is 22,000 and 11,000, and the secondary is 1,370 and 1,090. This station was completed in April 1925.



Westinghouse Electric Locomotive hauling Passenger Train on the Imperial Government Railways

Kawasaki: Of the sub-stations erected to supply trolley power perhaps the most important—owing to its capacity and location—is that situated at Kawasaki. Building operations were actually commenced early in 1923, but, being situated in the earthquake zone, it suffered very considerable structural damage, as did all other constructional work during that eventful period.

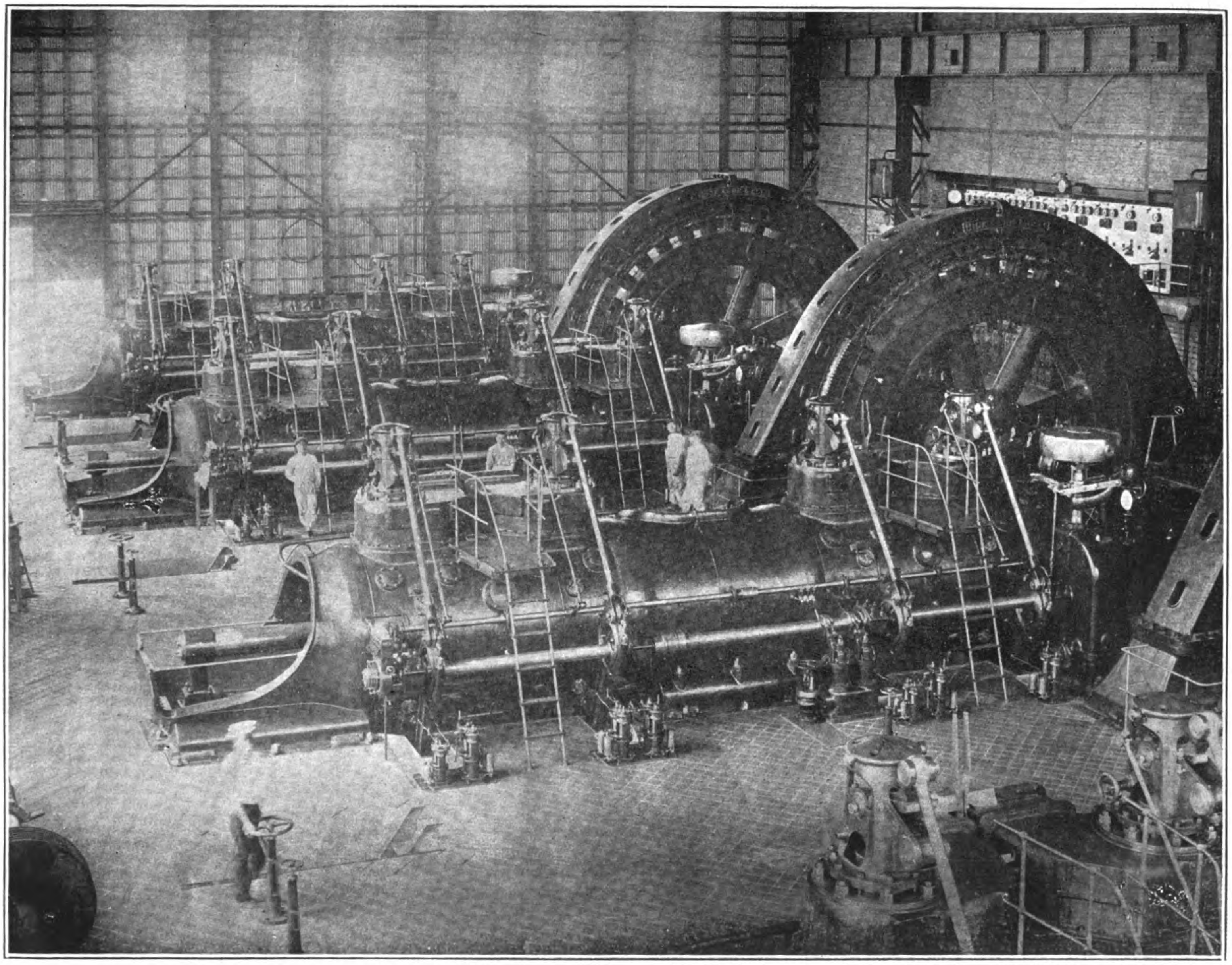
The Kawasaki sub-station will supply power at a direct current pressure of 1,500 volts to the

Tokyo end of the main line, and accordingly will be of primary importance owing to the very heavy passenger and freight traffic in that zone. The incoming 3 phase 50 cycle supply for this sub-station is obtained from the Tokyo Electric Light Company at a pressure of 66,000 volts. This is stepped down to a pressure of 11,000 volts by means of a bank of single phase outdoor transformers of Hitachi manufacture, together with the necessary outdoor oil circuit breakers, isolators and structural steelwork for supporting same. The transformers are of the water cooled type, each designed for a continuous output of 3,000 k.v.a. Owing to the lack of water, elaborate and efficient arrangements have been made for circulating cooling water by means of specially constructed concrete cooling ponds located near the building property.

departure from usual practice, and the starting operation is greatly facilitated thereby.

Four indoor type O.I.S.C. transformers—also manufactured by the above company—supply power at the requisite voltage to the above rotary converters. Each transformer is rated at 2,200 k.v.a. and steps down from a voltage of 11,000 volts. They are of the double wound secondary type, each to feed a series pair of 1,000 k.w. rotary converters.

Both the E.H.T. and D.C. switch-gear installed is of English Electric manufacture and consists of two incoming feeders and four transformer remote electrically controlled equipments mounted in very substantially constructed stonework cubicles. Each oil circuit breaker is capable of a rupturing capacity of 200,000 k.v.a. with the



Interior of Yaguchi Power Station of the Imperial Government Railway, showing Two of Four Sets of Dick Kerr (English Electric Co.) Alternators, 1,500 K.V.A. each, 3 phase, 25 cycles, 11,000 volts, driven by Lilleshall Gas Engines

Arrangements have been made for an additional incoming feeder to be installed at some future date when necessity arises.

The sub-station proper is equipped with rotary converter plant of the latest design and is capable of giving a continuous output of 8,000 k.w., with a peak of 24,000 k.w. momentarily.

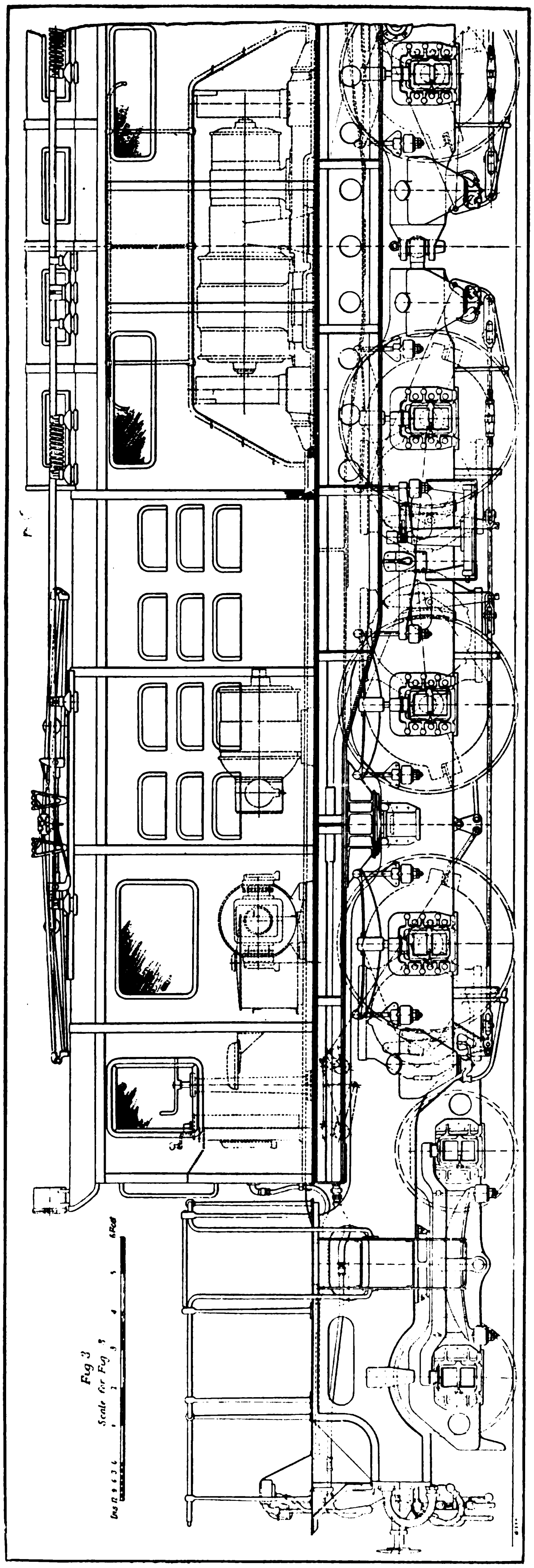
Installed therein are eight rotary converters of English Electric manufacture, each designed to give 1,000 k.w. at 750 volts and running at a synchronous speed of 750 r.p.m. They are arranged to run in series of pairs, each pair supplying 2,000 k.w. at 1,500 volts D.C. The design of these machines conforms with the English Electric Company's standard practice, each being fitted with roller bearings and arranged for self-starting without the aid of brush lifting or field splitting devices. The above is somewhat of a

solenoid operating gear mounted in front of each circuit-breaker cubicle.

The A.C. and D.C. switchboards are arranged in a gallery overlooking the rotary converters, a view of the latter board being illustrated on page 417.

As will be seen, the D.C. switchboard consists of 14 panels in all, *viz.* four rotary, one negative isolating, one total output and eight 2,000 k.w. feeder panels. A point of particular interest is that all the instruments are mounted on porcelain insulators behind each panel, being viewed through holes cut in same.

The isolating switches and circuit-breakers are remote mechanically controlled, the latter being of the magnetic blow-out type and mounted well behind each control panel.



Half Section of 1,800 H.P. 4-6-6-4 Type English Electric Locomotive for the Imperial Japanese Railways

Past experience has shown that it is policy to house important electrical apparatus in earthquake-proof buildings as far as it is possible to do so, and the Kawasaki sub-station has been constructed throughout on exceedingly strong lines. Economy has not been overlooked, inasmuch as old disued track rails have been utilised for the switch gallery and other interior structural work, as can be clearly seen from the views contained herein.

Kanagawa: Capacity, 8,000 k.w.; receiving voltage, 11,000, 50 cycles. This station has eight 1,000 k.w. 6-phase compound rotary converters, 750 r.p.m., delivering direct current at 750 volts. The transformers, four in number, are of 2,100 k.v.a. 3-phase delta connected in the primary and 6-phase diametrical connections in the secondary winding. The primary voltages are 11,000, 10,500 and 10,000, with 530 volts in the secondary. In addition, automatic switching apparatus is installed and all the equipment is from the Westinghouse Electric International Company.

Ofuna: Capacity, 8,000 k.w.; receiving voltage, 66,000, 50 cycles. This station has four 2,000 k.w. Bruce, Peebles motor converters and four 2,500 k.v.a. Mitsubishi Electric and Manufacturing Company transformers, three-phase delta connected in the primary and six-phase delta connected in the secondary winding. The primary voltage is 66,000, and 6,600 in the secondary. This station was also completed in April 1925.

Oimachi: The old station capacity is 6,000 k.w., receiving voltage 11,000, 50 cycles, equipped with six Shibaura 1,000 k.w. six-phase compound wound rotary converters operating at 750 r.p.m., delivering current at 600 volts and insulated for 1,200. The new Oimachi station's capacity is 4,000 k.w., receiving voltage 11,000, 50 cycles, equipped with four 1,000 k.w. six-phase compound wound Westinghouse rotary converters operating at 750 r.p.m., and delivering current at 750 volts, insulated for 1,500 volts into two 2,100 k.v.a. transformers, three-phase delta connected in the primary and six-phase diametric in the secondary, with Westinghouse automatic switching equipment. Six 800 k.w. Brown-Boveri mercury rectifiers will also be installed in this station.

Shiodome: This station is to be located near the main terminal of the railway in Tokyo. Capacity, 8,000 k.w.,; receiving voltage, 11,000/22,000, 50 cycles. It will be equipped with eight Westinghouse 1,000 k.w. synchronous converters shunt wound, 750 r.p.m., delivering current at 750 volts, with four 2,100 k.v.a. transformers, three-phase delta connected in the primary and six-phase diametric in the secondary. This station will have Westinghouse automatic switching equipment, and later increased to a total of 12,000 k.w.

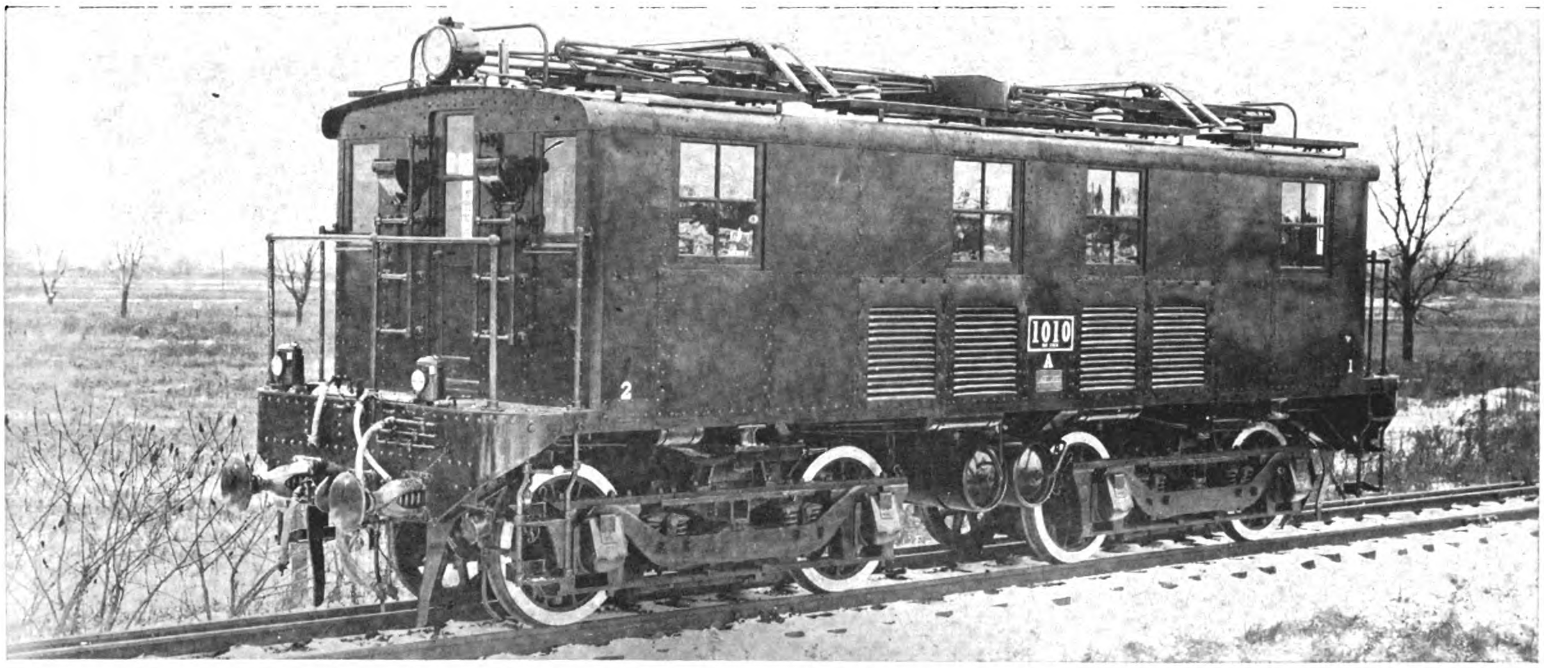
Iidamachi and Uyeno: Capacity of each of these stations is 6,000 k.w., equipped the same as the Shiodome station. Iidamachi is, however, unusual, in that it is designed to operate automatically at a trolley voltage of 600, 1,200 or 1,500 volts D.C.

Yugawara: This is the last station at the end of the present electrified line beyond Odawara. The capacity is 4,000 k.w.; receiving voltage, 66,000, 50 cycle. Two Westinghouse 2,000 k.w., 375 r.p.m. synchronous motor generating sets, generating 1,500 volts D.C. on a single commutator, will be installed. Also two 2,500 k.v.a. three-phase transformers step the supply voltage of 66,000 down to 2,300 for the motor of the motor generator set. Automatic Westinghouse switching equipment will control this station, and provision is made to handle regeneration from the locomotives operating on the heavy grade on which this station is located.

Ninomiya: Capacity, 6,000 k.w.; receiving voltage, 66,000, 50 cycles. The equipment is a duplicate of the Ofuna station and was completed in April last.

Automatic switching equipment has been installed in six of these new sub-stations in order to insure the continuity of service which is so essential to the successful operation of an electric railway. These installations represent the largest concentration of power in single sub-stations under automatic control in the world and their operation will be watched by electrical engineers from all countries.

Sub-station	No.	No. Mach.	Cap. Ea. k.w.	Type Switch-ing	Max. Oper. Volt.
Yeirakucho ..	1	6	1,000	Hand.	1,200
Kanda	2	1	1,000	Hand.	600
Tabata	3	3	1,000	Hand.	1,200
Okubo ..	4	3	1,000	Hand.	600
		4	1,000	Hand.	1,200
Kichijoji ..	5	2	500	Hand.	600



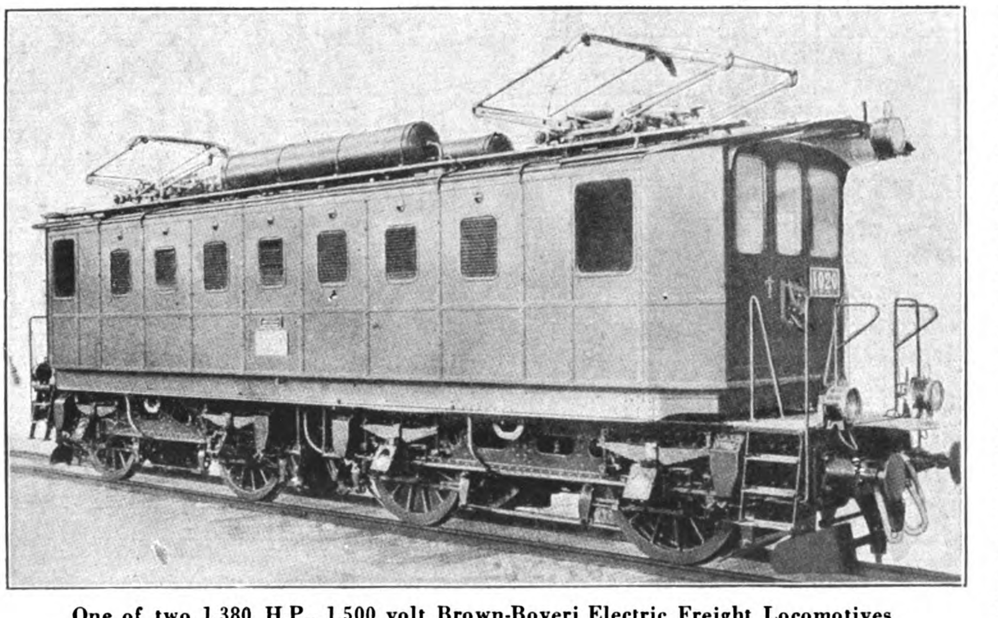
General Electric 600-1500 volt Locomotive for Imperial Japanese Railways

Sub-station	No.	No. Mach. Name	Cap. Ea. k.w.	Type Switching	Max. Oper. Volt.
Oimachi.. ..	6	6	1,000	Hand.	1,200
		4	1,000	Auto.	1,500
Kawasaki ..	7	6	1,000	Hand.	1,500
Kanagawa ..	8	8	1,000	Auto.	1,500
Shiodome ..	9	8	1,000	Auto.	1,500
Uyeno	10	6	1,000	Auto.	1,500
Iidamachi ..	11	6	1,000	Auto.	1,500
Ofuna	12	3	2,000	Hand.	1,500
Ninomiya ..	13	2	2,000	Hand.	1,500
Yugawara ..	14	2	2,000	Auto.	1,500

Connections between sub-stations is by overhead line or underground cable. For the Kawasaki-Ofuna-Ninomiya and the Kawasaki-Kanagawa sections, 66,000 and 11,000 volt overhead transmission lines are used, while a 22,000 volt underground cable connects the Kawasaki and Oimachi sub-stations. From the Akabane power station power is transmitted to Kawasaki sub-station by means of an overhead 66,000-volt line.

Trolley wire suspension is of the compound catenary system carrying a conductor of B.S4/0 grooved hard-drawn copper wire. The messenger wire is a steel cable 7 BWG No. 6 and the auxiliary messenger is a hard-drawn copper cable 19 B.S. No. 10. The side line is a single catenary system with 7/BWG No. 8 standard steel wire for messenger service.

Iron towers, spaced 80 metres apart, are in general use on the Tokyo-Yokohama and the Yokosuka sections, while on the other sections, wooden poles, spaced 40 metres apart, will be used on straight sections, with shorter distances on curves and straining points. The main line rails are double bonded with B 5-4/0 stranded copper wire.

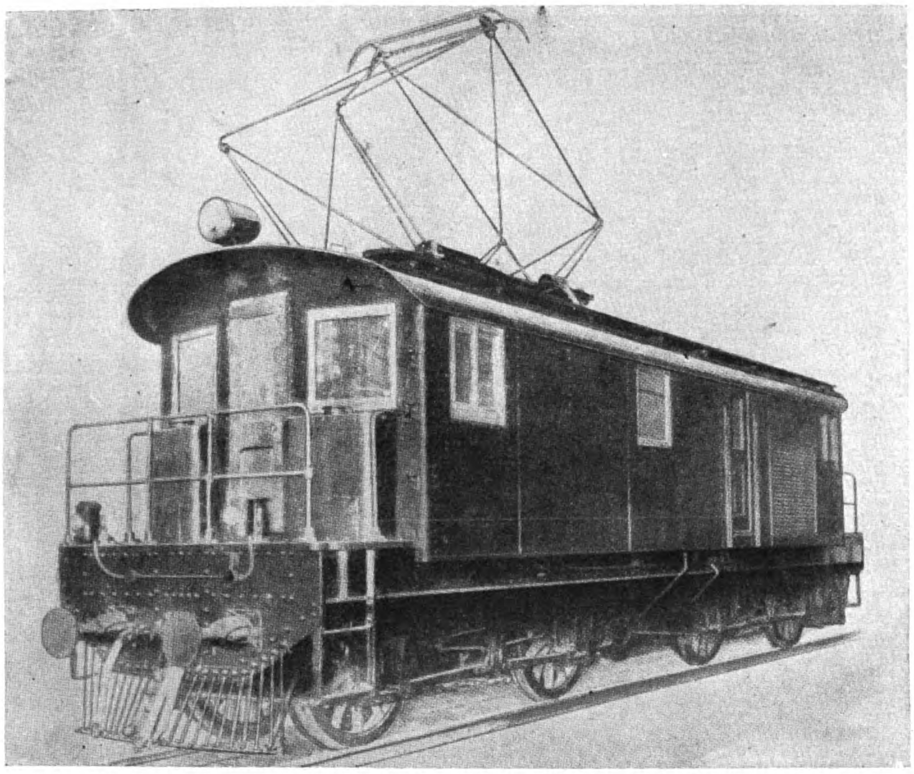


One of two 1,380 H.P., 1,500 volt Brown-Boveri Electric Freight Locomotives for the Imperial Japanese Railways

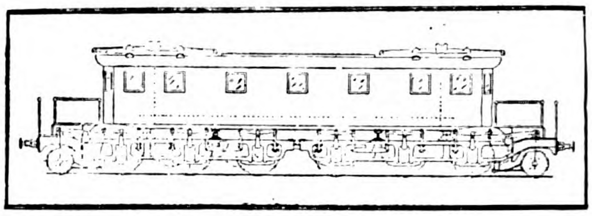
Fifty-six locomotives have been ordered from various makers for the service of the electrified sections and are to be placed in operation as soon as the new equipment is installed. Delivery of fourteen of these locomotives has been postponed until next year in order to meet the wishes of the Railway Board, whose appropriation was cut in order to carry out the present year's retrenchment program. In addition to the fifty-six locomotives actually ordered by the Railway Board, the Metropolitan Vickers Company of England have two locomotives in Japan awaiting trials for acceptance. The Hidachi Engineering Works, controlled by the Kuhara interests, one of the leading Japanese manufacturers of electrical machinery, has also turned out at their own shops two locomotives that passed successfully trial running tests, and have been accepted by the railway authorities. This gives a total of 60 new electri locomotives ordered and available for carrying out the new electrification program. The Railway Board also owns 343 motor coaches and 265 trailer cars. The details of the fifty-six locomotives are given in the table at the end of this article.

Supplementing the present electrified sections between Tokyo and Odawara is the still more pretentious scheme, which received the approval of the Imperial Diet, extending the system to the main Tokaido. Line from Odawara to Akashi, the other side of Kobe. The lines approved by the Diet are :

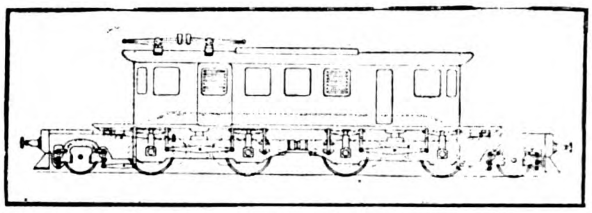
Odawara-Akashi	326.2	miles	(double track)
Uyeno-Omiya	16.6	,,	(four track)
Uyeno-Kanda	1.5	,,	,, ,,
Kokubunji-Hachioji	9.9	,,	double track
Manseibashi-Ryogokubashi	1.7	,,	,, ,,
Ryogokubashi-Chiba	22.7	,,	,, ,,
Joto Line (Osaka-Minatomachi) ..	8.9	,,	,, ,,
Katamachi Line (Katamachi-Shijonawate)	8.2	,,	single track



Two 60.5-ton Baldwin-Westinghouse Locomotives for the Imperial Japanese Railways



Two 105-ton, 1,500 volt D.C. Baldwin-Westinghouse Passenger Locomotives for the I.J.R.



Six 75-ton 1,500 volt D.C. Baldwin-Westinghouse Passenger Locomotives for the I.J.R.

Investigations and surveys are being carried out with the view of electrifying a further 3,000 miles of government railways, creating a network that will cover the main island. The execution of this plan will, however, be indefinitely postponed until the waterpower resources are developed to the point where ample power will be guaranteed at all seasons of the year.

General Electric Freight Locomotives for the Imperial Government Railways

The last order received by the General Electric Company (U.S.A.) for electric locomotives for the Imperial Government Railways of Japan covers four freight locomotives, similar in many respects to the two delivered in 1923 which have successfully passed the tests made by the engineers of the I. G. R. These new locoomtives are now being built in the Erie Works of the General Electric Company, and will be completed, tested, and shipped about December first of this year.

The principal data of these units are as follows :

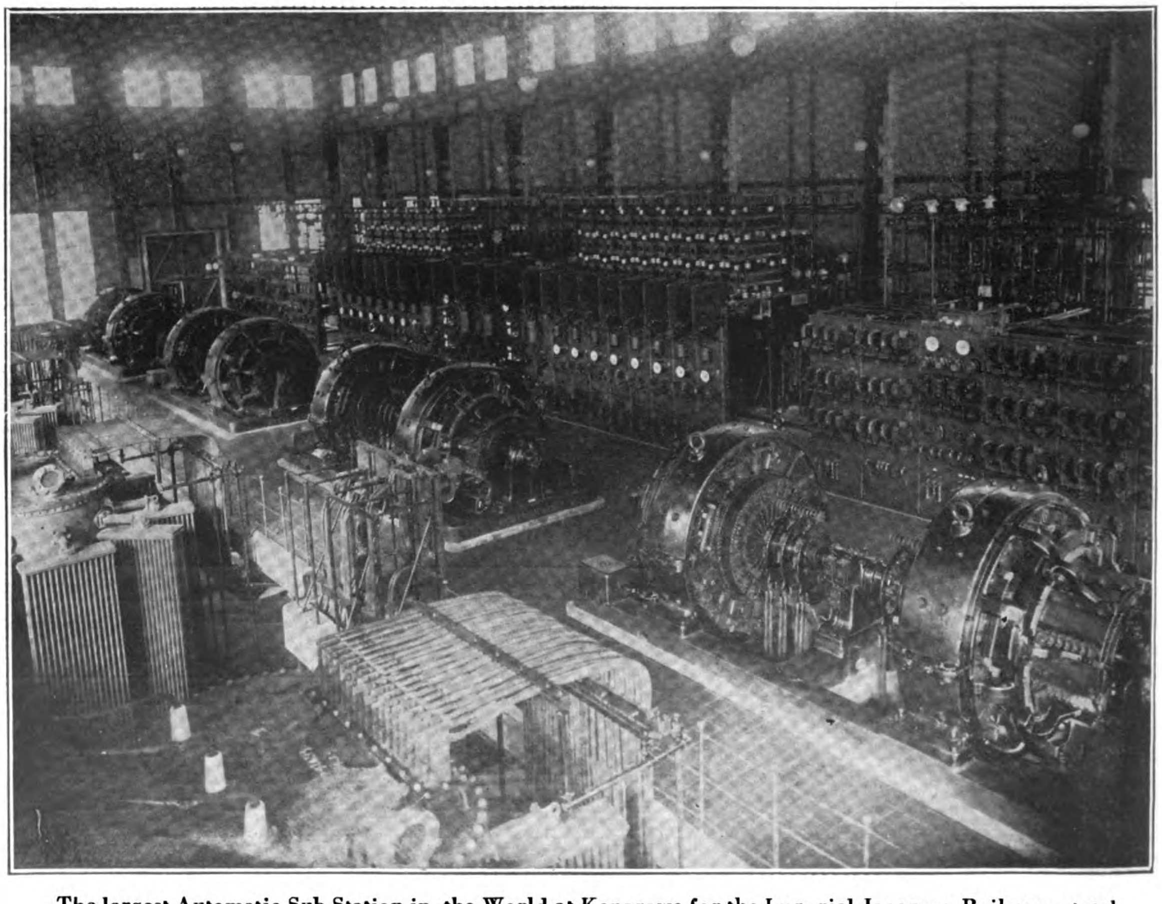
Trolley voltage ..	1,500 volts
Track gauge ..	1,067 m.m.
Length over cab	8,839 m.m.
Rigid wheel base	2,641 m.m.
Height over pantograph retracted	3,910 m.m.
Total weight, all on drivers ..	60,000 kg.
Type	0-4-4-0

The locomotives have two two-axle aticulated trucks, with one geared motor for each axle and a single cab carried on center plates on the trucks. The tractive effort available for 6½ minutes based on 30 per cent. adhesion is 18,000 kg.; with full field, and 1,500 volts at the trolley; a tractive effort of 7,100 kg. at a speed of 39.7 km. per hour will be obtained continuously with blowers operating under the same conditions; with 1,350 volts on the trolley, 7,100 kg. tractive effort will be obtained at a speed of 35.7 miles per hour.

Provision has been made for field tapping so that higher speeds may be obtained on straight level track. With 52 per cent. field strength the continuous blown rating, with 1,500 volts trolley potential, is 7,320 kg. tractive effort at 48 km. per hour.

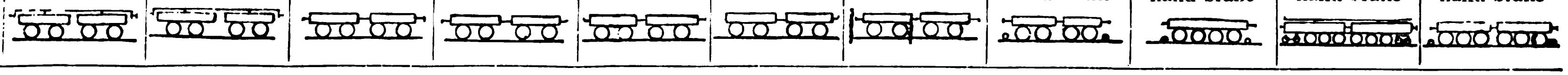
The maximum safe speed limited by the construction of the locomotive is 75 km. per hour, but since the limiting speed for freight trains is considerably below this, ample margin has been provided.

There are four traction motors of the geared type, rated GEZ-1234-750/1,500 volts on each locomotive. This is a form of the GE-274-A motor, which was so successfully applied to the first locomotives furnished, with the field windings re-designed. The motors are spring nose suspended, and drive the axle through a single

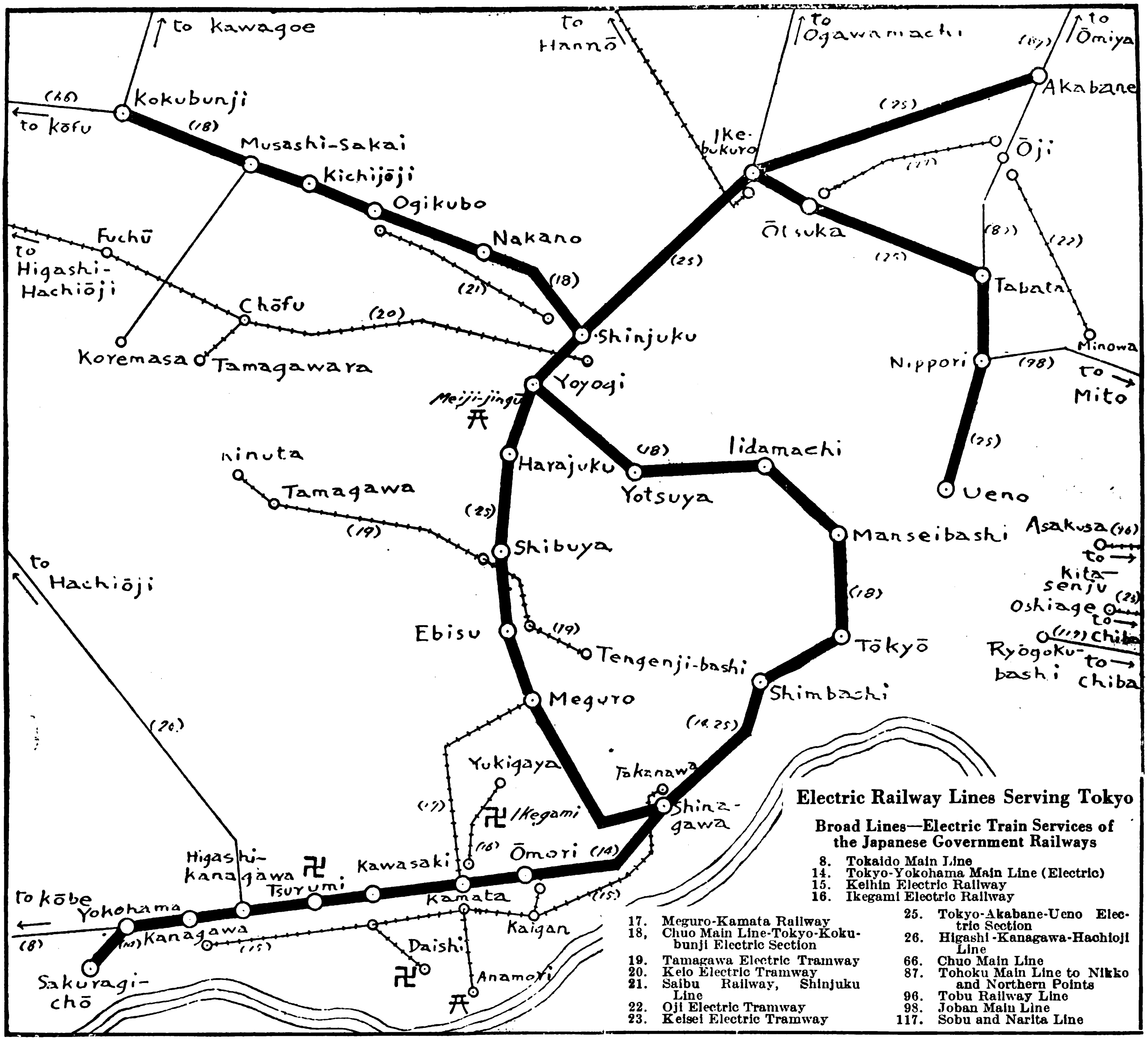


The largest Automatic Sub-Station in the World at Kanagawa for the Imperial Japanese Railways; total capacity 8,000 k.w., containing four Westinghouse 2,000 k.w., 1.500 volt d.c. Synchronous Converter Units.

ELECTRIC LOCOMOTIVE DATA, JAPANESE GOVERNMENT RAILWAYS

Type	1000	1010	1020	1030	1040	*1060	6000	*6010	*7000	8000	*8010
Service — Number	2	2	2	2	17	4	9	6	2	8	2
Service	Freight	Freight	Freight	Freight	Freight	Freight	Passenger	Passenger	Express passenger	Express passenger	Express passenger
Voltage	750v/1500v, 600v/1200v	750v/1500v, 600v/1200v	750v/1500v, 600v/1200v	750v/1500v, 600v/1200v	1500v	1500v	1500v	1500v	1500v	1500v	1500v
Maker — Mechanical part	Baldwin Loco. Works	G. E. Co.	Schlieren A.G.	Preston Works	North British Loco. Co.	G. E. Co.	North British Loco. Co.	Baldwin Loco. Works	Swiss Loco Co..	North British Loco. Co.	Baldwin Loco. Works
Maker — Electrical part	Westinghouse El. & Mfg. Co.	G. E. Co.	Brown Boveri Co.	English El. Co.	English El. Co.	G. E. Co.	English El. Co.	Westinghouse El. & Mfg. Co.	Brown Boveri Co.	English El. Co.	Westinghouse El. & Mfg. Co.
Gauge (m.m.)	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,067	1,067
No. of driver's compartment	2	2	2	2	2	2	2	2	2	2	2
Length (m.m.) — Total, over buffers	12,368	11,345	13,248	12,420	12,420	10,978	12,420	12,497	13,200	21,209	16,561
Length (m.m.) — Cab	9,754	8,839	10,850	11,582	11,582	8,839	11,582	9,754	—	15,240	11,582
Width (m.m.) — Overall, including grab handles	2,857	2,850	—	2,800	2,800	2,740	2,800	2,794	—	2,800	2,794
Width (m.m.) — Cab	2,794	2,820	2,744	2,590	2,610	—	2,610	2,765	—	2,591	2,765
Height above rail (m.m.) — Top of cab...	3,655	3,471	3,675	3,706	3,586	3,467	3,586	3,435	3,475	3,581	3,435
Height above rail (m.m.) — Pantograph up	5,200	6,100	6,240	6,146	6,285	—	6,285	—	—	6,285	—
Height above rail (m.m.) — Pantograph stowed	4,100	3,920	4,235	4,035	3,910	3,910	3,910	4,055	3,900	3,935	4,055
Wheel base (m.m.) — Rigid	2,769	2,590	3,150	2,820	2,820	2,641	2,820	2,032	1,900	4,267	4,064
Wheel base (m.m.) — Total	8,941	7,924	9,200	8,610	8,610	7,516	8,610	6,401	9,300	18,364	10,459
Distance between bogie centres (m.m.)	6,172	5,334	6,050	5,790	5,790	5,055	5,790	5,436	—	9,411	—
Wheel dia. (m.m.) — Driving	1,245	1,067	1,400	1,245	1,245	1,245	1,245	1,245	1,600	1,400	1,245
Wheel dia. (m.m.) — Leading	—	—	—	—	—	—	—	838	939	940	762
Construction of trucks	Bar frame with equalizer	Steel frame with equalizer	Steel frame without equal.	Plate frame	Plate frame	Plate frame	Plate frame	Bar frame	Plate frame	Plate frame	Bar frame
Connection of trucks	Non-articulated	Non-articulated	Articulated	Articulated	Articulated	Articulated	Articulated	Articulated	—	Articulated	Articulated
Weight (metric ton) — Total	56.48	59.6	59.22	60.4	58.32	60	57.97	69.42	76	97	93
Weight (metric ton) — Mechanical part	34.6	37.4	32	—	—	35.5	—	46.6	47	—	61.8
Weight (metric ton) — Electrical equipment	21.88	22.2	27.22	—	—	24.5	—	22.82	29	—	31.2
Weight (metric ton) — On driving axle	14.1	14.9	14.8	15.1	14.6	15	14.5	12.9	14.5	12	12.7
Weight (metric ton) — On leading axle	—	—	—	—	—	—	—	8.9	9	6.25	8.5
Weight (metric ton) — Adhesive	56.48	59.6	59.22	60.4	5,832	60	57.97	51.6	58	72	75.9
Number of motors	4	4	4	4	4	4	4	4	4	6	6
Type of motor	Delta 2726	G.E.-274-A	G.D.T.M. 75/6.22	D.K.-86-A	D.K.-86-A	G.E.-274-A	D.K.-86-A	352-K-5	G.L.M. 75/6.28	D.K.-86-A	@ 352-K-5
Voltage of motor...	750v	750v	750v	750v	750v	750v	750v	750v	750v	750v	750v
*One hour rating of motor — Voltage (v)	750	750	540	540	675	750	675	750	750	675	750
*One hour rating of motor — Current (a)	282	290	375	350	350	290	350	340	610	350	340
*One hour rating of motor — R. P. M. ...	625	765	270	500	630	934	630	630	830	630	630
*One hour rating of motor — Output (h)	250	260	235	220	275	265	275	300	550	275	300
Speed (KM/H) — *One hour rating	33.2	35.4	25	29	50	50.7	59	55.5	80	66.5	55.5
Speed (KM/H) — Max. safe	65	65	65	65	65	75	85	100	110	96	110
Tractive effort (kg.) — *One hour rating	7,840	8,050	10,000	8,350	6,100	5,400	5,100	6,000	7,820	6,940	9,000
Tractive effort (kg.) — Max. (20% adhesion)	14,100	14,900	14,800	15,100	14,600	15,000	14,500	12,900	14,500	18,000	19,000
System of power transmission	Single reduction gear	Single reduction gear	Twin single reduction gear	Single reduction gear	Single reduction gear	Single reduction gear	Single reduction gear	Flexible single reduction gear	Individual axle drive. Single reduction gear	Single reduction gear	Flexible single reduction gear
Gearing — Type	Helical stub	Spur	Helical	Spur	Spur	Spur	Spur	Spur	—	Spur	Spur
Gearing — Diametral pitch	2	2.5	2	2	2	2.5	2	2	—	2	2
Gearing — Gear ratio	16:72	19:82	23:90	18:73	23:68	19:82	26:65	24:64	41:138	26:65	24:64
System of control	Unit switch Type H.L.F.	Unit switch Type P.C.L.	Motor-operated cam shaft	Motor-operated cam shaft	Motor-operated cam shaft	Unit switch. Type P.C.L.	Motor-operated cam shaft	Unit switch. Type H.B.F.	Motor-operated cam shaft	Motor-operated cam shaft	Unit switch. Type H.B.F.
Control circuit — Source	Dynamotor	Dynamotor	Motor-gen.	Motor-gen.	Motor-gen.	Motor-gen.	Motor-gen.	Motor-gen.	Motor-gen.	Motor-gen.	Motor-gen.
Control circuit — Voltage	600	600	110	100	100	100	100	32	100	100	32
Brake equipment	Westinghouse El. 14 air brake, and hand brake.	Westinghouse El. 14 air brake, and hand brake.	Westinghouse El. 14 air brake, and hand brake.	Westinghouse El. 14 air brake, and hand brake.	Westinghouse El. 14 air brake, and hand brake	Westinghouse El. 14 air brake, and hand brake	Westinghouse combined air and vacuum brake, and hand brake	Westinghouse combined air and vacuum brake, and hand brake	Westinghouse combined air and vacuum brake, and hand brake	Westinghouse combined air and vacuum brake, and hand brake	Westinghouse combined air and vacuum brake, and hand brake
Wheel arrangement											

Remarks: * Based on short-field connections. ‡ Locomotives recently ordered.



Electric Railway Lines Serving Tokyo

Broad Lines—Electric Train Services of the Japanese Government Railways

8. Tokaido Main Line
14. Tokyo-Yokohama Main Line (Electric)
15. Keihin Electric Railway
16. Ikegami Electric Railway
17. Meguro-Kamata Railway
18. Chuo Main Line-Tokyo-Kokubunji Electric Section
19. Tamagawa Electric Tramway
20. Keio Electric Tramway
21. Saibu Railway, Shinjuku Line
22. Oji Electric Tramway
23. Keisei Electric Tramway
25. Tokyo-Akabane-Ueno Electric Section
26. Higashi-Kanagawa-Hachioji Line
66. Chuo Main Line
87. Tohoku Main Line to Nikko and Northern Points
96. Tobu Railway Line
98. Joban Main Line
117. Sobu and Narita Line

solid gear. The ventilation is accomplished by means of two external blowers, driven by 1,500 volt motors located in the cab, which supply air through suitable ducts to a large opening in each motor frame near the commutator end. Here the air divides in two paths, one of which is over the armature and around the field coils, and the other under the commutator and through the longitudinal holes in the armature core. Openings are provided in the pinion end of the frame through which the air is expelled.

The locomotives are equipped with PCL multiple unit non-automatic control. There is a master controller in each end of the locomotive, having ten steps with all four motors in series, eight steps with two motors in series, the two groups in parallel with full field, and two steps with this series parallel grouping of motors and shunted field. The tenth and eighteenth are running steps with all the accelerating resistance short circuited.

There are 22 electro pneumatic conectors which close and open the motor and resistance circuits in the proper sequence to obtain smooth acceleration of the locomotive. They are also used to commutate the motor circuits from one motor combination to another. The contact unit is closed by air pressure controlled by a magnetically operated valve and opened by a strong spring against which it is closed.

The reverser controlling the direction of rotation of the motors is electro-pneumatically operated and consists of a series of cylindrical castings mounted on an insulated shaft. The contacts are made by fingers mounted along the cylinder on insulated rods. It is interlocked with the line contactors so that they cannot close until the position of the reverser corresponds to the position of the reverse handle on the master controller.

The main switch is hand-operated and carries the entire locomotive current. It also serves as a disconnecting switch during inspection. By means of knife blade switches, one pair of motors may be cut out of the circuit in case of emergency. Suitable interlocks on these switches commutate the control circuits so that the locomotive may be operated with the remaining motors.

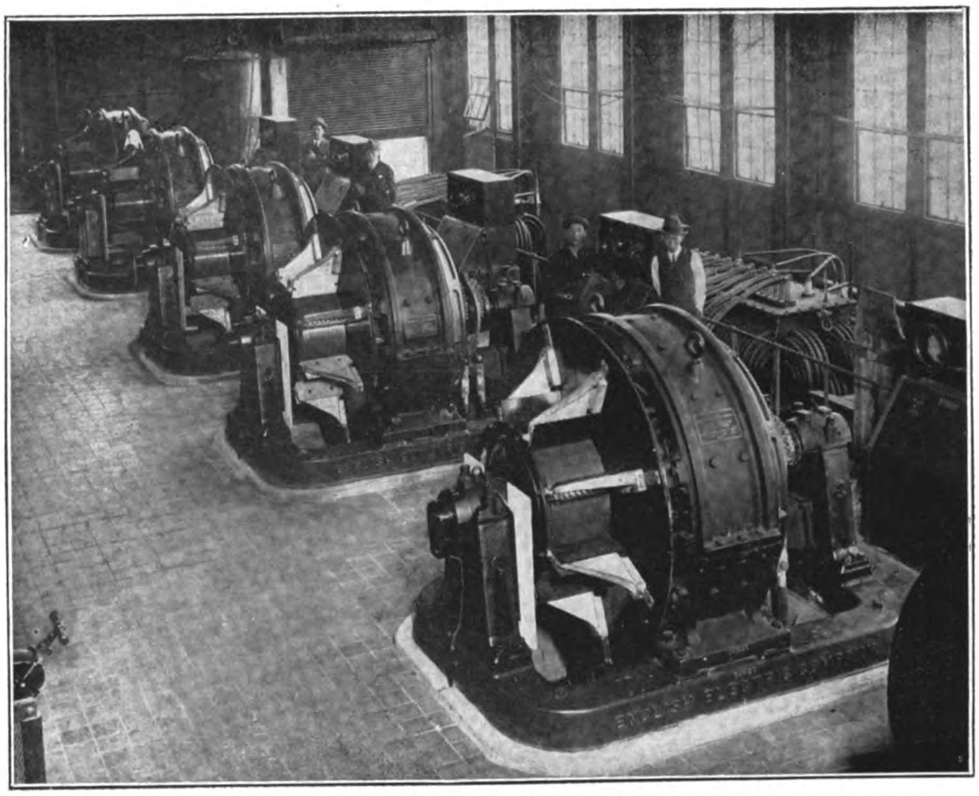
Power for the control circuit is obtained from a motor generator set rated GEZ-2,049-750/1,500-100 volts. For control operation a potential above 50 volts is preferred, due to the fact that a lower voltage may not be able to send sufficient current through contact surfaces that have become slightly dirty.

The voltage output of this set is held approximately constant at 100 volts by means of a General Electric type TD regulator over a trolley potential range from 1,500 volts down to 1,100 volts with full output, and down to 1,000 volts with reduced output sufficient to operate the control and lights. Below 1,000 volts trolley potential the power for control and lights is furnished by a storage battery automatically. This consists of 45 Edison cells type DMT-3, which has sufficient capacity to keep all lights and the headlight lighted for 4 hours.

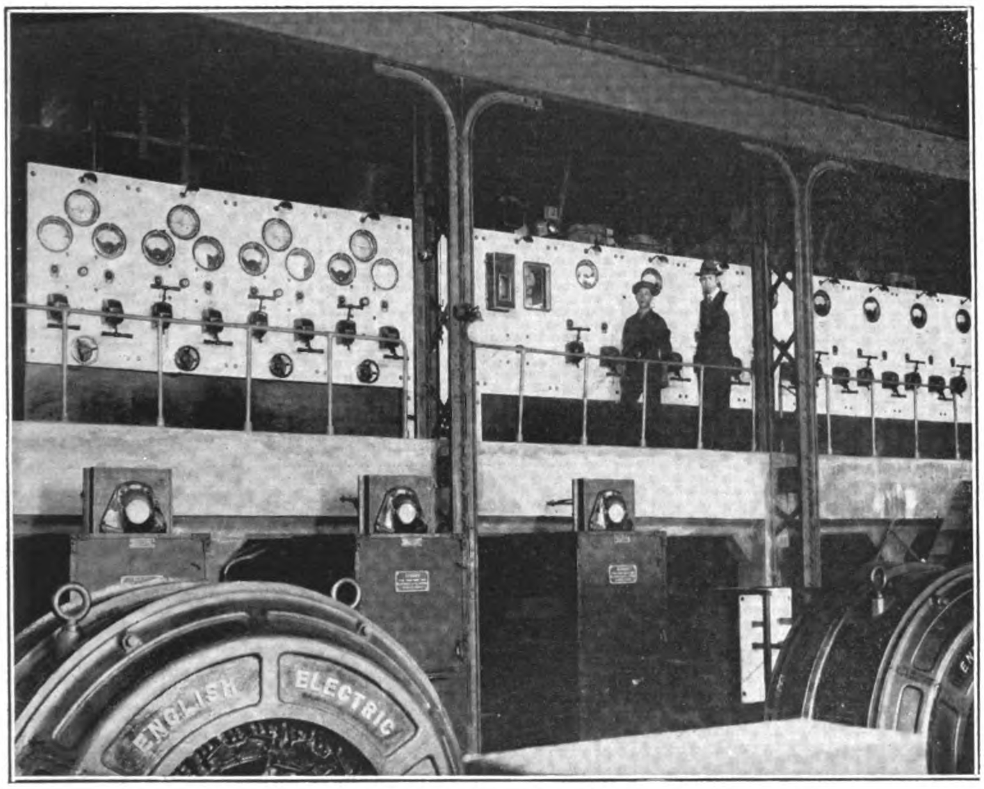
Each locomotive is equipped with two pantographs similar to those used on the Chicago-Milwaukee-St. Paul Railway, the Paulista and others. In tests conducted at the Erie Works of the General Electric Company a single pantograph of this design has shown its ability to collect 5,000 ampères from a suitably suspended trolley wire at a speed of 100 km. per hour.

The pantograph is raised by air pressure controlled by magnet valves and has an operating range of 2,030 mm. The contact surface of the pantograph consists of two steel pans provided with copper wearing strips which are easily renewed. The contacts are held at practically constant pressure against the trolley wire by means of cams and springs which are held in tension by the air cylinders.

For protection against short circuits or sudden overload type JR high speed circuit breaker of suitable capacity is provided, connected in the circuit directly after the main switch. The advantage which this breaker possesses over others is the elimination of any mechanical latches for tripping. This enables it to stop a current rush in approximately .008 seconds. The Imperial Government Railways have ordered over 50 of this type of high-speed breaker for the protection of sub-station apparatus.



Kawasaki Sub-Station; Part View of English Electric Rotary Converters and Starters



Kawasaki Sub-Station: English Electric 1,500 volt D.C. Switchboard

An overload relay provides for overload protection of the motors. When the motor current exceeds a certain predetermined value the relay contacts open up the line and resistance contactors. Operation can be resumed by returning the master controller to the first point.

Each truck of the running gear has side frames of steel plate securely bolted to two end transoms and a middle transom. These are of cast steel and suitably designed for the attachment of the side plates, draft gear, and draw head of the articulation. The middle transom, which is hollow, supports a hollow center plate and is designed with suitable strength to carry the various tressess and to conduct the air from the air duct in the platform down to the traction motors.

Semi-elliptic leaf springs, proportioned to the weight to be carried, support all parts except the wheels, axles, journal boxes and about one-half the motor weight.

The braking of the locomotive is accomplished by means of Westinghouse type EL-14 air brake equipment and a hand brake. Two General Electric CP-30-1,500 volt single stage air compressors are provided on each locomotive. They are automatically controlled by a pressure governor switch.

The box type cab is divided into apparatus and drivers compartments, which will be arranged in a similar manner to those of the previous locomotives. The master controller will be at the left of the cab in accordance with the practice of the Imperial Government Railways.

English Electric Locomotives

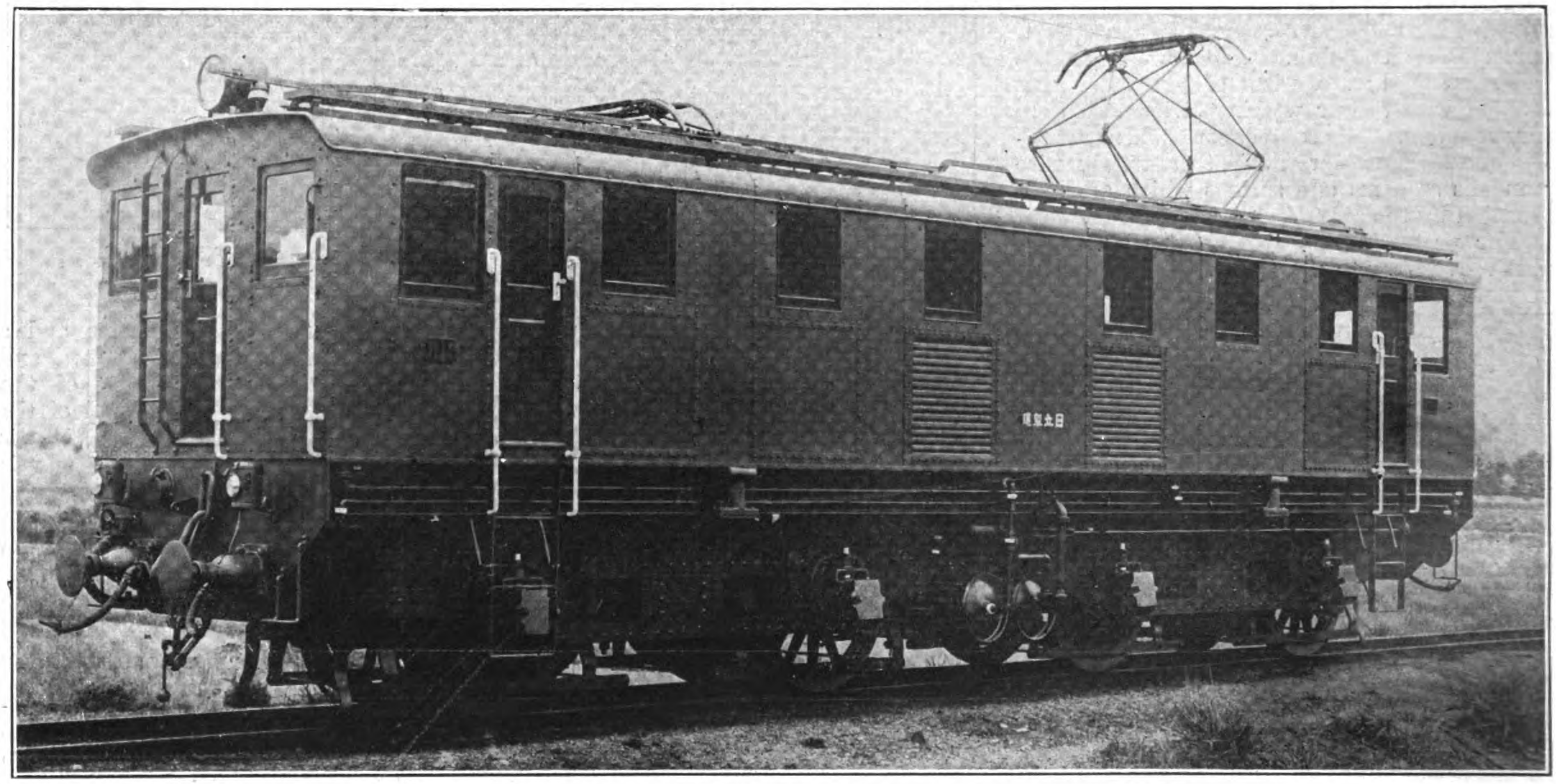
Eight of the locomotives from the English Electric Company are of the 4-6-4-4 type and the remaining 28 of the 0-4-4-0 type and have motor equipment of 1,200 h.p. The larger locomotives, the mechanical parts of which were made by the North British Locomotive Company, are to be employed in express passenger service. When first they are put into operation they will take trains from Tokyo to Kozu, a distance of some 50 miles, stopping about half-way at Yokohama. Eventually, however, they will run to Odawara over the new direct route to Numazu, 80 miles from Tokyo and about 4 miles beyond Mishima, the connecting point between the new line and the original main line.

As the gauge of the lines over which the locomotive works is 3-ft. 6-in., and as the service demanded required a high power, amounting to 1,800 h.p. at the one-hour rating, the question of the motor arrangement and drive required much consideration.

The conditions imposed by the narrow gauge operated in the direction of limiting the size of motor which could be carried between the frames, and accordingly six motors were adopted. These are each of 306 h.p. on one-hour rating. The line pressure is 1,500 volts direct current, and the motors are of 750 volts each and are run two permanently in series. A gear drive is used, and the arrangement follows closely that commonly utilized in connexion with multiple-unit passenger coaches.

The under-frame is carried on two trucks, each equippe dwith three driving axles and one swivelling bogie. The driving wheels are 4-ft. 7-in. in diameter, and the driving axles are each driven independently by a motor. The total weight of the locomotive is 100 tons, there being about 12 tons on each driving axle and 7 tons on each axle of the leading and trailing bogies. Compensation is provided between two axles only on each truck. As will be clear, the wheel arrangement of the locomotive is symmetrical about the centre line. The control of the locomotive is carried out on the English Electric Company's camshaft system. The electrical arrangements consist, briefly, of a main camshaft controller, and and main fuse, the magnetically operated line switches (which, as mentioned above, are interlocked with the camshaft controller), the camshaft controller itself, and the magnetically operated reversers, which are in the main circuit between the main motor armatures and the fields. The pantographs are raised by compressed-air cylinders operated from the brake compressor in the usual way. Each of them is capable of collecting the whole current required by the six motors. The high-tension control apparatus is situated in compartments arranged along each side of the locomotive body. Sliding doors are arranged to cut off these compartments from the remaining part of the interior of the locomotive body, and the doors are interlocked with the main isolating switch, so that it is impossible to obtain access to the high-tension gear when it is alive. The switches have magnetic-shield blow-outs and are closed against a spring, so that there is no time lost in opening.

The control current is obtained from the 100-volt side of a motor generator which is in the center of the locomotive body. Current is taken from this generator to the master controller at each end of the locomotive. The two controllers are similar, and the locomotive



A Japanese-built Electric Locomotive

Typical of the Enterprise and Determination of the Japanese Manufacturers to Keep Abreast of their Competitors and Meet the Requirements of their own Market. Two of these 59-ton Electric Locomotives, 1,500 volts, d.c., were made by the Hitachi Engineering Works on their own initiative and subjected to the most severe running tests. An American Electric Expert who witnessed these trials declared that the locomotives were in every respect equal to the best foreign product. The two locomotives were then purchased by the Japanese Railway Board and the name of the Hitachi Engineering Works placed on the list of Approved Makers.

may be driven from either of them. From the master controller current passes through the train wires to the position regulator on the camshaft controller, and from thence to the motor which drives the camshaft controller. The position regulator is in the form of a drum-type switch. As the master controller is operated the camshaft-controller motor is started and moves the camshaft controller into the position determined by the master controller. When the camshaft controller reaches this position the armature of the camshaft motor is short-circuited by a relay, the energising of the relay being determined by the position regulator. This short-circuiting brings the camshaft to rest instantly and without any hesitation or over-running. A 20-volt relay is provided in connection with the control circuit, and if the line supply fails the master controller must be brought back to the starting position before power can again be supplied to the main motors when the supply is restored. The line switches are tripped when the master controller is brought into the zero position. These switches are provided with an overload relay which is closed from the driver's compartment. They can only be closed when the master controller is in the zero position.

is operated by an electric motor which is controlled by a master controller. The camshaft controller handles the main 1,500-volt current, regulating the amount of resistance in the motor circuits and determining the grouping of the motors. It consists of a series of steel cams mounted on a mica-insulated steel shaft. The electric motor drives the shaft through a flexible drive and worm gear, and as the cams are set at different angles, each in turn closes a contactor, the contactors regulating the amount of starting resistance in the main circuit and determining the grouping of the motors. The order of operation of the contactors is determined by a purely mechanical arrangement, so that it is impossible for them to close in the wrong order and no interlocking arrangement is required. An interlock is, however, provided on the line switches, so that the camshaft cannot begin to rotate in a forward direction until the line switches have closed, not in a backward direction until they have opened. The main current is consequently always made and broken on the line switches only, and the camshaft contactors require neither blow-outs nor arc shields.

The apparatus in the main 1,500-volt circuit consists of the pantograph current collectors with choking coils, an isolating switch

The motor of the motor-generator set is fed from the 1,500-volt line. The controlling apparatus consists of an isolating switch interlocked with the door of the high-tension compartment and an automatic starter consisting of three small contactors and a starting resistance. A reverse-current relay is incorporated in the circuit, since if the live voltage dropped suddenly the inertia of the set would cause the motor to feed back into the line. This relay inserts resistance in the circuit and safeguards the motor. This motor of the motor-generator set, besides driving the 100-volt generator which supplies the auxiliary circuits, also drives two fans which are carried one at each end of the set. These fans supply forced ventilation air from the main motors. A stand-by supply for the auxiliary circuits is furnished by a battery carried by the locomotive, this battery having sufficient capacity to operate for four hours in case of failure of the motor-generator set.

The locomotive is fitted with automatic air brakes, and the compressor motors are supplied from the 100-volt auxiliary circuit. A vacuum exhauster is also driven from the same circuit. This exhauster is required for use in connexion with the operation of the vacuum brakes on the existing passenger stock. Ultimately it is the intention to change over all stock on the Japanese railways to compressed air brakes, and when this has been carried out the exhausters will be removed from the locomotives. Two or more of these locomotives can be run in multiple unit and driven from a single master controller. The draw-gear and couplings are made to the Japanese railway standard, but arrangements are made so that the present gear can be removed and M.C.B. couplers fitted if desired.

Baldwin Westinghouse Locomotives.

The first two Baldwin-Westinghouse electric locomotives furnished to the Japanese Government railways are designed primarily for local freight service over lines having heavy grades; they may be operated in multiple as a road freight locomotive of 121 tons deadweight. Following are the principal dimensions of the two locomotives: Weight, 120,950-lb.; Weight per driving axle, 30,240-lb.; Diameter of wheels, 49-in.; Rigid wheel base, 9-ft. 1-in.; Total wheel base, 29-ft. 4-in.; Maximum speed, 40 m.p.h.; Starting tractive effect, 30-240-lb.

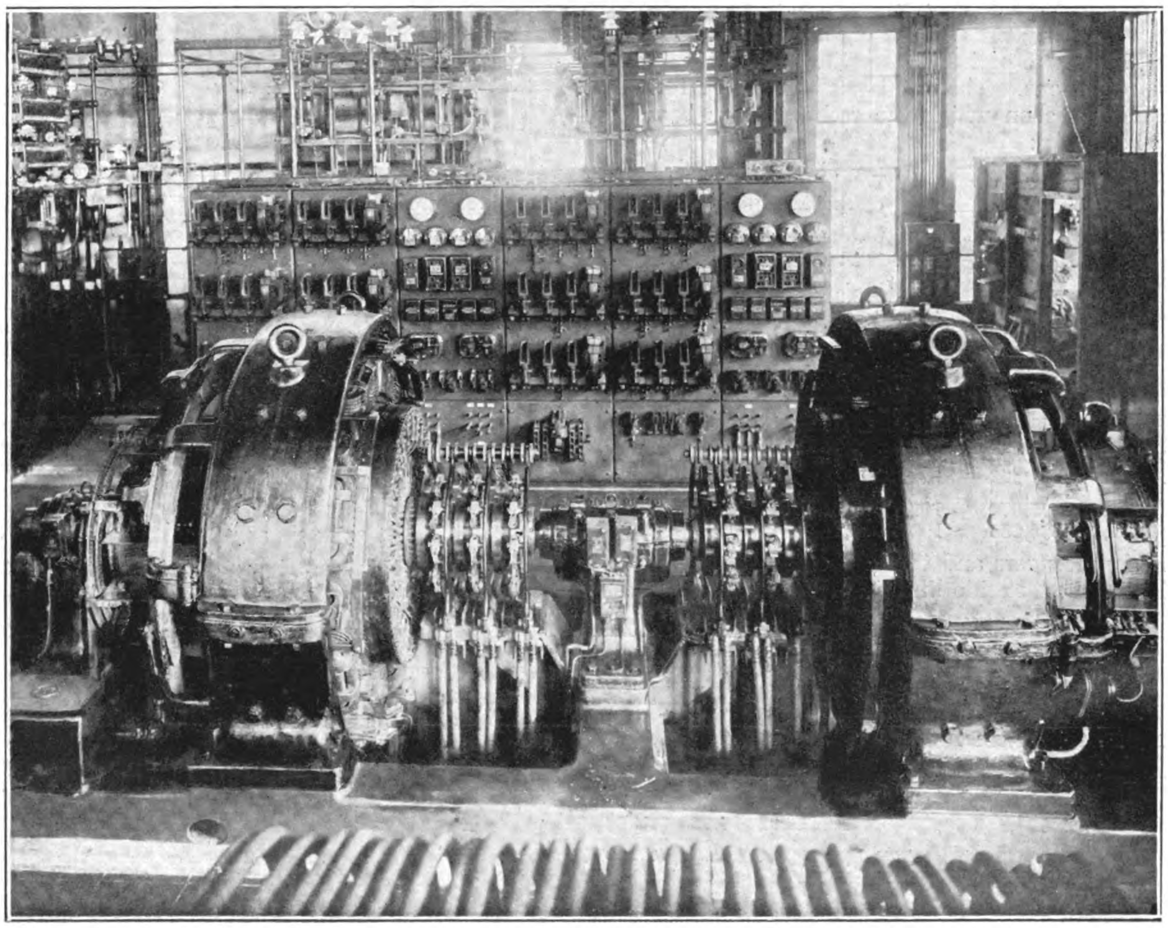
Two axle hung motors, inside hung and direct geared to the axle, are carried on each truck. These locomotives will be given close supervision while in service with a view to the acquisition of data concerning actual traffic requirements as well as of operation before determining the extent of the general electrification and the type of equipment on the Government lines.

In addition to the locomotives supplied by the Baldwin-Westinghouse Companies to the Government railways several are in operation on the Chichibu railways, a system traversing a district rich in the natural wealth of mines and quarries and noted for its production of raw silk.

For many years this railway was operated under steam power, but increasing freight movement and the ever-present fuel problem made it imperative to seek a solution of the power difficulties. Moreover, the development of electric plants in this district had been rapid and an ample supply of current was ensured. After a careful consideration, therefore, of all the operating factors, a decision was made calling for the electrification of the line from Kagemore to Kumagaya, a distance of 35 miles of main line.

Power is supplied by the Musashino Electric Power Company, transformed through two sub-stations to 1,200 volts direct current.

Three multiple unit cars, equipped by the Westinghouse Company, will be operated in passenger and express service. Five Baldwin-Westinghouse electric locomotives were shipped in October 1922 to handle mixed freight and passenger trains, which as a rule consist of four passenger cars and fourteen goods cars, making a total of approximately 204 gross tons. The electric locomotives are of the 0-4-0 0-4-0 non-articulated type, built for 3-ft. 6-in. gauge track with 38-in. wheels. They weigh approximately 82-150-lb.



Kanagawa Automatic Sub-Station, Imperial Government Railways of Japan: Westinghouse Relay and Control Switchboard for Two 2,000 k.w. 1,500 volt d.c., synchronous converter units and one of the 2,000 k.w. converter units. The unit consists of two 750 volt d.c. converters and a common bed plate operating in series.

Electrification of the Tokaido Main Line

TOKYO-AKASHI

THE second and most important phase of railway electrification in Japan covers the entire Tokaido Main Line between Tokyo and Kobe, a distance of 366 miles. The details for carrying out this plan were drawn up by a special investigation committee and submitted to the Minister of Railways on July 8, 1922. Although various minor changes have since been adopted, this report has been accepted and approved as the official program for electrifying the main line between Odawara and Kobe. In arriving at a conservative estimate of the volume of future traffic over the line, the committee added to the figures for the fiscal year 1921 the estimated increase of the preceding year, the ratio of increase being based on the traffic returns of the nine fiscal years 1908-16. The figures for 1917-20 were omitted from the calculation because of abnormal war conditions. The total passenger and ton-miles between Tokyo and Kobe on which the estimates are based are given in the following table :

Total passenger and ton-miles on the line between Tokyo and Kobe

Year	Total passenger-miles	Total ton-miles
1908...	763,571,345	389,360,272
1909...	801,529,382	425,396,602
1910...	861,511,448	475,492,403
1911...	930,809,853	490,662,644
1912...	971,280,355	565,979,612
1913...	928,657,762	606,680,291
1914...	924,349,531	570,475,958
1915...	1,051,291,762	665,485,639
1916...	1,131,752,043	900,467,322
1917...	1,451,562,040	1,146,039,908
1918...	1,702,081,111	1,322,275,979
1919...	2,056,811,574	1,489,830,885

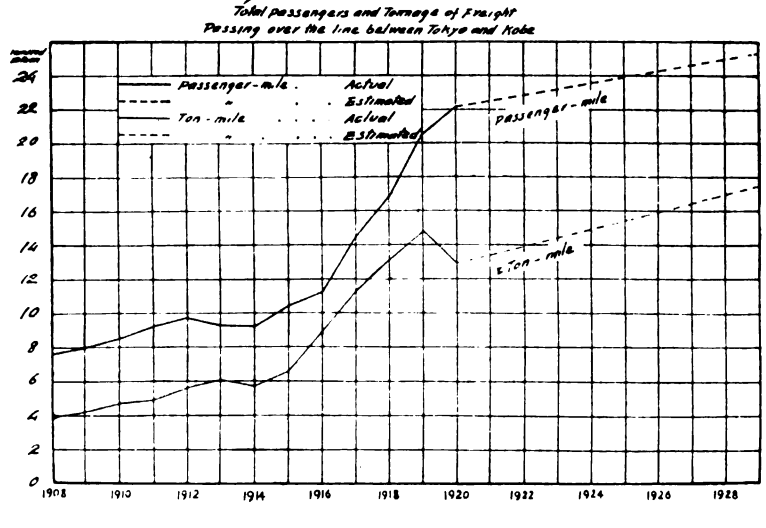
Total passenger and ton-miles on the line between Tokyo and Kobe

Year	Total passenger-miles	Total ton-miles
1920...	2,214,064,835	1,297,199,652
Annual increase	36,259,166	51,250,773
1921...	2,250,324,001	1,348,450,425
1922...	2,286,583,167	1,399,701,198
1923...	2,332,842,333	1,450,951,971
1924...	2,359,101,499	1,502,202,744
1925...	2,395,360,665	1,553,453,517
1926...	2,431,619,831	1,604,704,290
1927...	2,467,878,997	1,655,955,063
1928...	2,504,138,163	1,707,205,836
1929...	2,540,367,329	1,758,456,609

The number of passengers and tonnage of freight passing over the various section of the Tokaido lines is shown as follows :

Stations		Passengers: Number 1920	Passengers: Annual increase	Passengers: Basic number of passengers for present scheme	Freight: Tonnage 1920	Freight: Annual increase	Freight: Basic Tonnage for present scheme
Tokyo (Shiodome)	Shinagawa	26,945,790	223,121	28,953,879	797,096	32,545	1,090,001
Shinagawa	Yokohama	21,863,849	297,434	24,540,755	2,714,063	84,907	3,478,226
Yokohama	Ofuna	10,220,042	171,445	11,763,047	2,345,592	87,783	3,135,639
Ofuna	Kozu	5,654,310	94,222	6,502,308	2,302,791	85,186	3,069,465
Kozu	Nagoya	4,076,876	63,380	4,647,296	2,106,066	70,167	2,737,569
Nagoya	Maibara	4,157,257	70,549	4,792,198	1,867,052	58,795	2,396,207
Maibara	Kyoto	4,873,283	99,687	5,770,466	2,103,966	86,820	2,885,346
Kyoto	Osaka	8,027,638	114,178	9,055,240	2,413,875	82,049	3,152,316
Osaka	Kobe	8,638,035	229,404	10,702,671	1,902,466	83,261	2,651,815

REMARKS : Numbers of passengers are for both directions but tonnage of freight are for eastbound traffic only.



Train Operation

1. TRAIN UNITS.—The train units for handling this volume of traffic have been determined by the present length of the various yard tracks (which are not to be altered) which permit a maximum length of 800-ft. for passenger and 1,500-ft. for freight trains. The number of these cars to a train with their tractive tonnages are given below, the tonnages being estimated on a seating capacity of 45 per cent. for passenger trains, a loading efficiency of 67 per cent. for freight trains and a tractive efficiency of 85 per cent. for both passenger and freight trains.

Trains	No. of Cars	Tractive Tons
Passenger, Limited Exp.	11	420
Passenger, Express	12	460
Through Passenger	10	300*
Local Passenger...	8	250‡
Exp. and Through Freight	—	800
Local Freight	—	400

*The tractive power of the locomotive is placed at 360 tons with a 20 per cent. margin over the above tractive tonnage.

‡The tractive power of the locomotive is put down at 300 tons with a 20 per cent. margin over the above tractive tonnage.

The composition of some representative trains as shown in the following tables :

(*a*) LIMITED EXPRESS

	OC	1SC	1.2C	DC	2C	2C	2CS	2CS	1SC	2SC	MBC
Seating or Loading capacity	20	30	c 1 20, c 2 32	0	64	64	42	42	30	42	ton 11
Dead weight (tons)	36	37	34.5	35	34	34	37	37	37	37	31.5

Total seating capacity, 386 ; Total weight, 421.7 ton or 420 ton ; Dead weight, 390.0 ton ; Weight of passengers, 8.7 ton ; Weight of baggages, 11.0 ton ; Weight of motors, 12.0 ton.

NOTE : 1C, 1st class car ; 2C, 2nd class car ; 3C, 3rd class car ; 1.2C, 1st and 2nd class car ; SC, Sleeping car ; DC, Dinning car ; OC, Observation car ; MC, Mail car ; BC, Baggage car ; MBC, Mail and baggage car ; BV, Brake-van.

(*b*) EXPRESS

	1SBV	1SC	1SC	1.2C	DC	2C	2C	2SC	2SC	2SC	2SC	BC
Seating or loading capacity	28	30	30	1 2 20.32	0	64	64	42	42	42	42	ton 11
Dead weight (tons)	37	37	37	34.5	35	34	34	37	37	37	37	315

Total seating capacity, 436 ; Total weight, 459.8 ton or 460 ton ; Dead weight, 428.0 ton ; Weight of passengers, 8.8 ton ; Weight of baggages, 11.0 ton ; Weight of motors, 12.0 ton.

(*c*) THROUGH TRAIN

	3BV	3C	3C	2C	2C	3C	3C	3C	3.BC	BC
Seating or loading capacity	72	80	80	52	52	80	80	80	3 Bton 40 4	ton 9
Dead weight (tons)	26.5	25	26	27.5	27.5	26	26	26	26	25.5

Total capacity, 616 ; Total weight, 297.9 ton or 300 ton ; Dead weight, 263.0 ton ; Weight of passengers, 13.9 ton ; Weight of baggages, 13.0 ton ; Weight of motors, 8.0 ton. The tractive power of the locomotives for through passenger trains should be such as to leave a margin of 20 per cent. over the regular tonnage of the train.

(*d*) LOCAL TRAINS

	3BV	3C	2C	2C	3C	3C	3C	BC
Seating or loading capacity	72	80	52	52	80	80	80	ton 9
Dead weight (tons)	26.5	26	27.5	27.5	26	26	26	25.5

Total capacity, 496 ; Total weight, 237.2 ton or 250 ton ; Dead weight, 211.0 ton ; Weight of passengers, 11.2 ton ; Weight of baggages, 9.0 ton ; Weight of motors, 6.0 ton. The tractive power of the locomotive for local passenger trains should be such as to leave a margin 20 per cent. over the regular tonnage of the train.

NUMBER OF TRAINS.—The increase in the transportation capacity of local trains is to be accomplished by an increase in the number of cars. Only the express and through passenger services will be improved by the addition of more trains and in order to meet any special passenger traffic demand, extra trains corresponding to five per cent. of the regular service are to be worked into the train diagram when it is drawn up. The actual increase in the number of trains has been fixed at 60 per cent. for express and through services and 40 per cent. for local, these percentages being the proportion between the present number of express and through trains and the local. The number of trains in the scheme is shown in the following table :

Section	Passenger: Express or through: Regular	Extra	Total	Local	Total	Freight: Express or through	Local	Irregular	Total	Total
Tokyo, Shinagawa, Shiodome...	20	2	22	8	30	7	—	1	8	38
Shinagawa, Yokohama, Takashima	20	2	22	8	30	18	9	4	31	61
Yokohama, Ofuna, Takashima	20	2	22	8	30	15	11	4	30	60
Ofuna, Kozu	20	2	22	8	30	14	11	4	29	59
Kozu, Nagoya	20	2	22	8	30	13	9	3	25	55
Nagoya, Maibara	20	2	22	9	31	13	5	3	21	52
Maibara, Kyoto, Umekoji ...	22	2	24	12	36	16	5	3	24	60
Kyoto, Osaka, Umekoji ...	26	2	28	28	56	17	5	3	25	81
Osaka, Kobe	32	2	34	32	66	12	11	3	26	92

EXPLANATION : The number or trains on this table in half of the total for both directions in the case of passenger trains, and that of eastbound trains in the case of freight trains.

TRAIN SPEED.—The running speed has been fixed according to the number of trains shown above and the capacity of the electric locomotives. The limited express passenger trains (*a*) will run at an average speed of 38-40 miles per hour ; express passenger (*b*) 36-38 miles ; through passenger (*c*) 29-34 miles ; local passenger (*d*) 29-30 miles ; express and through freight (*e*) about 23 miles and local freight (*f*) about 22 miles.

ELECTRIC LOCOMOTIVES.—The electric locomotives to be used for each kind of train are as follows : (details are given below).

Kind of trains	Type	Electric locomotives to be used: Wheel arrangement	Motor capacity	Total Weight	Diameter of driving wheel	Gear ratio
			HP	ton		
Limited express passenger	A	ooo+oo—oo+ooo	250×8	114	49	2.25
Express & through passenger ...	B	oooo+oooo	„ ×6	78	„	2.5
Local passenger ...	D	oo+oo	„ ×4	52	„	3.14
Local freight ...	D	„	„	„	„	„
Express & through freight	E	ooo+ooo	„ ×6	72	„	„

EXPLANATION : The horse power of the electric motor is that in the case of 675 volts of terminal voltage of natural ventilation.

RUNNING TIME.—According to the schedule worked out for the new electric through service between Tokyo and Kobe, the limited express trains Nos. 1 and 2 will cover the 366.3 miles in 9.32 hours which includes twenty eight minutes for stops, or 2.10 hours less than the present steam schedule. Express trains Nos. 1A and 2A will make the westbound trip in 10.40 hours and eastbound, 1.33 hours. Express trains Nos. 3, 4, 5, 6, 3A and 4A will

Comparison in Times required to reach Destination and Speed of Principal Trains on the Tokaido Line. (Down) (A)

Proposed scheme: Train number	Class of cars	Present practice (1921): Train number	Class of cars	Proposed scheme: Times required to reach destination: Running trains	Stopping trains	Total	Average speed: Net running speed	Percentage of speed	Train speed	Present practice (1921): Times required to reach destination: Running trains	Stopping trains	Total	Average speed: Net running speed	Percentage of speed	Train speed	Decrease (or increase): Running trains	Stopping trains	Total
				h m.	h m.	h m.	miles per hr.		miles per hr.	h m.	h m.	h m.	miles per hr.		miles per hr.	h m.	h m.	h m.
1	1,2	1	1,2	9—04	28	9—32	40.4	100	38.4	10—50	55	11—45	33.8	100	31.2	1—46	27	2—13
1 A	3	—	—	9—39	1—01	10—40	38.0	94	34.3	—	—	—	—	—	—	—	—	—
3, 3 A	3	3	3	10—08	1—02	11—10	36.1	89	32.8	13—10	1—13	14—23	27.8	82	25.5	3—02	11	3—13
5	1,2	5	1,2	10—08	1—02	11—10	36.1	89	32.8	13—14	1—14	14—28	27.7	82	25.3	3—06	12	3—18
7, 7 A	3	7	3	10—39	1—04	11—43	34.4	85	31.3	12—32	1—13	13—45	29.2	86	26.6	1—53	9	2—02
9	1,2	9	1,2	10—01	54	10—55	36.6	91	33.6	12—44	1—06	13—50	28.8	85	26.5	2—43	12	2—55
11, 11 A	1,2	11	2,3	9—32	48	10—20	38.4	95	35.4	12—37	1—13	13—50	29.0	86	26.5	3—05	25	3—30
13	1,2	—	—	9—49	1—01	10—50	37.3	92	33.8							3—12	38	3—50
13 A	3	13	mail 2,3	9—49	1—01	10—50	37.3	92	33.8	13—01	1—39	14—40	29.3	83	25.0	—	—	—
13 B	Mail baggage	—	—	9—49	1—36	11—20	37.6	93	32.3							3—17	3	3—20
A 19	2,3	15	2,3	10—48	1—07	11—55	33.9	84	30.7	15—09	2—22	17—30	24.2	72	20.9	4—21	1—14	5—35
17	2,3	17	2,3	12—33	3—07	15—40	29.2	72	23.4	15—23	2—48	18—11	23.8	70	20.1	2—50	(19)	2—31
Tokyo-Maibara local p	2,3	77	2,3	9—25	1—35	11—00	29.4	73	25.2	12—00	2—06	14—06	23.1	68	19.6	2—35	31	3—06
Express f.	—	401	exp. p.	15—43	3—16	19—04	23.1	57	19.1	19—38	6—42	26—20	18.6	55	13.9	3—50	3—26	7—18

Comparison in Times required to reach Destination and Speed of Principal Trains on the Tokaido Line. (Up) (B)

Proposed scheme: Train number	Class of cars	Present practice (1921): Train number	Class of cars	Proposed scheme: Times required to reach destination: Running times	Stopping times	Total	Average speed: Net running speed	Percentage of speed	Train speed	Present practice (1921): Times required to reach destination: Running times	Stopping times	Total	Average speed: Net running speed	Percentage of speed	Train speed	Decrease (or increase): Running times	Stopping times	Total
				h m.	h m.	h m.	miles per hr.		miles per hr.	h m.	h m.	h m.	miles per hr.		miles per hr.	h m.	h m.	h m.
1	1,2	2	1,2	9—05	28	9—33	40.3	100	38.4	10—50	52	11—42	33.8	100	31.3	1—45	24	2—09
2 A	3	—	—	9—35	58	10—33	38.2	95	34.7	—	—	—	—	—	—	—	—	—
4, 4 A	3	4	3	9—37	1—01	10—38	38.1	95	34.4	13—22	1—16	14—38	27.4	81	25.0	3—45	15	4—00
6	1,2	6	1,2	9—37	1—01	10—38	38.1	95	34.4	13—18	1—12	14—30	27.5	81	25.3	3—41	11	3—52
8, 8 A	3	8	3	10—02	1—01	11—03	36.5	91	33.1	12—40	1—10	13—50	28.9	86	26.5	2—38	9	2—47
10	1,2	10	1,2	9—34	53	10—27	38.3	95	35.1	12—22	58	13—20	29.6	88	27.5	2—48	5	2—53
11, 12 A	1,2	12	2,3	9—37	53	10—30	38.1	95	34.9	12—37	1—08	13—45	29.0	86	26.6	3—00	15	3—15
14	—	—	—	9—37	1—01	10—38	38.1	95	34.4							3—50	32	4—22
14 A	3	14	mail 2,3	9—37	1—01	10—38	38.1	95	34.4	13—27	1—33	15—00	27.2	80	24.4	—	—	—
14 B	Mail baggage	—	—	9—50	1—35	11—25	37.3	93	32.1							3—37	(2)	3—35
20	2,3	16	2,3	10—39	1—07	11—46	34.4	85	31.1	15—34	2—17	17—51	23.5	70	20.5	4—55	1—10	6—05
18	2,3	18	2,3	12—28	3—09	15—37	29.4	73	23.5	15—23	2—48	18—11	23.8	70	20.1	2—55	(21)	2—34
Maibara-Tokyo local p.	2,3	80	2,3	9—18	1—57	11—15	29.8	74	74.6	12—20	2—05	14—25	22.5	67	19.2	3—02	8	3—10
Express f.	—	400	exp. f.	15—50	4—13	20—03	23.1	57	18.2	19—14	10—00	29—14	19.0	56	12.5	3—04	5—47	9—11

cover the distance westwards in 11.10 and eastwards in 10.38 hours while trains Nos. 7, 8, 7A and 8A will do it in 11.43 hours westwards and 11.03 eastwards. Through passenger trains will make the westward trip in 11.40 hours and eastbound in 11.155 hours while the local passenger trains stopping at every station, are scheduled to make the trip in about 12.49 hours. The through freight schedule is about 15.20 hours and local freight about 17 hours.

The tables on the preceding page give a comparison between the new electric service and the present steam services showing the time to reach destinations and average speed :

Electric Installation and Cost

1. Power Required and Electric System.—It is estimated that about 100,000 kilowatts will be required for the electrification of the entire Tokaido lines between Tokyo and Akashi, a station west of Kobe, and the railway authorities propose to purchase the surplus power from the many private electric power companies operating plants along the line. A network of transmission lines is to connect the various power houses located on the Fuji, Oi, Tenryu, Kiso, Uji and other rivers, each independent of the other as to water supply. The power is to be purchased at the entrance of the direct current substations, so the cost for building power stations, transmission lines, substations, etc., is not included in the estimates of the government scheme. Recognizing, however, that the demand for power is constantly on the increase and that the private companies may not be able to meet the combined requirements of industry and railways, the government has acquired water rights on the Shinano River and approved the construction of a 100,000 kilowatt power plant at this point. Another large steam power plant to be erected at some suitable point for the service of the Tokaido lines is also under consideration. The electric system to be adopted is 1,500 d.c. with the single catenary aerial system approved by the British and French Electrification Committees as the most advanced standard.

2. Lines to be Electrified.—The lines to be electrified are as follows : *Main lines*, 378.3 miles : Yard sidings, 257.4 miles. *Branch lines*, 21.3 miles : Yard sidings, 33.3 miles.

The main line mileage between Kodzu and Numazu is calculated by the Atami cut-off and the electrification between Kyoto and Kobe is based on thc projected completion of quadruple tracks. Of the yard sidings belonging to the main lines the above includes the freight switching tracks at Inazawa, Maibara and Syita, while the branch lines to be electrified are as follows :

Sections	miles	Sections	miles
Takashima—Yokohamako ...	2.8	Suita—Miyahara	2.2
Kawasaki—Hamakawasaki ...	2.7	Azumanada—Onohama ...	2.0
Higashikanagawa—Takashima.	1.4	Osaka—Fukushima ...	0.5
Hiratsuka—Hiratsukashisen ...	1.0	Fukushima—Ujigawaguchi	3.1
Numazu—Hebimatsu	2.5	Ujigawaguchi—Sakurajima	1.3
Ejiri—Shimizuko ...	1.0		
Otsu—Hamaotsu	1.3	Total	12.3

3. Direct Current Substations.—According to the special requirements of each section, either rotary converters or motor generators are to be installed in the various substations. If a rotary converter is used, two 750 volt machines will be connected in series into a set, but if instead, the motor generator is adopted, one generator for 1,500 volts will be used. In either case, one extra set will be installed for reserve at each substation.

The location and capacities of the substations have been decided upon as per the following list based on the train diagrams, voltage drop, wire and other conditions, the distance between every two stations being about 115 miles.

Sections	Substations proposed near stations named below	Unit capacity	Number of sets	Total capacity
		K.W.		K.W.
		1,000	1	1,000
Tokyo-Numazu :	Eirakucho	,,	,,	,,
	Hodogaya ...	2,000	2	4,000
	Ofuna	,,	,,	,,
	Kozu	,,	,,	,,
	Yugawara ...	,,	,,	,,
	Numazu	,,	,,	,,
Numazu-Nagoya :	Kanbara ...	,,	,,	,,
	Shizuoka ...	,,	,,	,,
	Shimada ...	,,	,,	,,
	Kakegawa ...	,,	,,	,,
	Hamamatsu ...	,,	,,	,,
	Futagawa ...	,,	,,	,,
	Gamagori ...	,,	,,	,,
	Kariya	,,	,,	,,
Nagoya-Kyoto :	Nagoya	,,	,,	,,
	Gifu	,,	,,	,,
	Sekigahara ...	,,	,,	,,
	Hikone	,,	,,	,,
	Omihachiman ...	1,500	,,	3,000
	Otsu	2,000	,,	4,000
Kyoto-Akashi :	Yamazaki ...	,,	,,	,,
	Osaka	1,500	3	4,500
	Sumiyoshi ...	,,	,,	,,
	Tarumi	,,	2	3,000

A 1,000 k.w. converter is to be added to each existing substation at Eirakucho and Kawasaki.

Power Lines.—The compound catenary system has been adopted for power-line suspension using a maximum voltage of 1,500 volts direct current on all sections except the Tokyo-Shinegawa section (4.3 miles) which will use 1,200 volts. The steel messenger wire will be 7/13 W. G. No. 6 with No. 19 B. S. hard drawn copper wire for auxiliary messenger service and No. 40 B.S. grooved hard drawn copper wire for the power line. Steel towers with a maximum distance between towers of 300-ft. are to be erected to carry the wires the cost of which has been computed separately for tunnel, bridge and other sections in order to obtain the per mile cost of these different works.

On branch lines timber poles will be used as wire supports for single linetrack and steel towers for double line while as for yard sidings a careful study has been made of the Shinagawa and Kamata stations and two sets of per mile costs have been worked out on the basis of the same study and each of these costs have been applied to the two stations according to the scheme finally approved.

The costs of the complete Toyko-Kobe scheme do not include the work on the additional two tracks between Yokohama and Odawara the Yokosuka line and the sections between Higashi-Kanagawa and Umi-Kanagawa, nor between Nagoya and Nagoya-Minato, Ogaki and Mino-Akasaka and the Taketoya line. For the section between Kodzu and Numazu the Atami cut-off is followed instead of the old Hakone line. Of the yard sidings on trunk lines, the freight siding tracks at Maibara and Suita are also excluded from the estimate. For the section between Kyoto and Kobe, the cost has been worked out upon the basis of quadruple tracks.

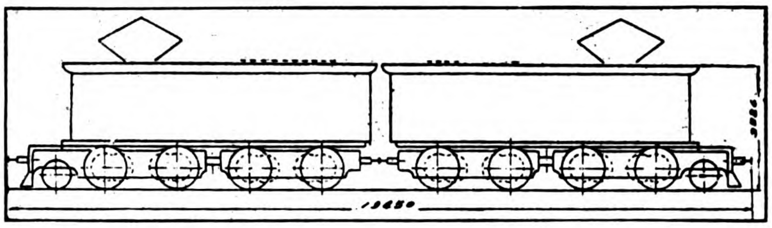
Feeders.—The size ef the feeder has been decided separately for each section, according to the locations of the D. C. substations and the train diagrams, and the cost has been computed accordingly.

Size of Feeders

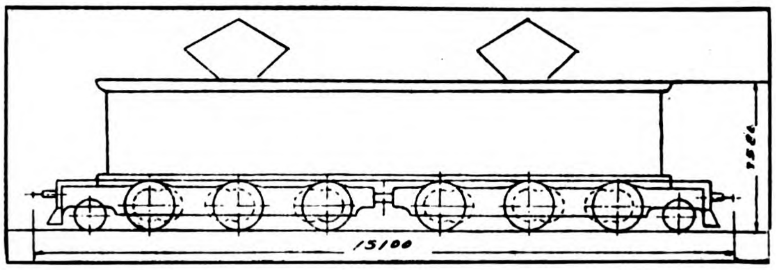
Sections	Mileage	Size of Feeder (10,000 circular miles)
Tokyo—Kawasaki	11.3	0
Kawasaki—Hodogaya	8.4	0
Hodogaya—Ofuna	9.1	0
Ofuna—Kozu	19.4	240
Kozu-Yugawara	13.1	80
Yugawara-Numazu	17.1	160
Numazu—Kambara	17.9	120
Kambara—Shizuoka	15.7	100
Shizuoka—Shimada	17.1	,,
Shimada—Kakegawa	13.4	80
Kakegawa—Hamamatsu ...	17.2	160
Hamamatsu-Futagawa	18.4	200
Futagawa—Gamagori	15.0	120
Gamagori—Kariya	19.2	240
Kariya—Nagoya	15.1	120
Nagoya—Gifu	18.8	200
Gifu—Sekigahara	17.3	80
Sekigahara—Hikone	17.4	160
Hikone—Hachiman	14.0	80
Hachiman—Otsu	18.2	200
Otsu—Yamasaki	14.9	80
Yamasaki—Osaka...	18.0	160
Osaka—Sumiyoshi	14.5	80
Sumiyoshi—Tarumi	14.0	,,
Tarumi—Akashi	3.8	,,

Rolling Stock

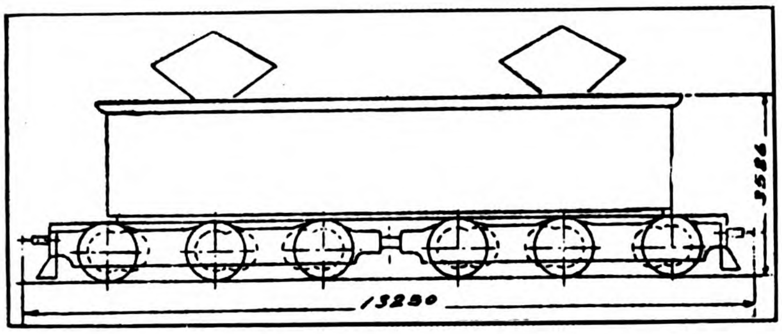
(A) Electric Locomotives.—The electric locomotives to be used will be of the kind known as the Nose Suspension System, in which driving wheels are run by single reduction gears operated by two 750 volt electric motors (insulation to be applied in the case of 1,500 volts) connected in series. The capacity of each motor to be 250 horse power of one hour rating when the voltage is 675 volts with natural ventilation (10 per cent. voltage drop), the same kind of motor to be used in each locomotive. The number of motors,



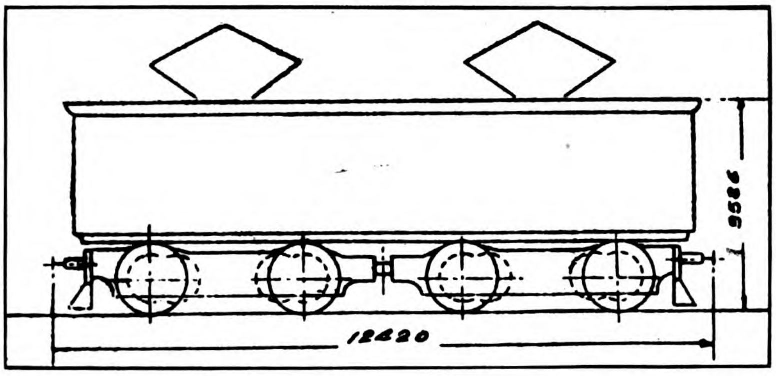
Electric Locomotives for Limited Express Passenger Train: No. of Motors, 8; Capacity, 250 h.p. × 8; Total Weight, 114 tons; Diameter of driving wheel, 49"; Gear Ratio, 2.25.



Electric Locomotive for Express and Through Passenger Train: No. of Motors, 6; Capacity, 250 h.p. × 6; Total Weight, 78 tons; Diameter of driving wheel, 49"; Gear Ratio, 2.5.



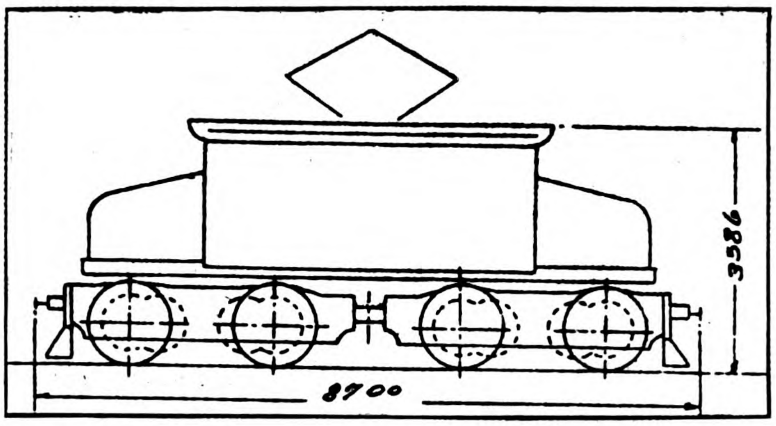
Electric Locomotive for Express and Through Freight: No. of Motors, 6; Capacity, 250 h.p. × 6; Total Weight, 72 tons; Diameter of driving wheel, 49"; Gear Ratio, 3.14.



Electric Locomotive for Local Passenger and Freight: No. of Motors, 4; Capacity, 250 h.p. × 4; Total Weight, 52 tons; Diameter of driving wheel, 49"; Gear Ratio, 3.14.

gear ratio, the diameter of driving wheels, etc., have been decided according to the use to which the locomotives are to be put. One axle with leading wheels are to be put on at each of the front and rear ends of the locomotives for high speed limited express, and ordinary express and through trains for passenger service.

The capacity and the number of motors, etc., have been approved as per the following list, after a study of the loading conditions of motors, and the balancing speed of each train on different grades with due reference to the characteristics of the freight train electric locomotives which had been ordered for the use on the Yamato line. Further, the selection of the type of locomotives, etc., has been made in consideration of grades all over the line, and other circumstances upon the basis of the performance curve of each train on representative section.

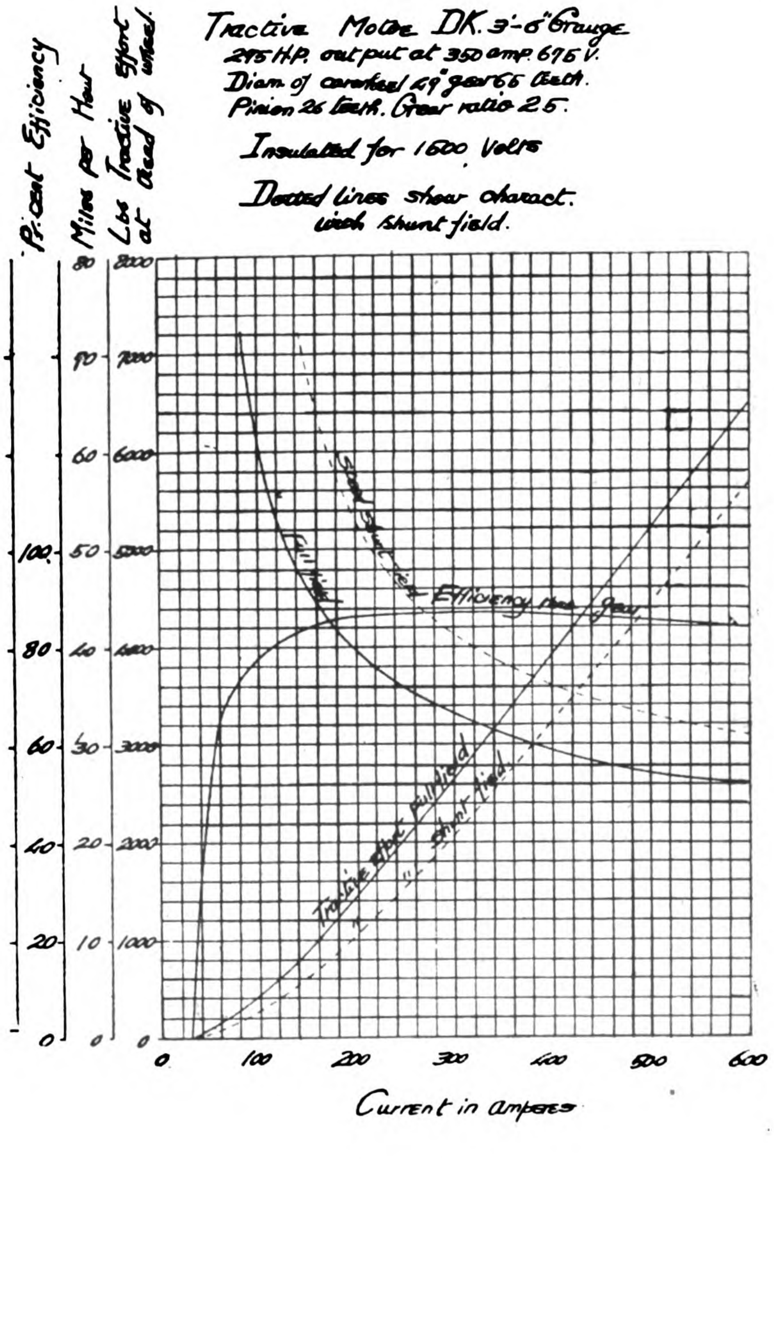


Electric Shunting Locomotive: No. of Motors, 4; Capacity, 150 h.p. × 44; Total Weight, 45 tons.

	Kind of electric locomotives	Wheel arrangement	Motor capacity	Weight (tons) Total weight	Driving wheel road	Diameter of driving wheel	Gear ratio
A	For limited express passenger	000+00—00+000	HP. 250×8	114	104	49	2.25
B	For express passenger	0000+0000	„ ×6	78	72	„	2.50
D	For local passenger and freight	00+00	„ ×4	52	52	„	3.14
E	For express and through freight	000+000	„ ×6	72	72	„	„
F	For shunting	00+00	150×4	45	45	—	—

Explanation: The horse power of the motor is one available in the case of 675 terminal voltage with natural ventilation.

The following list shows the balancing speed of each train and



the loading conditions of the motors on various grades, when the aforesaid locomotives are used. Motor current per cent. in the list is the percentage to 350 amperes of one hour rating current.

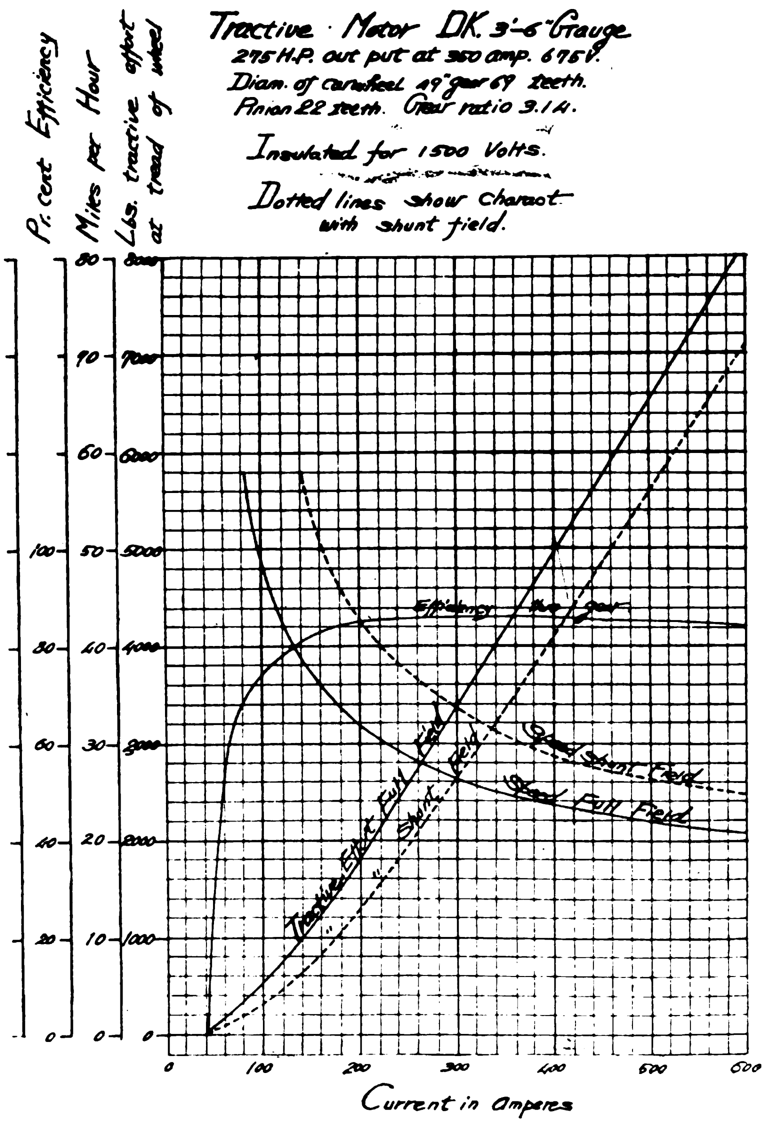
LIMITED EXPRESS PASSENGER TRAIN.—Weight hauled 420 tons; A type electric locomotive: Total weight, 114 tons; Main motors, 8 tons; Diameter of driving wheel, 49-in.; Gear ratio, 2.25.

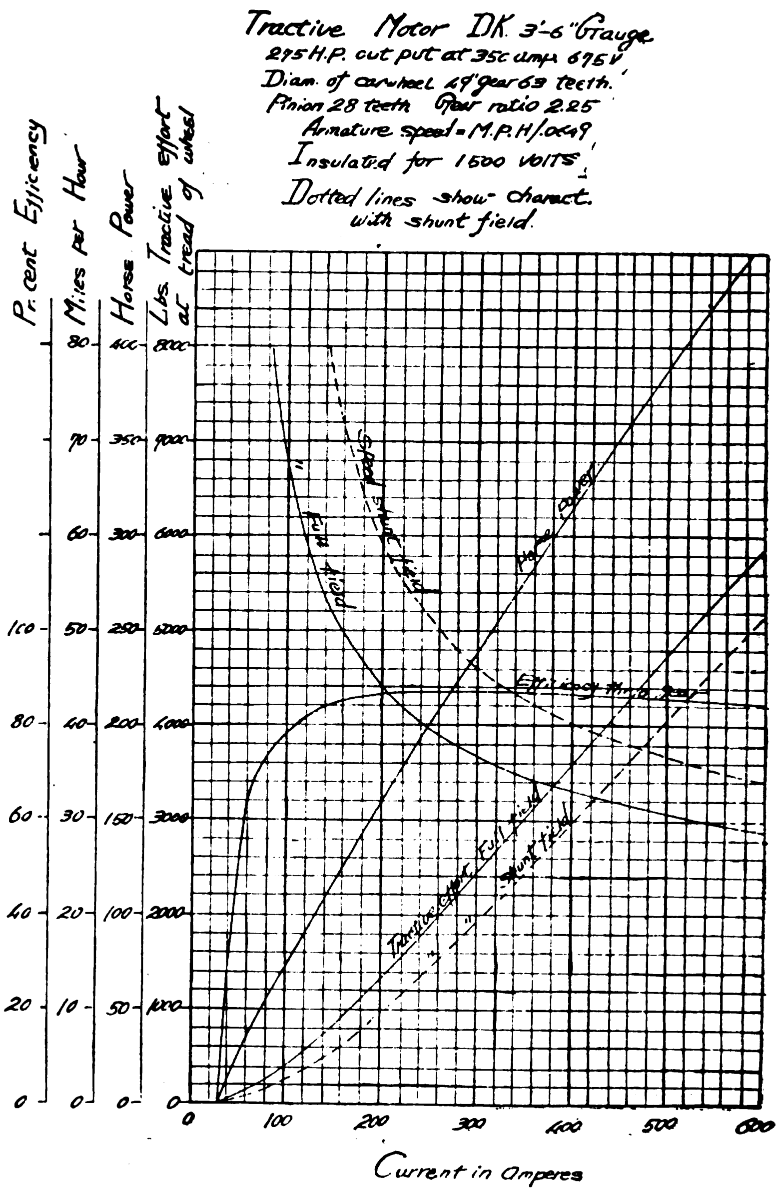
Gradient	Balancing speed (miles per hr.) Full field	Shunted field	Motor current Full field Ampere	Full field Percentage	Shunted field Ampere	Shunted field Percentage
Level ...	52.7	61.2	142	40.6	190	54.2
1/800 ...	49.5	57.7	158	45.2	205	58.5
1/500 ...	48.0	56.0	166	47.2	215	61.5
1/300 ...	45.0	53.1	185	52.8	235	67.1
1/150 ...	41.0	47.9	230	65.7	276	79.0
1/100 ...	38.3	44.2	266	76.0	325	92.9
1/50 ...	33.2	38.0	395	113.0	455	130.0

EXPRESS PASSENGER TRAIN.—Weight hauled, 460 tons; B type electric locomotive: Total weight, 78 tons; Main motors, 6 tons; Diameter of driving wheel, 49-in.; Gear ratio, 2.5.

Gradient	Balancing speed (miles per hr.) Full field	Shunted field	Motor current Full field Ampere	Full field Percentage	Shunted field Ampere	Shunted field Percentage
Level ...	45.3	52.3	152	43.4	202	57.5
1/800 ...	42.5	49.2	173	49.4	222	63.4
1/500 ...	41.2	47.5	183	52.3	234	67.0
1/300 ...	39.0	45.0	205	58.5	255	72.9
1/150 ...	35.2	40.7	255	72.9	308	88.0
1/100 ...	32.5	37.8	305	87.1	360	103.0
1/50 ...	27.7	32.5	450	128.7	515	147.0

THROUGH PASSENGER TRAIN.—Weight hauled, 260 tons; B type electric locomotive: Total Weight, 78 tons; Main motors, 6 tons; Diameter of driving wheel, 49-in.; Gear ratio, 2.5.





Gradient	Balancing speed (miles per hr.) Full field	Shunted field	Motor current Full field Ampere	Full field Percentage	Shunted field Ampere	Shunted field Percentage
Level ...	47.0	54.5	144	41.2	191	54.6
1/800 ...	43.9	51.5	164	46.9	207	59.2
1/500 ...	42.5	50.0	173	49.4	216	61.8
1/300 ...	40.2	47.5	197	56.4	234	66.9
1/150 ...	36.5	43.1	237	67.7	274	78.3
1/100 ...	34.0	40.1	273	78.0	316	90.3
1/50 ...	29.2	34.3	392	112.0	454	129.7

LOCAL PASSENGER TRAIN.—Weight hauled 300 tons; D type electric locomotive: Total weight, 52 tons; Main motors, 4 tons; Diameter of driving wheel, 49-in.; Gear ratio, 3.14.

Gradient	Balancing speed (miles per hr.) Full field	Shunted field	Motor current Full field Ampere	Full field Percentage	Shunted field Ampere	Shunted field Percentage
Level ...	39.7	46.3	133	37.9	175	50.0
1/800 ...	37.2	43.8	150	42.8	190	45.2
1/500 ...	36.3	42.7	155	44.2	200	57.1
1/300 ...	34.4	40.5	170	48.5	220	62.8
1/150 ...	30.8	36.6	210	59.9	263	75.3
1/100 ...	28.5	33.5	250	71.4	305	87.2
1/50 ...	24.0	27.3	385	110.0	445	127.0

LOCAL FREIGHT TRAIN.—Weight hauled, 400 tons; D type electric locomotive: Total weight, 52 tons; Main motors, 4 tons; Diameter of driving wheel, 49-in.; Gear ratio, 3.14.

Gradient	Balancing speed (miles per hr.) Full field	Shunted field	Motor current Full field Ampere	Percentage	Shunted field Ampere	Percentage
Level ...	20.2	35.2	122	34.8	163	46.6
1/800 ...	18.3	33.4	152	43.4	180	51.4
1/500 ...	17.3	32.4	167	47.7	190	54.3
1/300 ...	16.0	30.8	193	53.4	210	60.0
1/150 ...	14.1	28.0	243	69.4	260	74.3
1/100 ...	13.1	25.7	298	85.0	310	88.5
1/50 ...	11.5	21.9	440	126.0	490	140.0

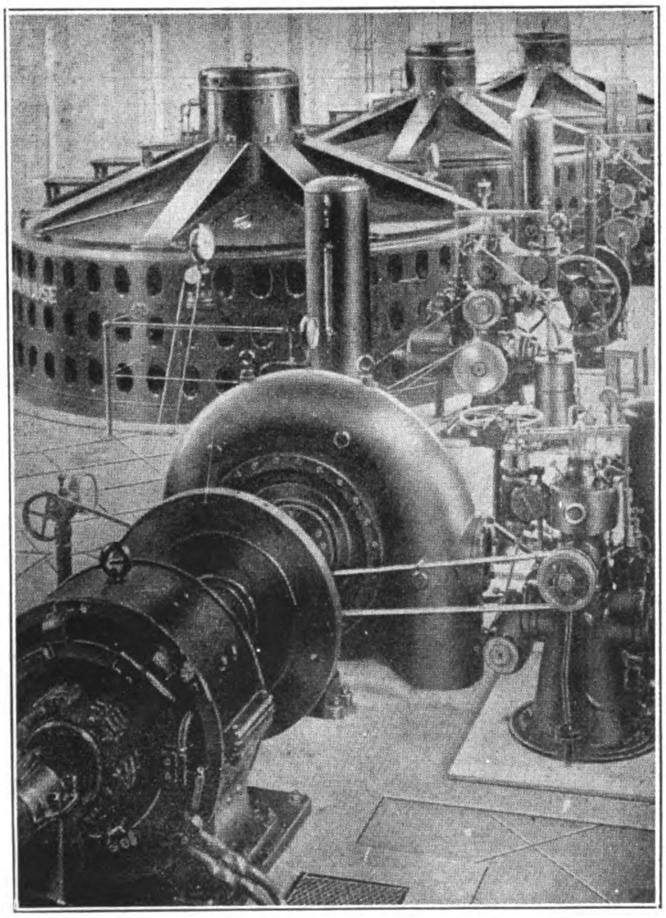
Express and Through Freight Trains.—Weight hauled, 800 tons; E type electric locomotive; Total weight, 72 tons; Main motors, 6 tons; Diameter of driving; Wheel, 49-in.; Gear ratio, 3.14.

Gradient	Balancing speed (miles per hr.) Full field	Shunted field	Motor current Full field Ampere	Percentage	Shunted field Ampere	Percentage
Level ...	24.0	33.5	155	44.3	178	50.8
1/800 ...	22.0	31.5	180	51.5	198	56.5
1/500 ...	21.1	30.3	195	55.7	217	61.9
1/300 ...	20.1	28.8	215	61.5	245	70.0
1/150 ...	18.0	26.0	275	78.5	305	87.0
1/100 ...	16.5	24.3	304	97.2	365	104.0
1/50 ...	14.1	20.9	540	154.0	565	161.5

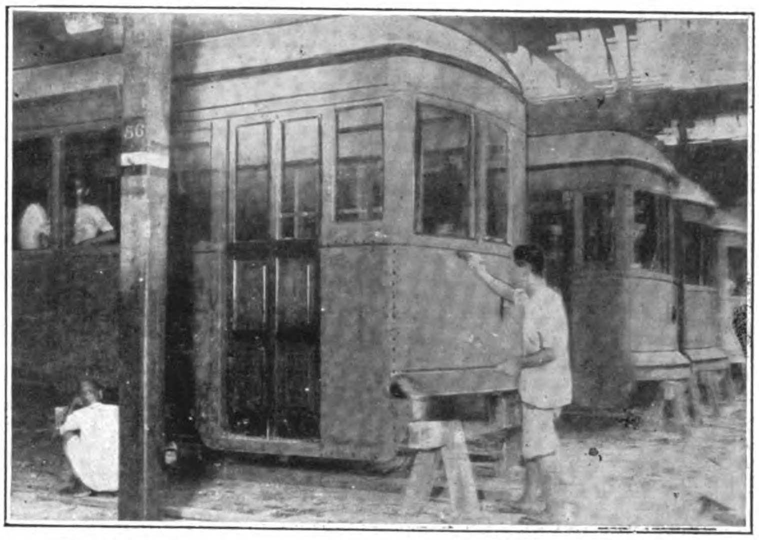
Number of locomotives required and number allotted to various sheds are as follows:

	Kinds of electric locomotives	Number
A.	For limited express passenger trains ...	29
B.	For express and through passenger trains...	46
D.	For local passenger and freight trains ...	107
E.	For express and through freight trains ...	48
F.	For shunting	81
	Total	291

Passenger Cars and Freight Cars.—The present type of passenger and freight cars will be used without any alteration. In the passenger cars, however, 10 one k.w. electric heaters are to be installed. The number of cars to be thus equipped is 1204 for the Tokaido Line and 353 for services between the lines to be electrified and the Hokuroku and the San-yo Lines, total 1557.



Okuwa Power House of the Daido Electric Power Company, 15,000 k.v.a., one of the many Generating Stations feeding into the Districts traversed by the Main Tokaido Railway Line



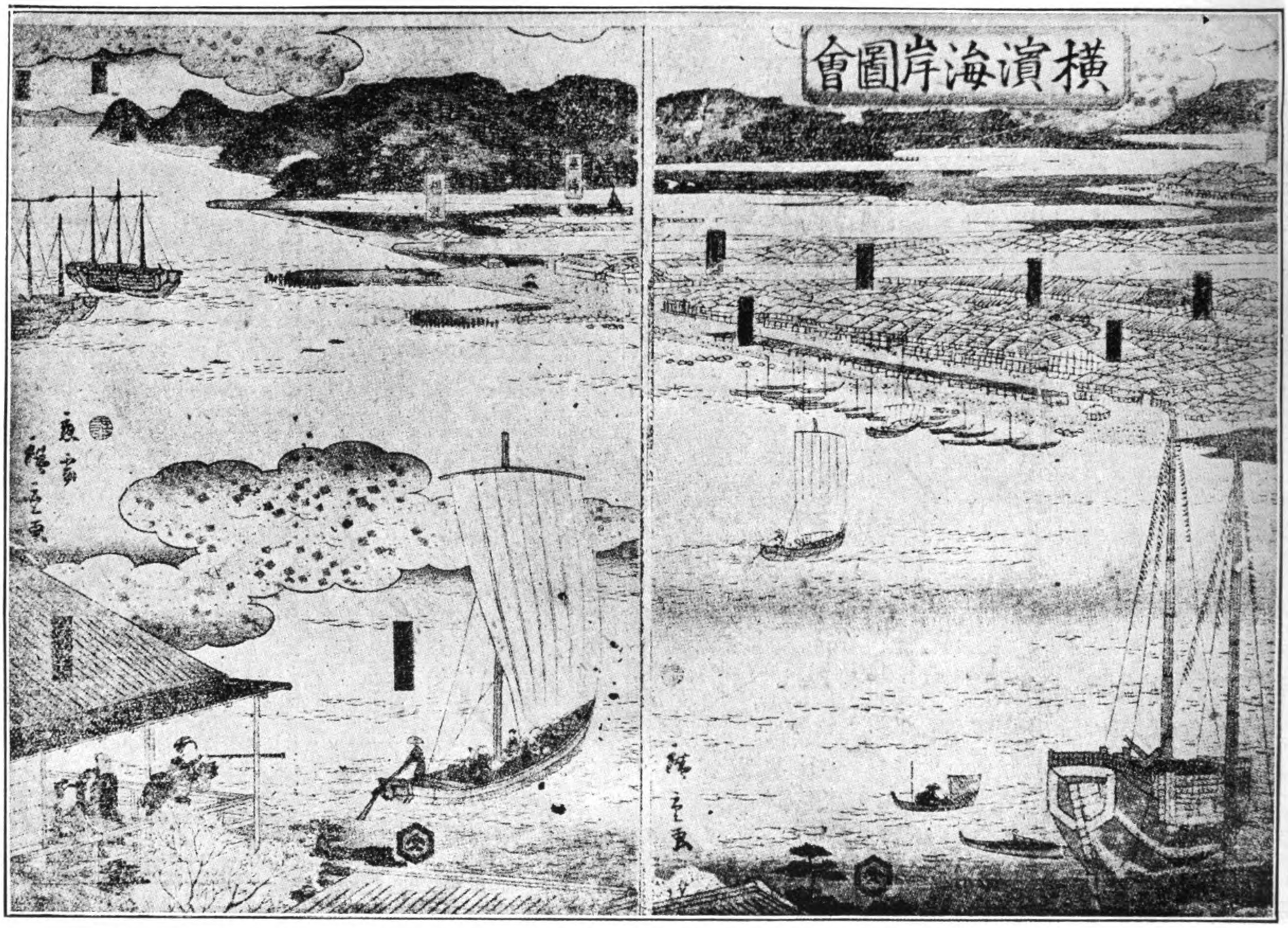
All Steel Cars are now being manufactured in Japan for the Imperial Railways and Private Tramway Lines

Number of locomotives to be allotted to various sheds on the Tokaido Lines.

Sheds	For Limited Express: Regular service	Extra service and reserve	Total	For Express and Through: Regular service	Extra service and reserve	Total	For Local: Regular service	Extra service and reserve	Total	Total: Regular service	Extra service and reserve	Total
For passenger trains—												
Ueno (Tabata) ...	8	4	12	23	6	29	4	1	5	35	11	46
Shinagawa	—	—	—	—	—	—	—	—	—	—	—	—
Takashima	—	—	—	—	—	—	—	—	—	—	—	—
Numazu	—	—	—	—	—	—	2	1	3	2	1	3
Hamamatsu ...	—	—	—	—	—	—	4	1	5	4	1	5
Nagoya ... ... } Inasawa ... ... }	—	—	—	—	—	—	3	1	4	3	1	4
Maibara	—	—	—	—	—	—	2	1	3	2	1	3
Umekoji	—	—	—	—	—	—	5	2	7	5	2	7
Suita	—	—	—	—	—	—	—	—	—	—	—	—
Kobe (Takatori) ...	4	2	6	13	4	17	8	2	10	25	8	33
Total	12	6	18	36	10	46	28	9	37	76	25	101
For freight trains—												
Ueno (Tabata) ...	—	—	—	—	—	—	3	1	4	3	1	4
Shinagawa	—	—	—	11	3	14	—	—	—	11	3	14
Takashima	—	—	—	—	—	—	9	3	12	9	3	12
Numazu	—	—	—	—	—	—	5	1	6	5	1	6
Hamamatsu ...	—	—	—	—	—	—	9	3	12	9	3	12
Nagoya ... ... } Inasawa ... ... }	—	—	—	15	5	20	4	1	5	19	6	25
Maibara	—	—	—	—	—	—	3	1	4	3	1	4
Umekoji	—	—	—	—	—	—	11	3	14	11	3	14
Suita	—	—	—	10	3	13	2	1	3	12	4	16
Kobe (Takatori) ...	—	—	—	1	—	1	3	1	4	4	1	5
Total	—	—	—	37	11	48	49	15	64	86	26	112
Total—												
Ueno (Tabata) ...	8	4	12	23	6	29	7	2	9	38	12	50
Shinagawa	—	—	—	11	3	14	—	—	—	11	3	14
Takashima	—	—	—	—	—	—	9	3	12	9	3	12
Numazu	—	—	—	—	—	—	7	2	9	7	2	9
Hamamatsu ...	—	—	—	—	—	—	13	4	17	13	4	17
Nagoya ... ... } Inasawa ... ... }	—	—	—	15	5	20	7	2	9	22	7	29
Maibara	—	—	—	—	—	—	5	2	7	5	2	7
Umekoji	—	—	—	—	—	—	16	5	21	16	5	21
Suita	—	—	—	10	3	13	2	1	3	12	4	16
Kobe (Takatori) ...	4	2	6	14	4	18	11	3	14	29	9	38
Total	12	6	18	73	21	94	77	24	101	162	51	213

Explanation: For limited express trains two locomotives are put together, but the above figures show the number of single locomotives instead of such sets. Locomotives for local passenger trains and those for freight trains are interchangeable in their use. Besides the locomotives shown above 81 locomotives are required for shunting purpose and 6 helpers on the section between Ogaki and Sekigahara.

Improvement of Communication Lines.—Some of the poles for communication lines planted along the lines are to be removed on account of the erection of steel towers for electrification. The cost of such removal has been calculated according to the investigations made by each Divisional Office concerned.



FROM FISHING VILLAGE TO THE PREMIER PORT IN JAPAN IN 60 YEARS

The above is a reproduction of an old Japanese print picturing Yokohama in 1860, viewed from the Kanagawa shore, looking across the bay towards the shore where the Bund of the Settlement now runs, and the Bluff

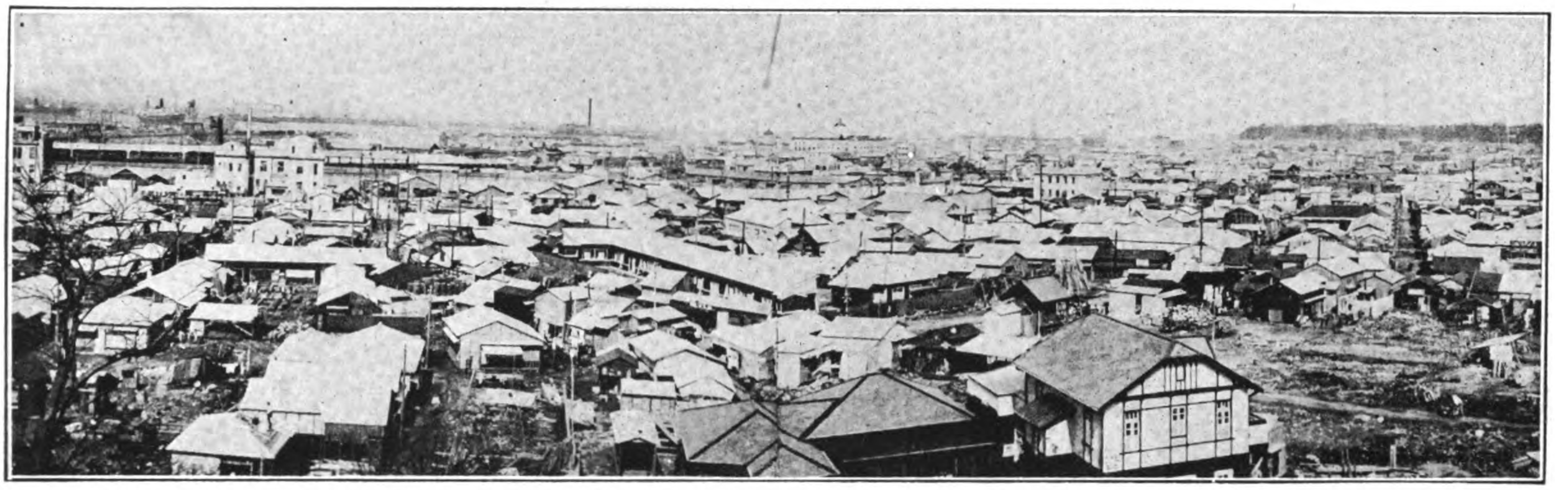
Yokohama Rising From Its Ashes

THE development of Yokohama in the short space of sixty years from a tiny fishing village on a marshy beach to the premier port of Japan has kept step with the equally remarkable rise of the empire to the front rank of world powers. From 100 houses in 1860, the city grew in size until it had a population of nearly half a million in 1919 and was classified by the Diet as one of the six great cities of the empire. In drafting regulations for expanding these six municipalities, the Diet included a plan for a Greater Yokohama that covered the towns of Tsurumi, Machida, Tajima and Kawasaki, together with 23 villages that would quadruple the area of the old city and make Yokohama three times larger than Tokyo. The population of the city had increased to 550,000 in 1920, and it was estimated that in another twenty years it would grow to 1,200,000.

A town planning committee was formed with the idea of speeding up the improvements to maintain the paramount position of the port and facilitate the creation of new industries. Special inducements held out by far-seeing legislators had attracted many industrial plants to Yokohama, and in ten years three big shipyards and several hundred factories of all kinds had taken advantage of these facilities and converted the dreamy old port into a hive of modern industry.

Motomachi, a Favorite Shopping Street of Yokohama as It Appears To-day

This monument to human endeavor was reduced to a pile of charred ruins and



A Year Ago Yokohama was a Dreary Waste of Gaunt Ruins and Brick-strewn Desolation: Temporary Structures Now House a Determined People as They Push Through the Heart-breaking Task of Reconstructing Their City from Its Ashes. View from Nogeyama

smoking ashes after the quake and conflagration had spent their fury in the two days of hell that broke over the city on September 1, 1923. The city that was Yokohama was wiped off the map. Buildings, roads, bridges, the harbor, factories, in fact, all public utilities, were so badly damaged that it would be difficult to convey any accurate idea of the work that had to be done to restore them to a condition that would meet the needs of the population. The population dwindled in a few days to 300,000, but as time passed the people returned to their old homes, and now Yokohama has a population of about 380,000.

Out of a total of 94,000 houses 56,000 were consumed in the fire and 18,000 collapsed, leaving intact some 20,000 more or less damaged shelters as a nucleus for the new city. Out of a total of 206 bridges scattered throughout the city, 74 were completely destroyed and 120 rendered useless by the failure of abutments and damages to superstructure, roadway and approaches.

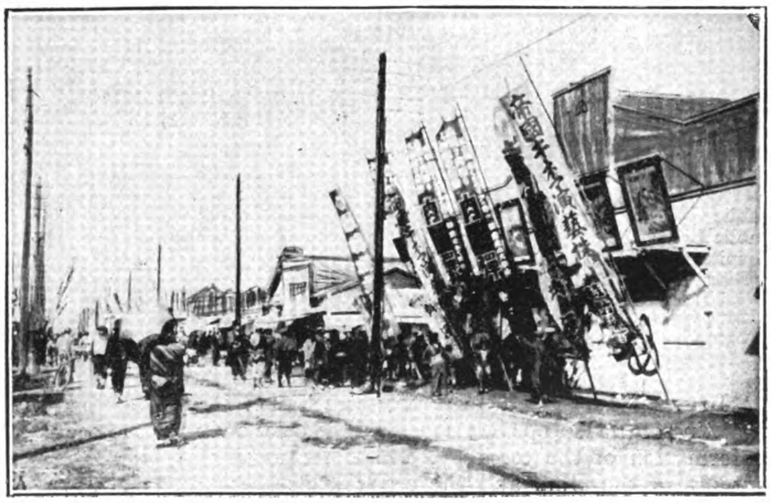
The Town Planning Committee, referred to above, divided the city into various zones along the lines that Greater Tokyo was being planned, and about sixty per cent. of the total area (6,900,000 *tsubo*) was set aside for residences; 22.8 per cent. (2,800,000 *tsubo*) for business edifices; and 11.2 per cent. (1,300,000 *tsubo*) for industries. Buildings on both sides of Yamashita-cho, the main street in the old Foreign Settlement, as well as Honcho-dori, Kaigan-dori, Basha-michi-dori, Isezaki-cho-dori, Onoe-cho dori and Choja-machi-dori were to be constructed of fire-proof materials. This plan has been adopted as the basis for the new rebuilding scheme, the National Government lending to the city of Yokohama the sum of Y. 20,000,000 to facilitate the construction of the fire-proof structures by subsidizing the property owners. This building subsidy, as in the case of Tokyo, amounts to about half the difference between the costs of erecting an ordinary Japanese house and a fire-proof structure. In addition to this assistance, much of the fire-proof reconstruction will be undertaken by the Reconstruction Building Company headed by Baron Nakajima, which is to receive a loan of Y.60,000,000 from the National Government, of which Y.10,000,000 is earmarked for Yokohama.

The Reconstruction Budget as finally passed in February 1924 allotted Y.56,589,000 for the five-year period 1923-29 (fiscal year) as the contribution of the National Government for the rehabilitation of roads, canals, bridges, parks, gas, waterworks, sewers, schools, tramways and the expenses attached to replotting. In addition, the municipality has expended large sums and prepared its own budget for reconstruction, the expenditures aggregating Y.168,740,000, spread over a period of 22 years (1924-41). The following itemization includes the appropriation of the Reconstruction Board, and such sums as may hereafter be set aside for the rebuilding of Yokohama :

	Yen.
Reconstruction of Yokohama Harbor	16,000,000
Railways	9,820,000
Telegraphs and Telephones	17,100,000
Roads and Bridges	43,560,000
Canal Work	17,190,000
Sewerage	4,590,000
Water Works	4,250,000
Revision of Land Lots and Boundary Readjustment	7,840,000
Parks	2,730,000
Yokohama College of Technology (Koto Kogyo Gakko) and Prefectural Schools	4,980,000
Public Primary Schools	16,000,000
Public Library	500,000
Hospital and Other Hygienic Measures	1,900,000
Garbage and Rubbish (Disposal) Station	600,000
Social Undertakings	750,000
Central Markets	4,000,000
Gas Works	3,000,000
Electrical Undertakings	13,000,000

In order to carry out the new street plan for Yokohama, the replotting of the land presents many difficulties owing to the peculiar conformation of the territory, and the necessity of following the contours of the Bluff and the crooked streams and canals which

Another View of Yokohama As It Is To-day



Isesakicho, or Theater Street in Yokohama: New Stores and Moving Picture Theaters Attract the Shoppers and Amusement Seekers

flow through the city. Land values, however, are lower than in Tokyo and there is less inclination on the part of the property-owners to haggle over prices to be paid for their surrendered holdings. The city has been divided into twelve replotting districts, covering approximately 900,000 *tsubo*, or about one-fourth of the burnt area. The National Government will stand the expense of adjusting five of these districts, covering 320,000 *tsubo*, at an approximate cost of Y.2,600,000 and the municipality will undertake the rest with its own funds.

Under the general plan of the Reconstruction Board for replotting the cities of Yokohama and Tokyo landowners are to be requested to surrender ten per cent. of their holdings where their land is required for carrying out the improvements, and in each " land adjustment " district those landowners who are not called upon to surrender any part of their property will compensate those who are deprived of more than ten per cent. to the extent of their loss in excess of that figure. While this scheme is working fairly well in other parts it has been difficult to apply it to the old Foreign Settlement of Yokohama, where the land is held on perpetual lease from the Japanese Government for a nominal ground-rent and is exempt from further taxation.

Although many of these lots have been sold by their original holders to Japanese, a large proportion remain in possession of the foreigners. Land values have enormously increased as a result of the remarkable growth of the port, and the Japanese authorities in the past have sought to levy taxes over and above the ground-rent stipulated in the original agreement. This question was finally carried to The Hague Tribunal, which rendered a decision against Japan. At the end of the war approximately 650 of these perpetual leases were valid, representing about 1,353,628 square feet, paying an annual rental of Y.60,406. Some of these leases have since passed into the hands of Japanese and reverted to normal tenure, and all plots belonging to enemy subjects were confiscated after the war and also sold to Japanese.

In order to rebuild this main business centre along lines that will fit into the general reconstruction scheme and provide for the future growth of the port, the streets of the old Settlement must also be widened and improved, but the foreign leaseholders are withholding their consent to the " mutual aid and sacrifice " plan until they receive definite assurance that their contribution will not be nullified by some new scheme. In general, however, they support the ten per cent. give-and-take idea, but contend that the street widening scheme is too grandiose for the Settlement, and if this be modified the leaseholders will be relieved of the obligation of finding large sums for compensating those who lose more than ten per cent. of their property. As a consequence of this uncertainty, the Settlement and Bluff residential districts remain a dreary waste of gaunt ruins and brick-strewn desolation. A few make-shift wooden structures have been erected in the Settlement and only a tiny church and two or three bungalows remain of the many handsome residences which adorned the Bluff. The erection of many new office buildings planned by foreign firms to take the place of their destroyed quarters are being held up awaiting a concrete scheme for reconstruction which will not be modified.

On the other hand, the value of the foreign leases along the Bund will be considerably diminished if the Japanese Government should exercise its right to fill in the foreshore and reclaim an area stretching out one hundred yards or more into the harbor. When this scheme was first broached it was explained that the land so reclaimed would be converted into a waterside park, and the announcement was received with great satisfaction by foreigners whose properties would be appreciated in value by such an improvement. This contribution to the general welfare of the Foreign Settlement should have served to offset the sacrifices entailed upon the foreign leaseholders in surrendering their land for necessary improvements. As this concession apparently failed to conciliate them, the announcement was made that the reclaimed area would be covered with warehouses and godowns, which, if carried out, would relegate the old Bund with its historic associations to a side street and depreciate the value of the leases by half. Should the National Government insist upon its right to extend this reclamation and hand the new building sites over to Japanese, it would be well within its rights. Such a step, while meeting with the unanimous disapproval of the foreign leaseholders, would probably

hasten the solution of a vexatious problem and permit the early rebuilding of the Settlement.

Before the disaster there were 800,000 *tsubo* of streets in Yokohama, of which some 200,000 *tsubo* on the Bluff were comparatively undamaged. In addition to repairing the damaged streets, the plans of the Reconstruction Bureau call for twenty new thoroughfares, twelve of which, aggregating 30,534 meters in length, will be built by the National Government and the other ten, 12,814 meters long, by the municipality. Appropriations by the Reconstruction Bureau provide Y.6,018,000 for new streets in Yokohama, Y.4,729,000 for repairs, and Y.2,712,559 for bridges forming part of the road system, a total expenditure of Y.13,460,000. Further extensions and improvements on the part of the city over a period of twenty years calls for another Y.30,000,000. The municipality will construct the following roads :

The Horiwarigawa, one of Yokohama's Busy Canals

Number	From To	Length Meters	Width Meters.
13	Hinode Machi, 1-chome, to Idogaya Machi, Kawata	2,789	16
14	Aoki Machi, Shichikencho, to Sengen Machi	2,768	18—27
15	Omote Takashima Cho to Ogida Nishitobe	1,260	15
16	Koyasu Machi sea-shore to Koyasu Machi Kaminoki	1,364	16
17	Kurumabashi to Yamamoto Cho	600	18
18	Hodogaya Machi no Kawata to Ooka Machi, Ohashi	606	22
*19	Chitose Machi, 2 chome, to Minami Yoshida Machi, Minami Mutsume	1,382	20
20	Nakamura Machi, Nishi-no-tani, to Minami Ota Machi, Nishinaka Kochi	945	16—20
21	Kitagata Machi, Kominato, to ShinYamashita Cho	636	18
22	Maita Machi, Mawaritsubo, to Minami Ota Machi, to Shimizu Kochi	464	16

*Expense to be borne by the Municipal Tramway Bureau, which will use this road for a tram line.

The roads to be built by the National Government are given in the article on Roads. The total area of these new roads will be 800,000 *tsubo* (equal to the area of all the roads in Yokohama before the disaster), with 414,000-ft. of gutters with cement surface. Of the twelve roads to be built by the National Government, having an aggregate length of 31 kilometers, 92 per cent. have been surveyed and working plans for 20 per cent. completed. Work on No. 1 road at Onote-Takashima-cho and the reclamation along the waterfront for carrying it through has been commenced.

The main street system will have as its starting-point the new Yokohama station of the Imperial Japanese Government Railways to be erected on the coast near Kanagawa, and will form part of the Tokyo-Tokohama section of the new national highway. Two roads will start from the Sakuragicho station, one *via* Honcho turning to the left and reaching the quays, and the other *via* Bashamichi to Honmoku through a tunnel. A third main thoroughfare will start from the international bridge, and, passing through the business section of the city, connect with the highway to Kamakura.

Of the 37 bridges to be rebuilt by the National Government, the Hagoromo Bashi and three others are now under construction, and preparations pushed forward to start work on five more, three of which are to be finished in the 1925 fiscal year. On the part of the municipality 11 new bridges are to be built, 50 re-spanned and 20 repaired, a total of eighty. Work on some of these has been started and plans for the rest prepared. All of the old wooden bridges are to be replaced with reinforced concrete structures.

Water Works

Yokohama enjoyed the distinction of having the pioneer modern waterworks in Japan, located at Nogeyama, where a reservoir and settling beds distributed the water by gravity to the consumers in the city. These settling beds and reservoir were so completely shattered that they are beyond repair. There was also a settling tank at Nishiya which escaped complete destruction, permitting immediate repairs and the distribution of a partial supply to the city by September 14. Three hundred and thirty thousand feet of mains, 66,000-ft. of distributing and 162,000-ft. of supply pipes, were rendered useless and all the buildings belonging to the Water Bureau destroyed.

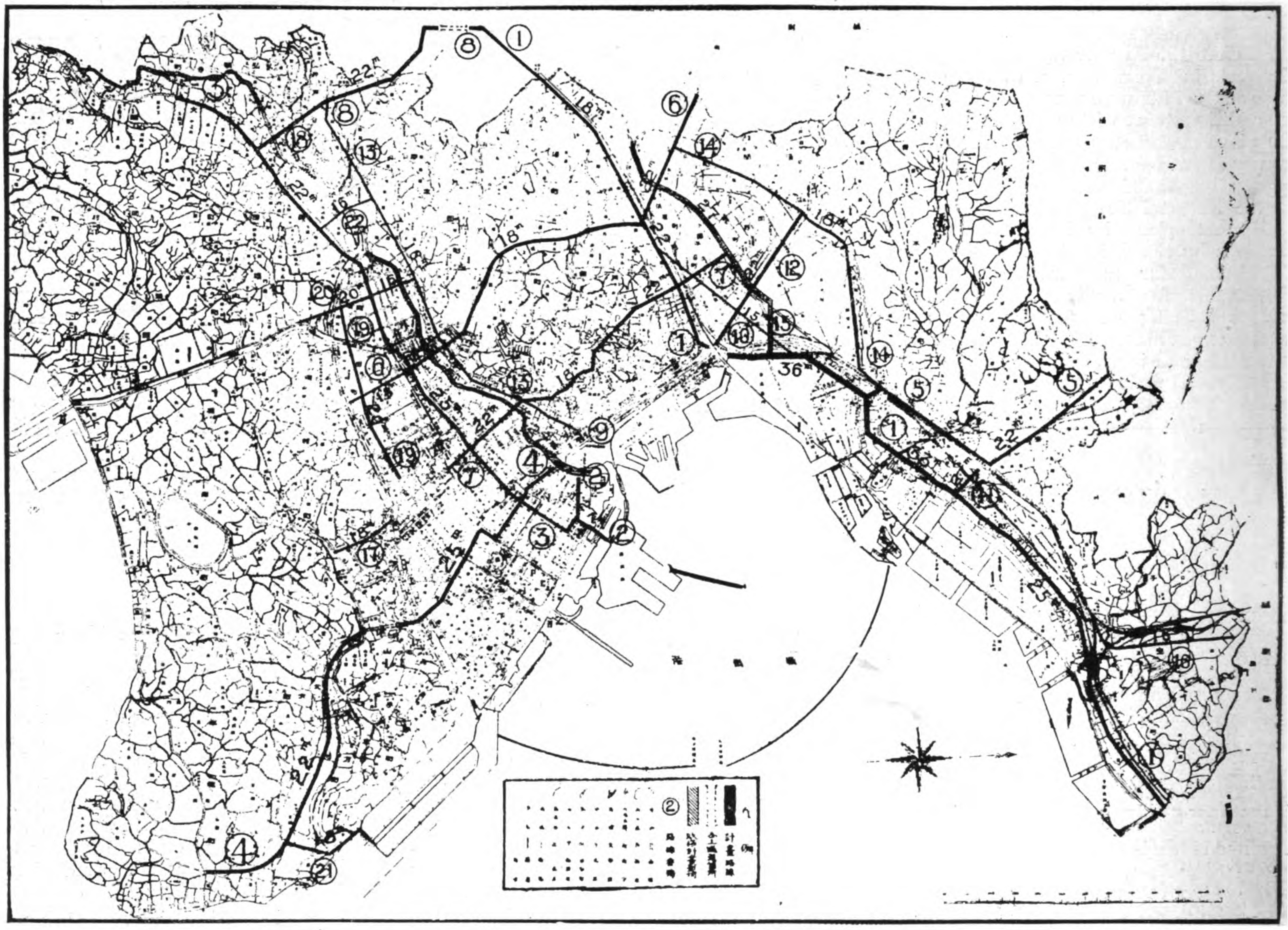
By April of this year the entire water system had been repaired, so that it is now temporarily in the same state as before the disaster. Two new filtration ponds and two new service reservoirs will be commenced in July of this year, to be completed by the end of 1926. Service pipes are to be laid in conformity with the street plans of the Reconstruction Bureau. Before the disaster water was supplied to 85,000 houses, and by April 10 of this year 70,852 houses (including barracks) had been connected up. The water is analyzed daily at the filtration beds and purified by the chlorine process. The Reconstruction Budget sets aside Y.3,000,000 for repairs to the waterworks, of which the National Government will defray one-third. Other extensions projected by the city will raise this to a total of Y.4,250,000.

Nogemachi Street, Yokohama

Gas Works

The gas supply of Yokohama is a municipal undertaking, and in the quake the gas works were badly damaged and most of the distributing mains rendered useless. Rehabilitation consists of restoring the manufacture and supply to 2,500,000 cubic feet per day by a new gas producing and by-products plant, gas holders and other equipment, repairs to buildings and relaying and repairing mains and supplying new meters. New equipment, ordered last July from the Power Gas Corporation of Stockton-on-Tees, to produce 1,000,000 cubic feet per day, is now being erected, and supplementary equipment is also being arranged for.

Repairs to 100 miles of gas mains was commenced last July, and to date 85 miles have been completed. Before the disaster the city



Map of Yokohama showing New Street System: Streets Numbered 1 to 12 are to be built by the National Government; from 13 to 22 by the Municipality

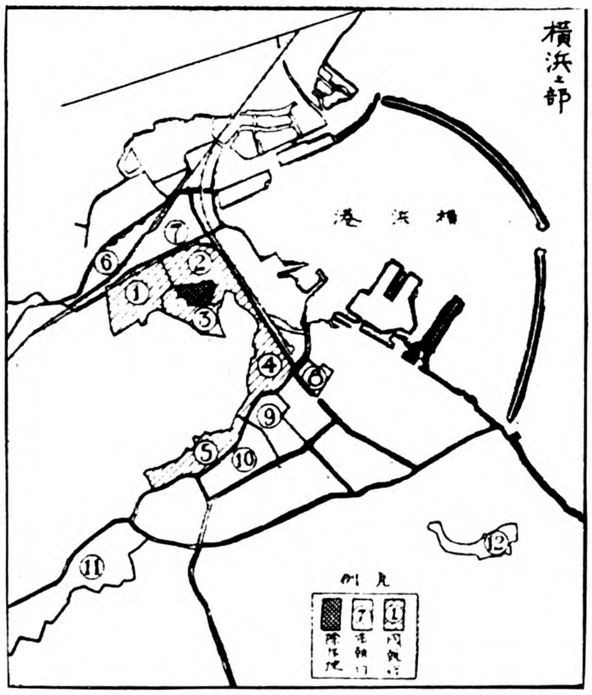
was supplying 2,140,000 cubic feet of gas daily to 22,000 houses, and in June of this year connections were restored to 9,000 houses. By the end of March 1926 the plant will be producing 1,500,000 cubic feet per day and supplying 18,000 houses. The Reconstruction Budget allots Y.3,000,000 to defray the costs of new plant and repairs to the Yokohama Gas Works, which, however, must be borne entirely by the city, as well as the interest charges.

Sewers and Drains

The sewer and drainage system of the city was also completely destroyed by the action of the earthquake, and to facilitate reconstruction the National Government has allotted the sum of Y.1,250,000, bearing half the expense. About 300,000-ft. of sewer mains will be built with this money at an estimated cost of Y.4.25 per lineral foot.

Canals

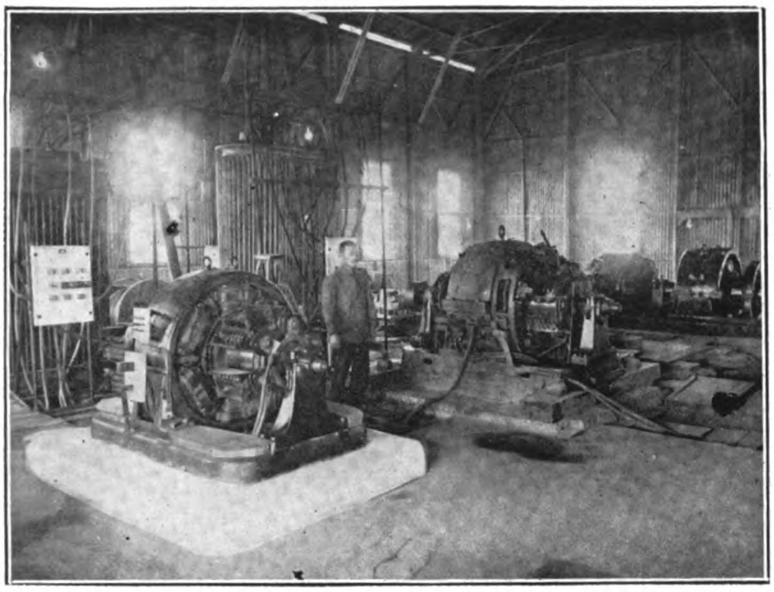
There are five canals in Yokohama—the Katabiri-gawa on the north; Ooka-gawa and Shinyoshida-gawa in the centre; Nakamura-gawa and Horiwari-gawa on the south. The two last are short cuts that connect Yokohama with the Boso districts and the peninsula of Miura, but are too shallow, so the section between the Yawata and Yamashita bridges, about 2,900-ft. in length, are to be dredged to a depth of 5-ft. at low tide and widened from 90 to 108-ft. The Katabara-gawa, running through the factory district to the harbor, is to be dredged to a depth of 5 feet at low tide, and the Ooka-gawa is to be widened to 90-ft. and dredged to 5-feet at low tide. The expenditure for canal improvement in Yokohama is set at Y.5,612,000.

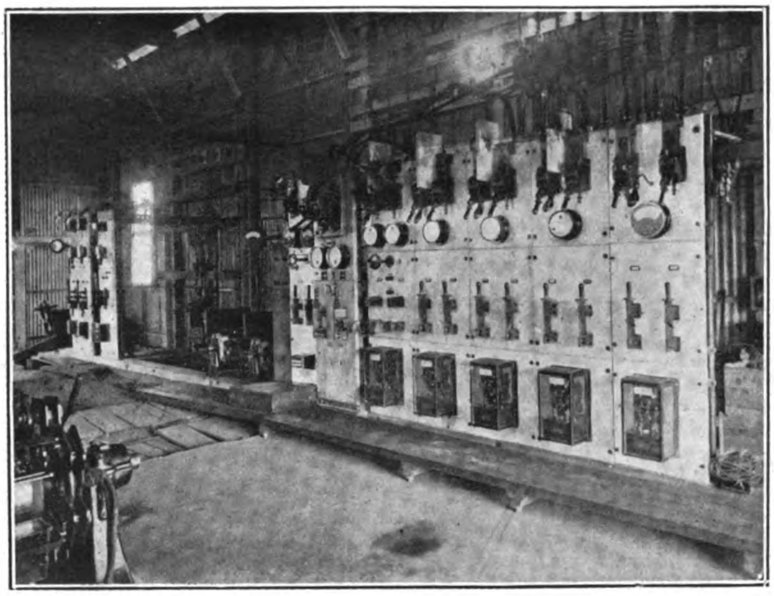


Sketch showing the 12 Replotting Districts of Yokohama. The expenses attached to adjusting the values of five of these districts shown by diagonal lines will be borne by the National Government; the rest by the Municipality

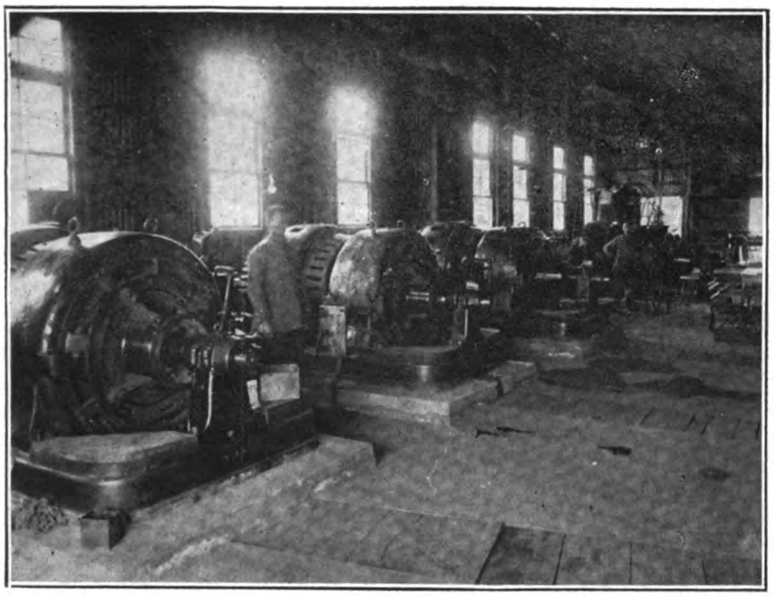
Parks

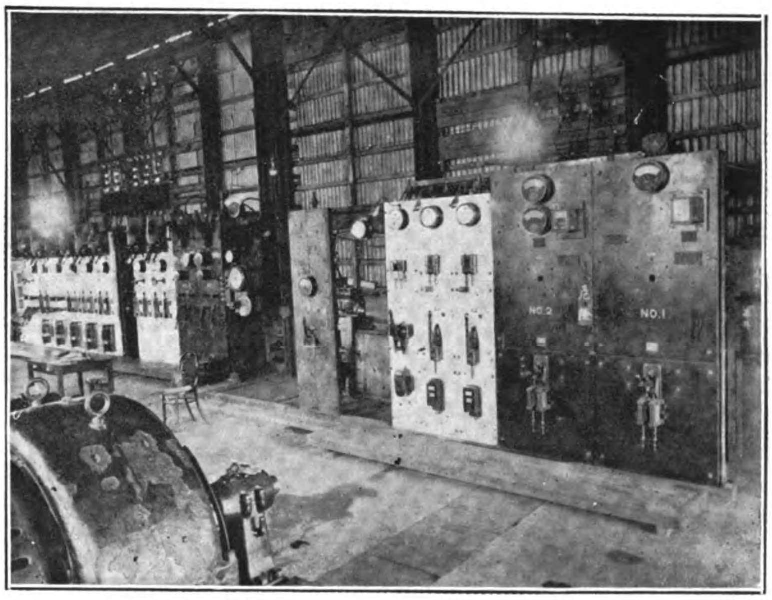
Four new parks are to be created by the municipality, covering an area of 46½ acres. The principal park is the one referred to in this article along the waterfront to be known as the Yamashita Park, to be formed on the reclaimed area, 3,000-ft. long and 300-ft. wide. The Hinode river, so-called, is to be filled in and used as a park, while another park will be located on the foreshore at Kanagawa. The old settling pond at Nogeyama, which



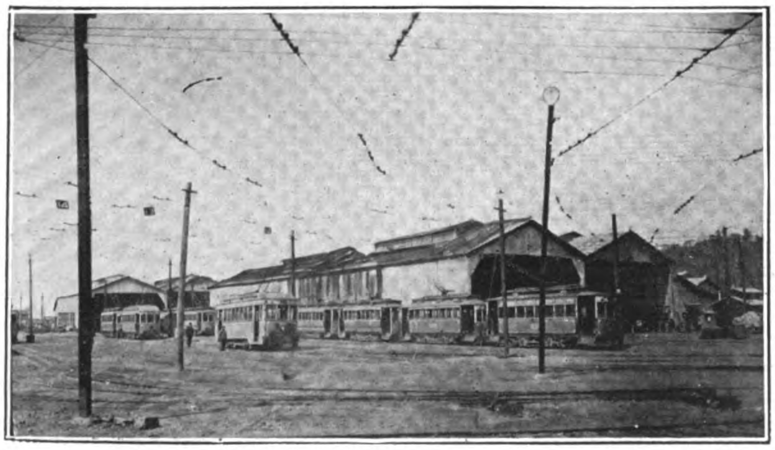


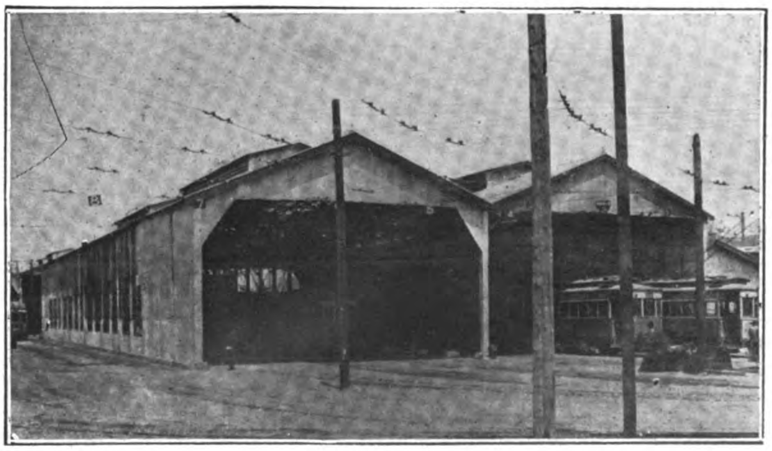
Chitose Transformer Station and Switchboard





Minato Bashi Transformer Station and Switchboard

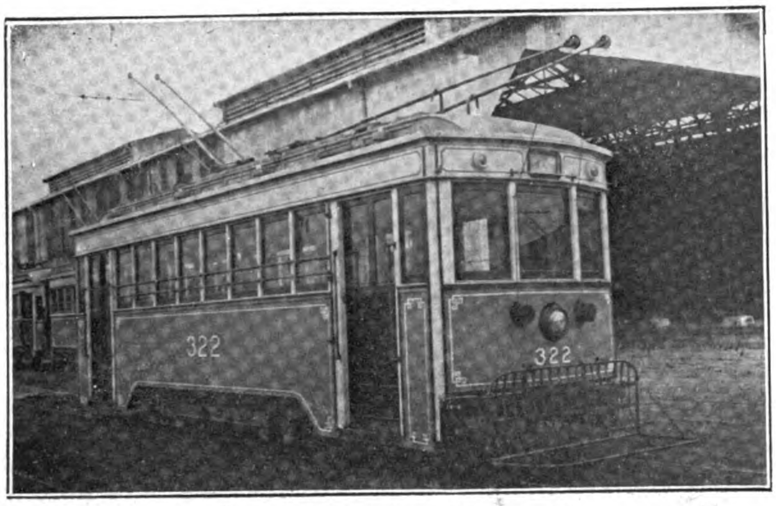




Takigashira Car Barns

YOKOHAMA MUNICIPAL TRAMWAYS

The Sub-stations and Car Barns are Temporary Steel Frame Structures Sheathed and Roofed with Corrugated Galvanized Iron Sheets



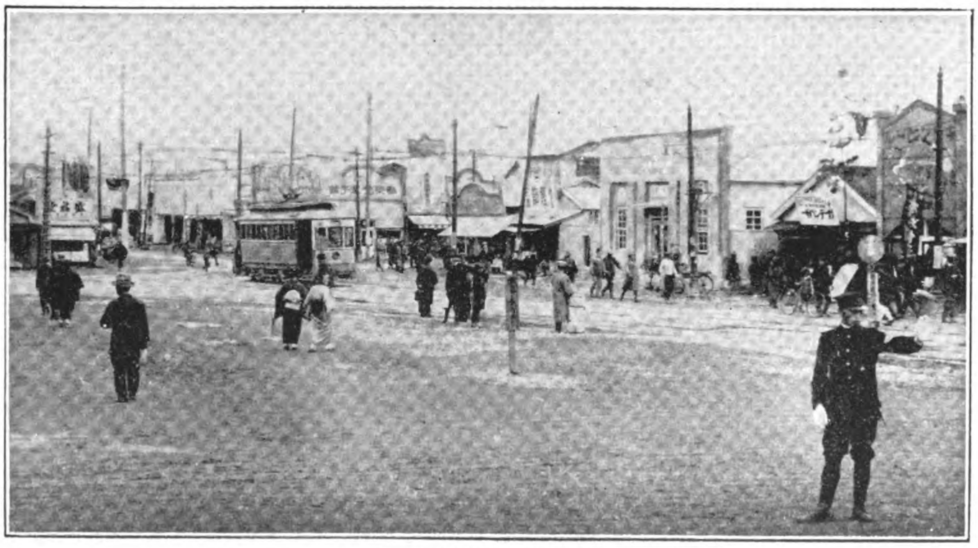
New 30-ft. Cars of the Yokohama Municipal Tramways, Carrying 70 Passengers

suffered such great damage, as to be beyond repair is also to be converted into a park.

In addition to the above reconstruction plans, the National Government has liberally provided for Yokohama in allotting funds for social welfare institutions, hospitals, schools, markets and other public utilities whose immediate restoration costs are beyond the ability of the city to meet at this time. These national appropriations are to be used up before the end of 1929, when the city will take over the financing of its own program of improvements and extensions.

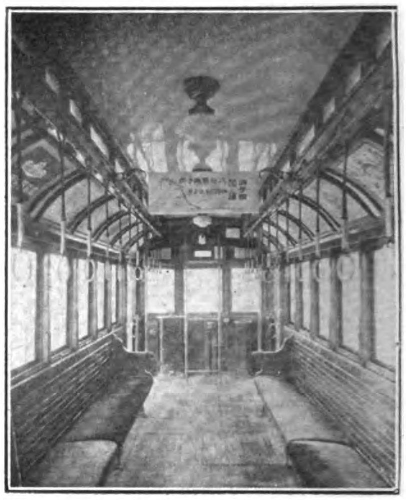
When the surface lines in Yokohama were taken over from the Yokohama Electric Railway Company by the municipality in 1921 the city acquired 12 miles 14 chains of track, 32.1 miles of low pressure transmission lines, 1,341 wooden poles, 1,055 iron supports, and 107 electric cars, as well as certain office and service buildings and one transformer station.

The lines were then rapidly extended and in many places double-tracked. Progress up to the time of the earthquake was rapid and the value of the properties greatly enhanced. With the exception of the line to Yawata Bashi and one or two other places, the earthquake practically wiped out the entire system. The tracks remained, but in many places it was impossible to run cars over them until new foundations were laid. The fire played havoc with the wires and pole supports; bridges had to be rebuilt and temporary structures erected; the transformer station was a wreck; office buildings were lacking; in fact, all the equipment had to be replaced or repaired before traffic could be resumed.



Bashamichi Road, Yokohama

Untiring labor cheerfully performed worked miracles, and by April 1924, six months after the town was laid in ruins, the tramways were again in operation, several additions were made to the lines, and many improvements carried out. At the end of 1924 there were 26 miles of track, of which 13.2 miles were single and 13.8 miles double. In 1924 two new lines were constructed: 1, Honmoku line, 1 mile 15 chains; 2, Isogo line, 1 mile 10 chains. During the present year two more new lines will be completed—the Sugayama line, 1 mile 75 chains, and the Kubo Machi line.



Interior View of Car

Despite the hard times through which Yokohama has passed since the earthquake, the tramway returns for last year compared favorably with 1922, the year before the earthquake. The number of passengers carried was 48,394,796, and the revenue Y.2,440,914. In the earthquake year 47,679,796 passengers were carried and Y.2,369,760 collected in fares, while in 1922 the number of passengers was 47,424,796, with revenues of Y.2,754,800.

In March and April 1924 only 70 cars were in operation, but by the end of May this had increased to 107, and by July to 120. At the end of December 1924 the Electric Bureau owned 158 four-wheel cars, 2 box freight cars, 6 flat freight cars and 2 water-sprinkling cars.

The Bureau owns two transformer stations, one at Chitose, equipped with one 300 k.w. rotary converter, one 500 k.w. rotary converter, and one 500 k.w. motor converter, with transformers, switchboards, etc. The other station at Minato Bashi is equipped with two 300 k.w. motor generators, 1 rotary converter of 300 k.w. and two motor converters of 200 k.w. There are also well-equipped workshops at the Takagashira car barns, containing all the most modern machines for car repairs and line maintenance.

The financial statement of the Electric Bureau gave its assets on December 31, 1924, as follows: Cash, Y.695,052.52; equipment, tracks, machinery, etc., Y.9,674,792.98; and materials in storage, Y.426,913.75, a total of Y.10,796,732.25.

The income of the Bureau in 1924 was Y.2,440,914.83, and expenditure Y.1,367,782.19, leaving a balance of Y.1,073,132.64 as profit for the year.

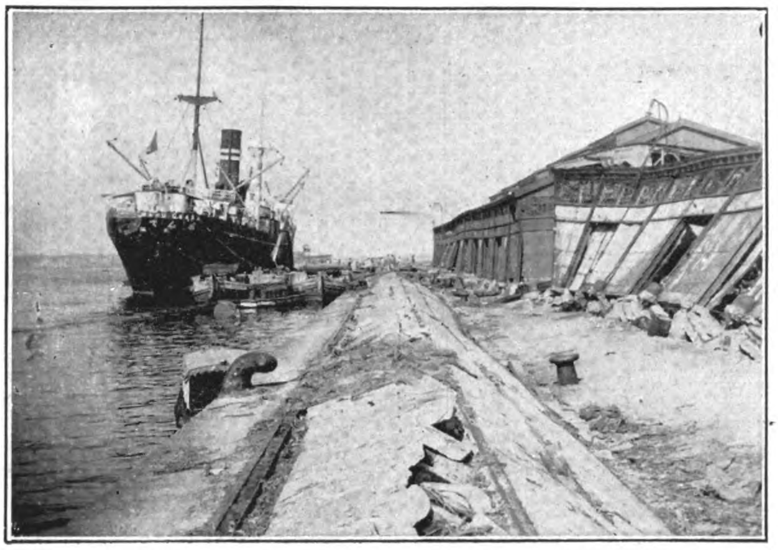
The Key to Tokyo's Future Prosperity

(Continued from page 360)

The details of how this area will be aggregated is shown in the following table:

	Tsubo
First section: adjacent point to compounds of the former Imperial detached palace in Shiba	41,460
Second section: adjacent point to Itchome, Shibaura,..	57,700
Third section: adjacent point to Shinagawa station ..	181,723
Fourth section: adjacent point to Tsukijima	234,699
Fifth section: adjacent point to Etchujima	192,811
Sixth section: adjacent part to the fifth section on the south side	127,944
Seventh section: adjacent part to the sixth section on the east side	225,676

Failure of Quay Wall and Consequent Damage to Warehouse

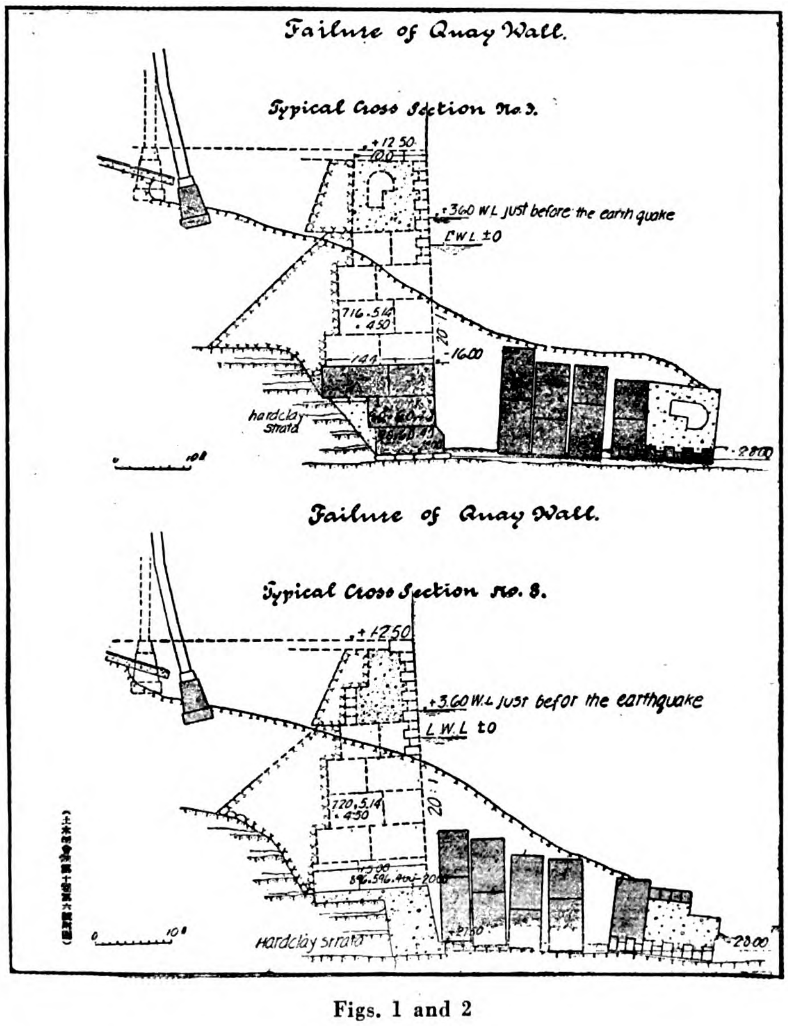


Showing Damaged Warehouse Caused by the Quay Wall Sliding Out

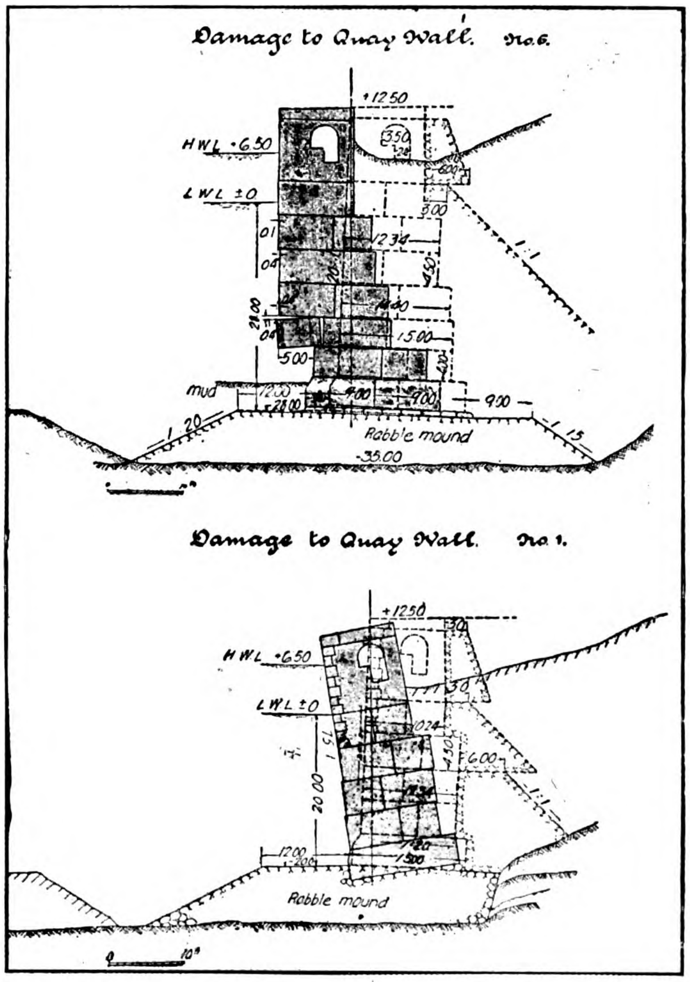
Yokohama's Brilliant "Come-Back"

The Splendid Work of the Harbor Engineers

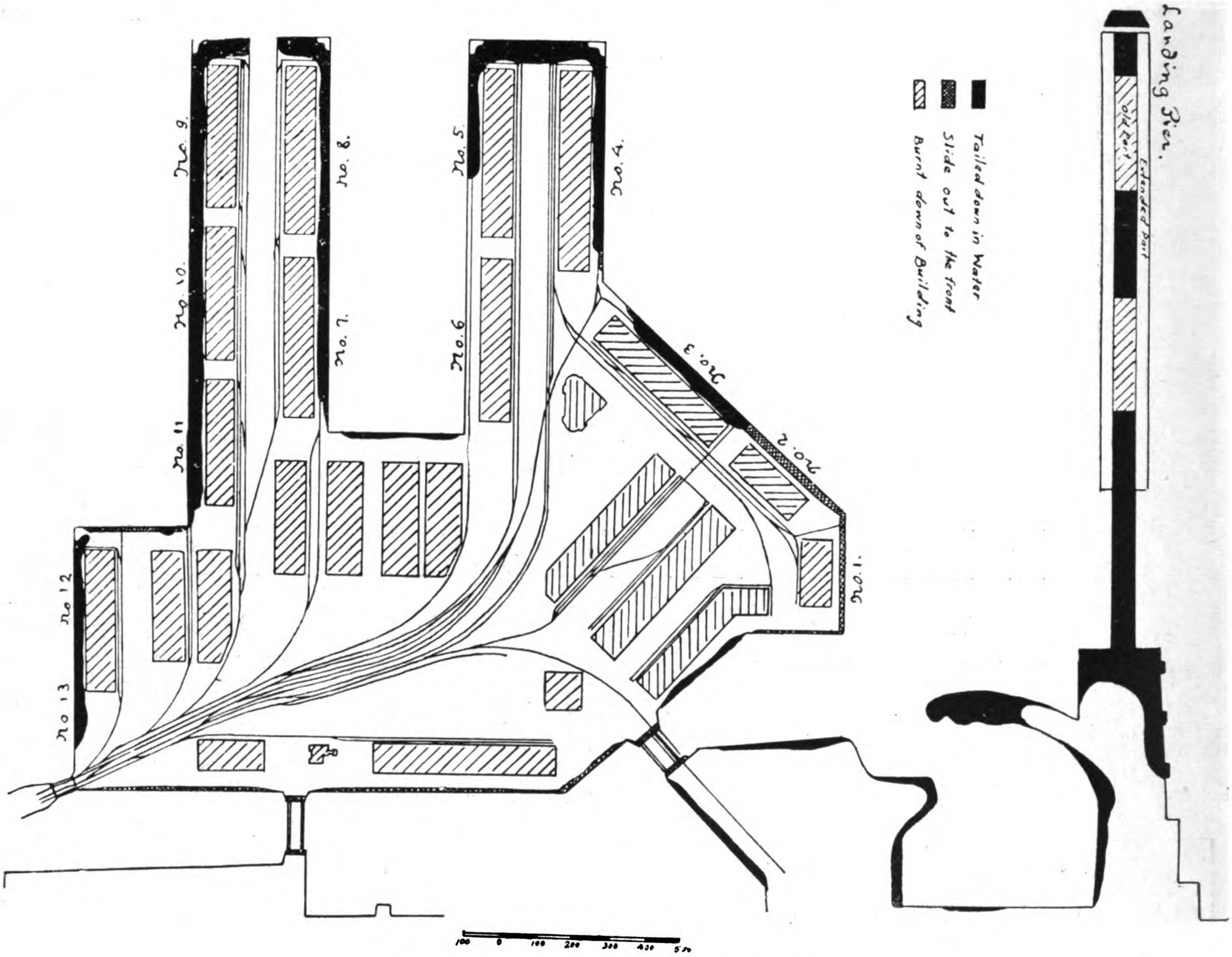
It is no detraction from the splendid work accomplished by other official and private technical organizations in restoring the shattered public utilities of the Tokyo district to state that the task of the Yokohama harbor authorities calls for a very high measure of praise, not for the rapidity with which restoration was carried out, but for the skillful manner that many serious engineering problems were encountered and surmounted. The quake and fire which wiped out the city of Yokohama and destroyed its wharves, quays, breakwater and other harbor facilities struck a blow that menaced the very economic life of Eastern Japan. Yokohama is the main gateway to the country, the port of entrance through which passes a steady stream of travellers and the major articles of import and export upon which the economic prosperity of the empire so largely



Figs. 1 and 2



Figs. 3 and 4

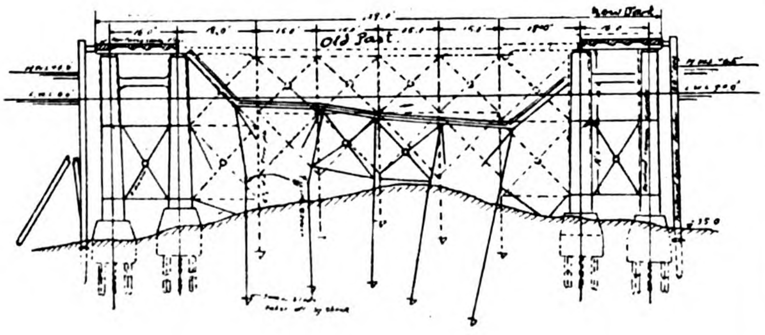


Damage to Port Facilities of Yokohama Customs House

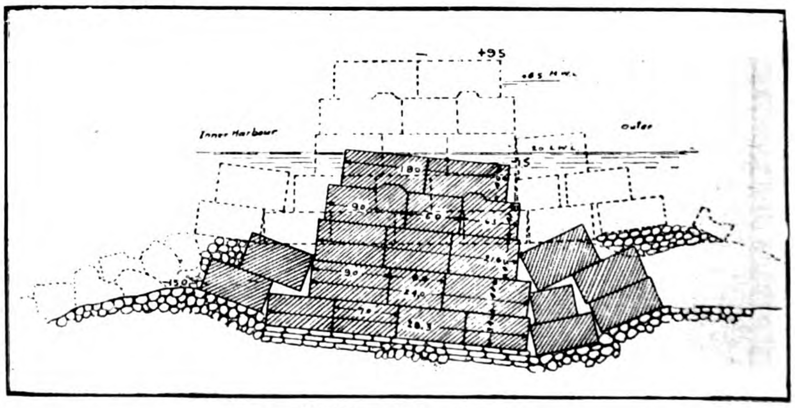
depends. The harbor is filled with vessels flying the flags of all nations, the ocean gateway of a great empire, the front door to its capital city.

Because of the shallowness of Tokyo bay only the smallest coastwise steamers can discharge alongside the inadequate quays of the capital; all major cargo has to be transferred from ocean-going steamers at Yokohama and transported by rail or lighter to Tokyo at a cost which often exceeds the value of the merchandise laid down in Yokohama. A very large percentage of this traffic is made up of the necessities of life, and the extra transportation charges bear heavily on the costs of living in the metropolitan district. Some idea of the importance of this traffic is seen in the following figures. Out of a yearly average of 7,500,000 tons of cargo handled at the port of Yokohama, 3,700,000 tons are destined for or shipped from Tokyo, of which some 200,000 tons are handled by the railway and the balance by lighter. The bulk of the traffic is carried by lighters and barges discharging direct to the warehouses and stores situated along the 50-odd miles of Tokyo's main arteries of traffic, the canals and waterways, which carry an aggregate of 18,000,000 tons of merchandise annually. Any serious breakdown in this vital distribution machinery, increasing the costs of transport between Yokohama and Tokyo, would immediately be felt in higher costs of living.

This is just what happened when the earthquake dislocated the railway facilities and the fire destroyed sixty per cent. of the lighters and threw the task of meeting the abnormal transporta-



Failure of Landing Pier



Sinking of Breakwater

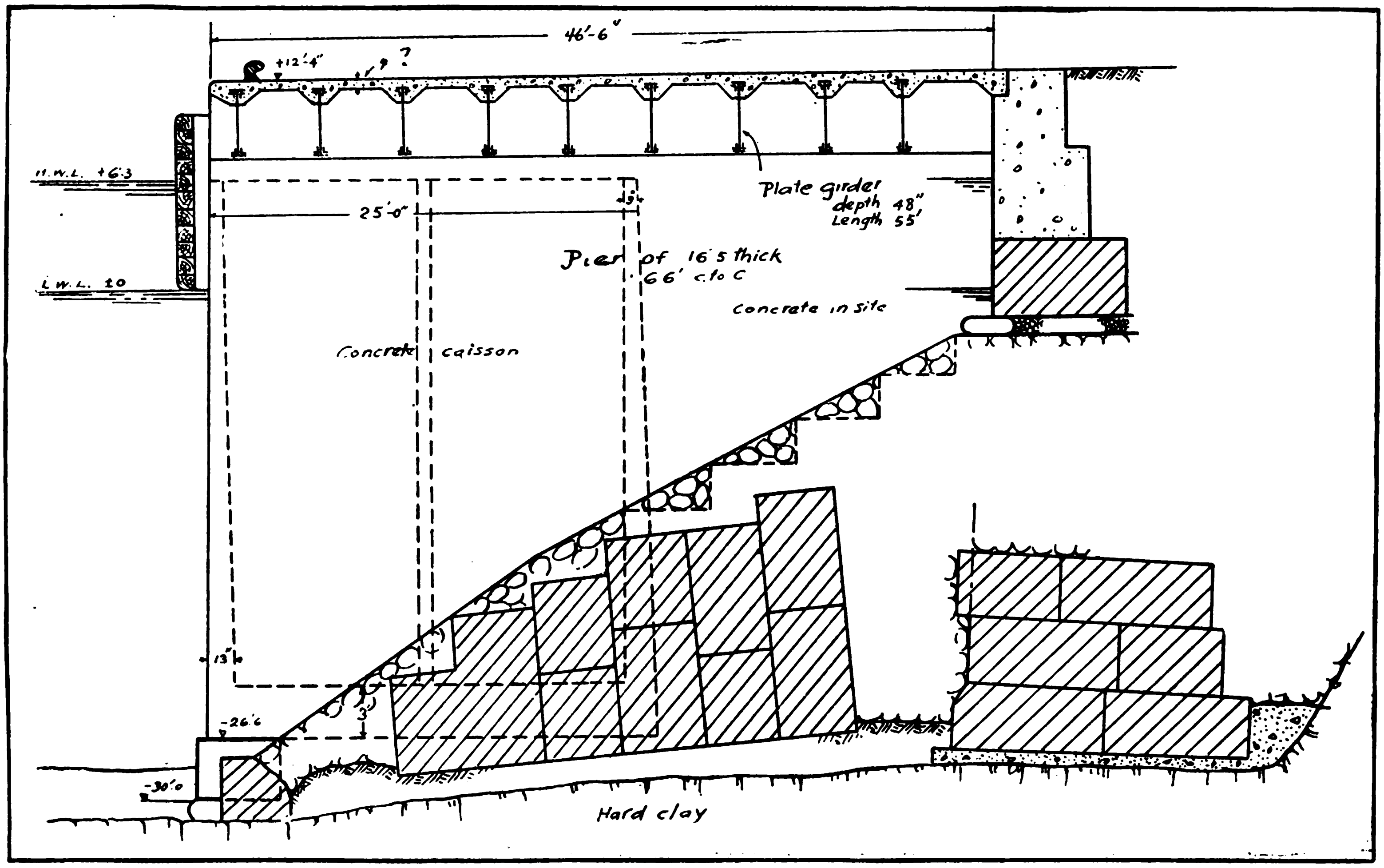


Fig. 7 : Reconstruction of Quay Walls Nos. 9, 10 and 11

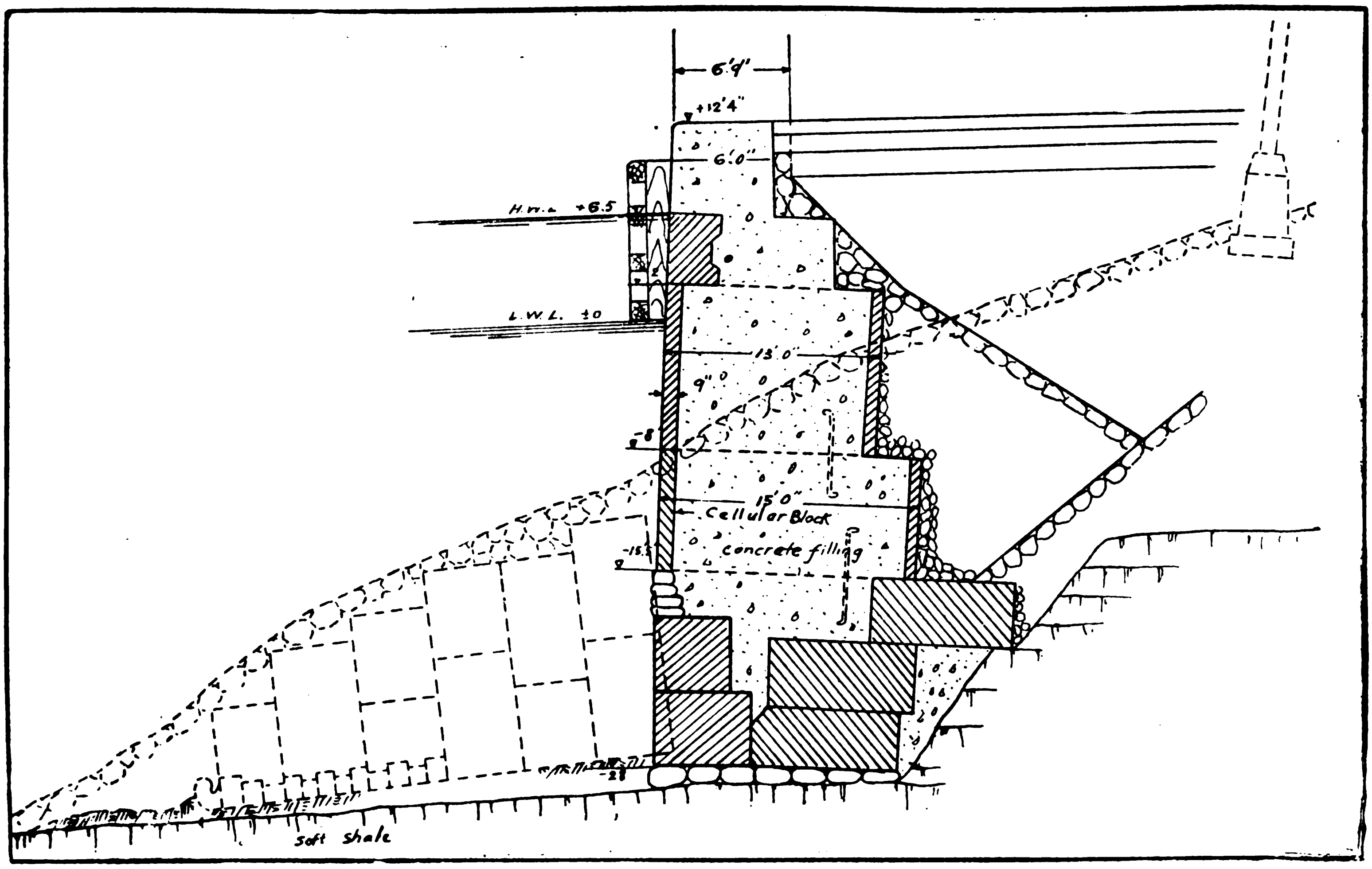


Fig. 8 : Reconstruction of Quay Walls Nos. 3, 5 and 8

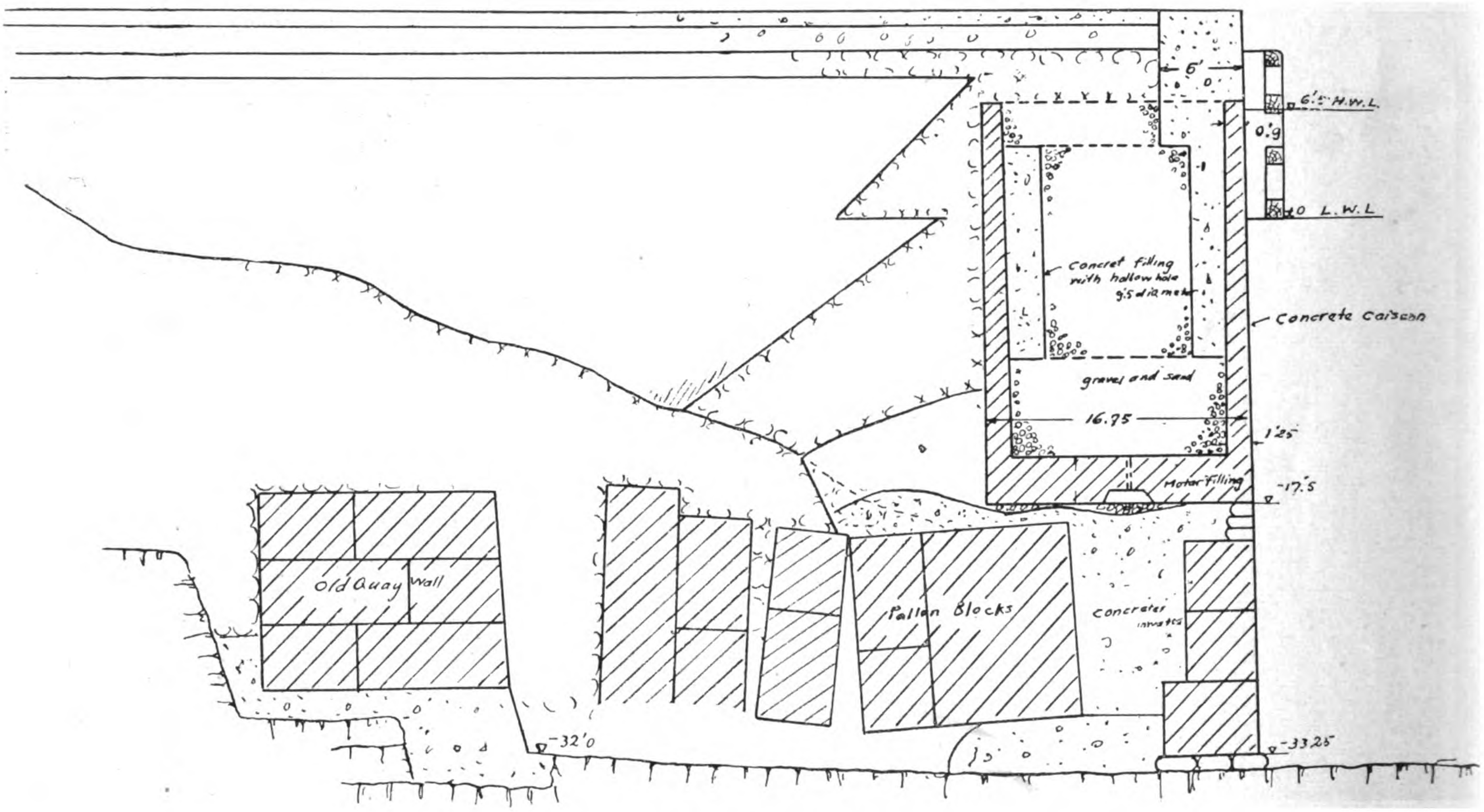


Fig. 11: Reconstruction of Quay Wall No. 4

tion demand between Yokohama and Tokyo upon the 3,000 remaining lighters. The transport charges jumped from Y.1.80 per ton to six and seven yen and over. Not only was the import and export trade of the port brought to a complete standstill, but the immense coastwise traffic supplying the daily requirements of millions of people was paralyzed. Large ships were compelled to creep up as near as they could to Tokyo, anchoring in the offing several miles from the shore, in order to decrease the lighterage on articles of immediate necessity for the relief of the people and erection of temporary quarters.

For the time Yokohama's usefulness was suspended. Heavy cargo could be landed only under the greatest difficulties, and the charges became so prohibitive that the business of the port was diverted to Kobe and articles of prime necessity for the relief and rebuilding of the stricken area unloaded there and transported to Yokohama and Tokyo by rail. Many business houses despairing of early restoration of the port moved their head offices to Kobe, and an agitation was started to divert the huge silk export shipments from Yokohama to this port. The authorities, however, were keenly alive to the importance of Yokohama as the main entrance to the capital, and one of their first acts was to complete plans for rehabilitating the harbor works, appropriating for this purpose Y. 14,000,000. The Home Department of the Imperial Government, entrusted with the supervision of harbors, allocated from its own funds the sum of Y. 9,255,546 towards carrying out the urgent repairs to Yokohama harbor. The appropriation was passed in October 1923, and work started immediately after, in December. That work has been completed, and to-day the facilities of Yokohama harbor are superior to what they were prior to the earthquake. Before describing these works in detail a brief résumé of the damage done to the port will help to understand better what the engineers had to contend with.

The quay wall of the Yokohama Customs-house had a length of 6,620-ft., allowing thirteen vessels to moor alongside at the same time. The height of the wall ranged from 32½ to 45-ft. and the width of the base from 15 to 18-ft. The greater part of the wall was built on a hard clay strata and the balance on rubble mound. The hard clay strata was excavated and massive concrete deposited by means of a pneumatic caisson to form a strong foundation on which concrete blocks (4½-ft. by 5-ft. by 7-ft. and 4-ft. by 6-ft. by 9-ft.) were laid in several layers. The wall was erected in several sections, 36-ft. in length, and the vertical bond of each block reinforced by cement mortar filled in the vertical grooves. Nothing was done to stiffen the horizonal bond, and to this oversight is due to a large part the failure of the quay wall. No wall was overturned from its base, but with the exception of the foundation for the stationary wharf cranes all the walls slid out towards the front, forced out step by step by the vibration of the earthquake. The lower two or three courses of concrete blocks for an extent of 4,800-ft. remained fixed, because they were cemented to the hard clay strata by concrete, but the upper courses were forced out so far by the seismic force that they fell down into the water, causing the back fill to slide out and carry with it the foundations of the warehouses. This accounts for the initial damage done to these structures. The other part of the quay wall, covering 1,440-ft. in length, was forced out from the base where it was built on the rubble mound or the hard clay

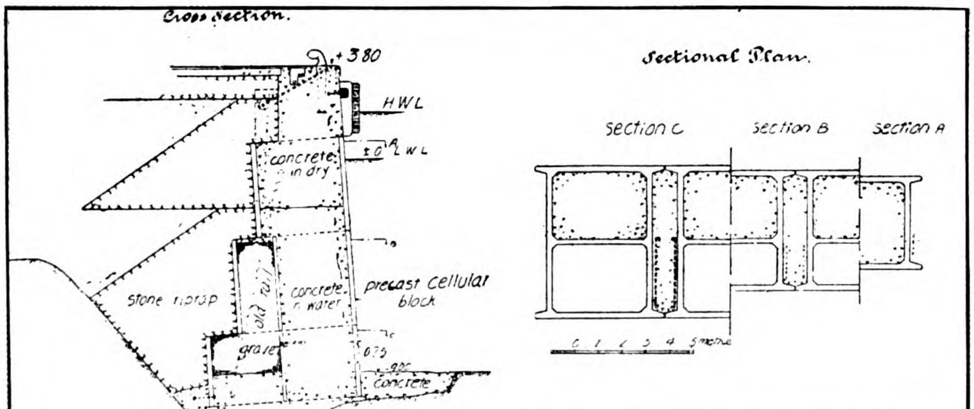
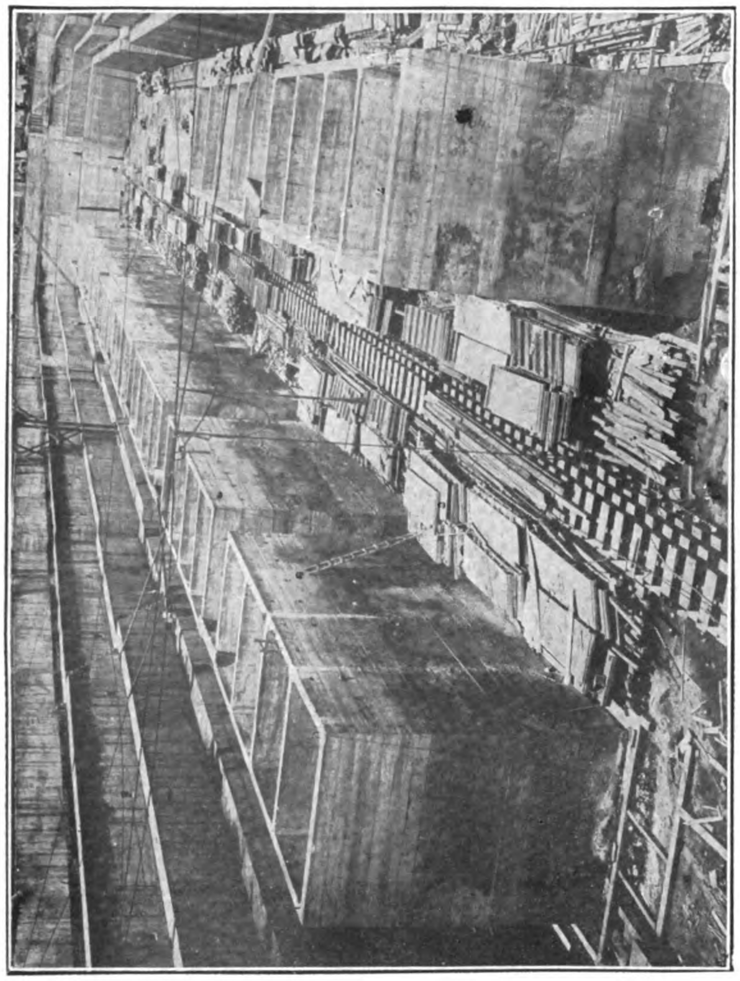
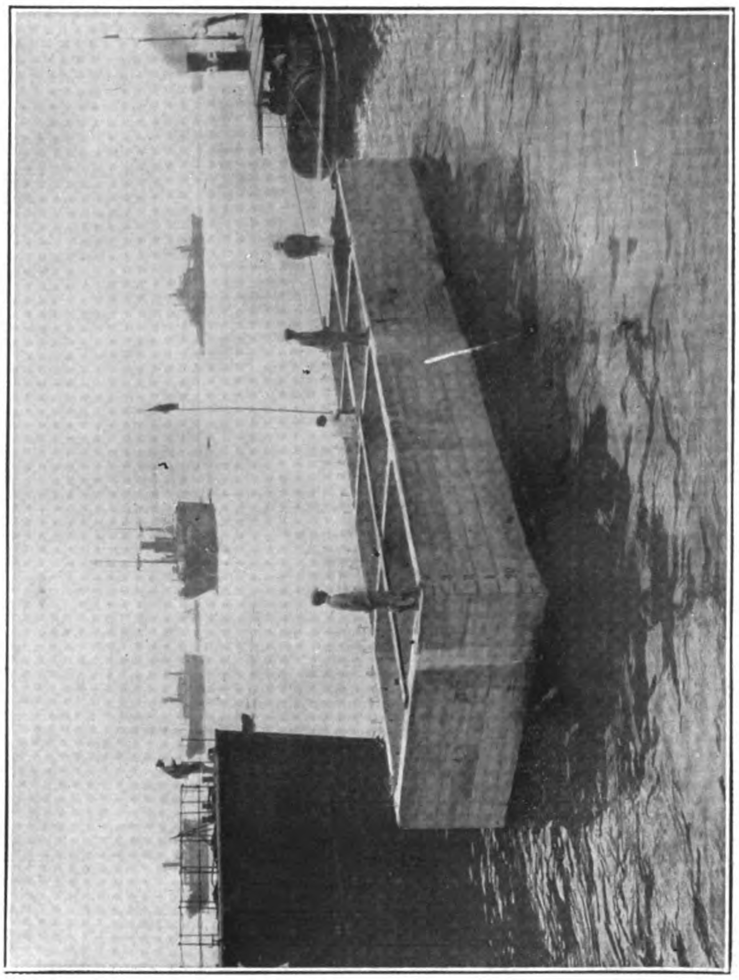


Fig. 6: Cellular Block Type Quay Wall used in Present Reconstruction of Yokohama Harbor

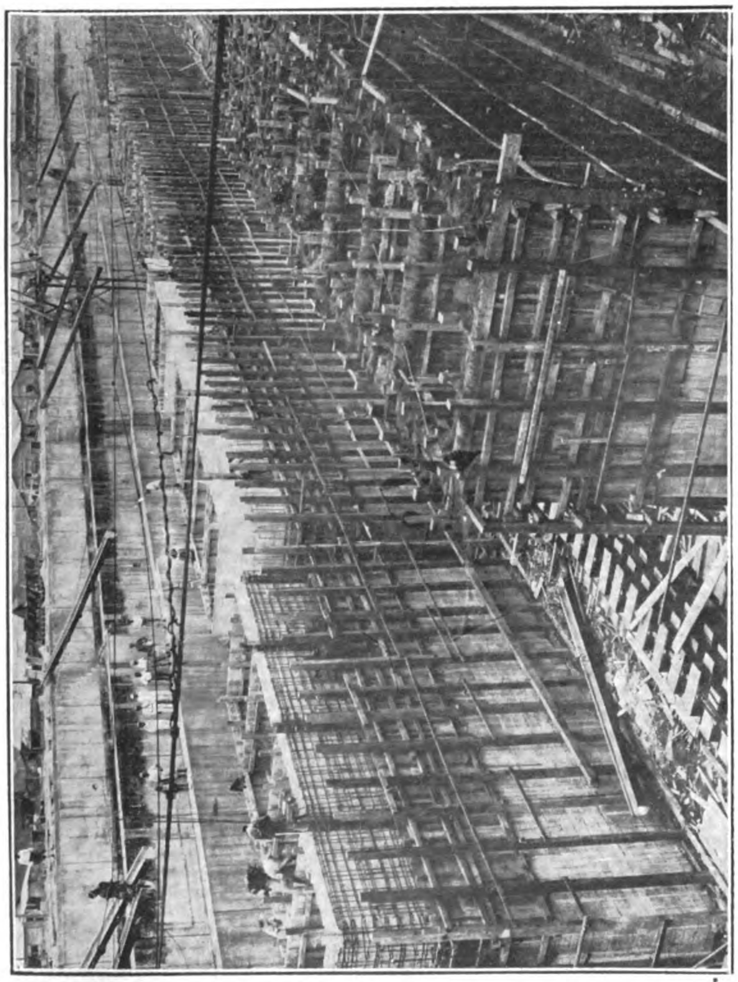
Reinforced Concrete Caissons (17-ft. Wide, 24-ft. High, 51-ft. Long, 430 Tons Weight) for the Yokohama Harbor Reconstruction; Built in the Dry Docks of the Asano Shipbuilding Co.



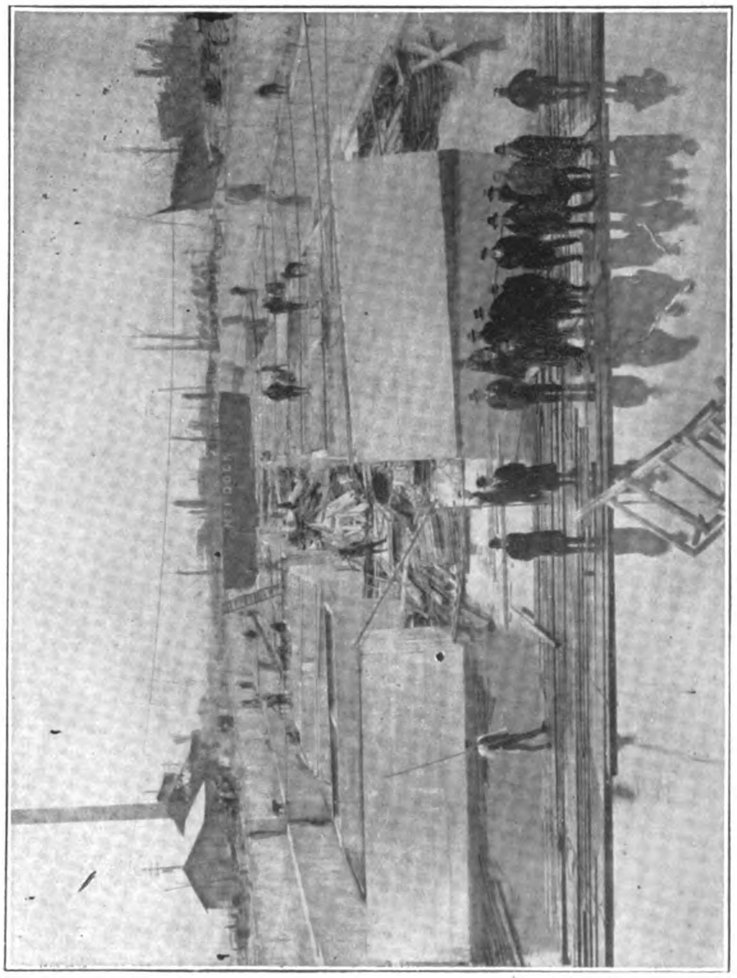
Completed Caissons Ready to Float



Passing out the Dock Gate into the Harbor

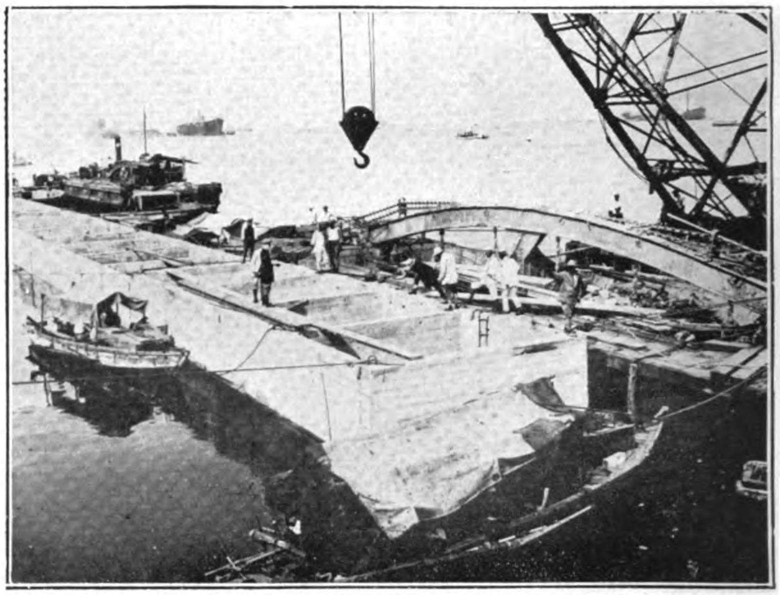


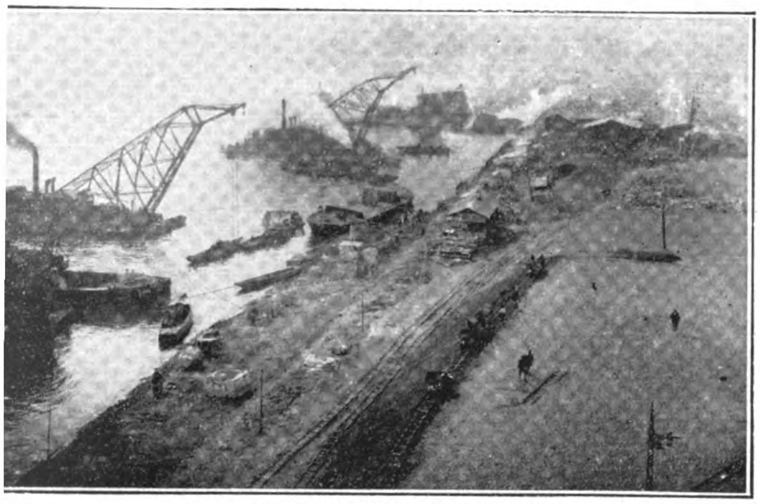
Caissons in Course of Construction

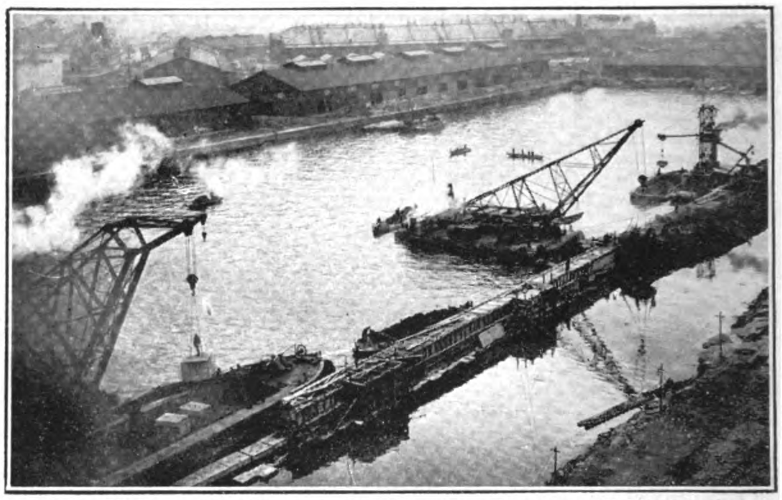


Caissons Afloat Ready to be Towed to the New Quay Construction

Bringing Concrete Caissons in Position for Sinking


Sinking of Concrete Caissons in Site to make Solid Quay Wall


Foundation Work for Quay Wall


Quay Wall under Construction, Showing Concrete Block Laying, Back-filling and Concreting

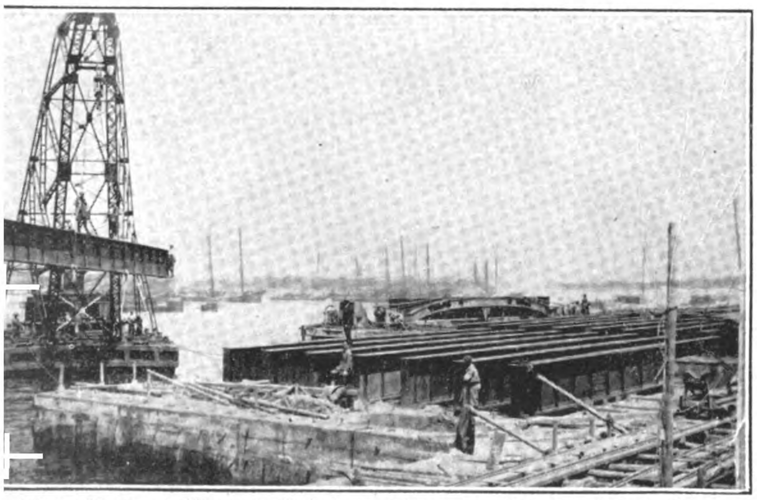
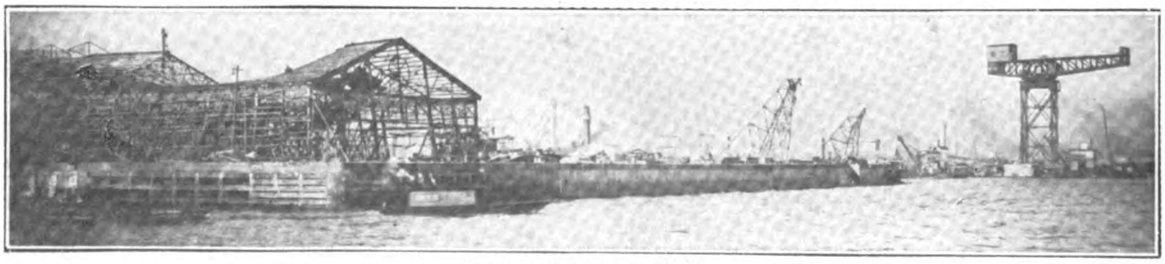
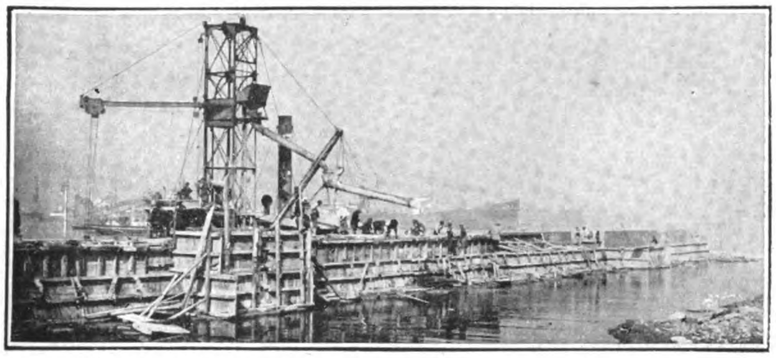


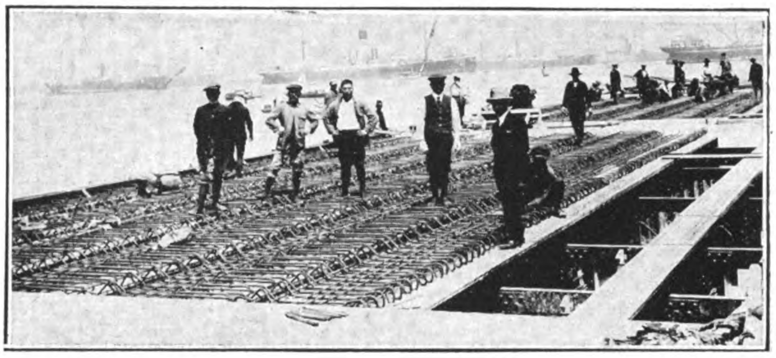
Plate Girders laid on the Reinforced Concrete Caissons filled with Concrete to make the Bridge Type Quay Wall

General View of Bridge Type Quay Wall


Completed Quay Wall



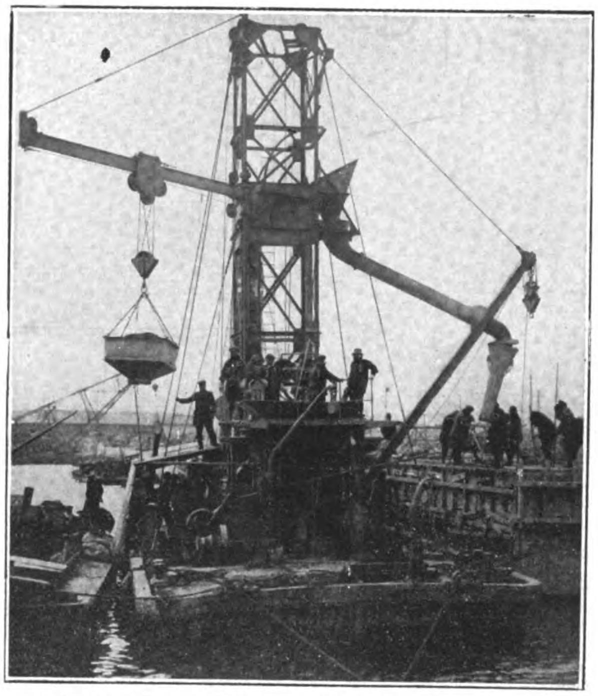
Placing Concrete on Caissons by a Floating Concrete Mixer



Reinforced Concrete Slab Floor on the Bridge Type of Reconstructed Quay Wall

strata without bonding. Moreover, relative displacement between horizontal courses had taken place, the upper courses overhanging the lower in places by five or more feet.

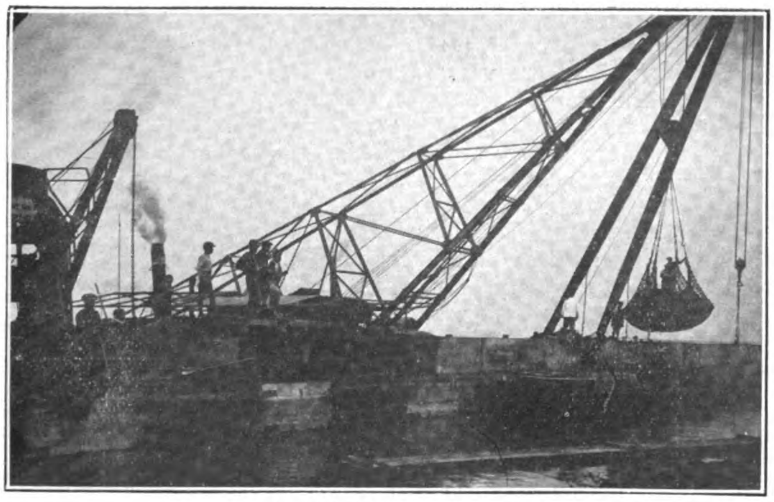
Figs. 1 and 2 show the typical failure of that part of the quay wall built on the hard clay strata and Figs. 3 and 4 show the damage to the walls built on the rubble mound. Fig. 5 shows the section of the foundation for the 20-ton stationary wharf crane which came through the quake without damage. Generally speaking, the foundation of the quay wall was sufficiently hard and the work well executed, but no attention was paid to bonding the horizontal course. Had they been stiffened by providing grooved and tenoned concrete blocks, the quay wall would have not suffered so severely. A highly interesting and valuable study on the general theory concerning earth pressure and seismic stability of retaining walls and dams, from data derived from the effects of the earthquake, has been written by Mr. Saburo Okabe, C.E., engineer-in-charge of the Yokohama Harbor Works, and published in the Journal of the Civil Engineering Society of Tokyo. Mr. Okabe has been for many years in charge of the design and construction of the quay walls in Yokohama, and has arrived at very definite conclusions which are highly valuable to all harbor engineers.

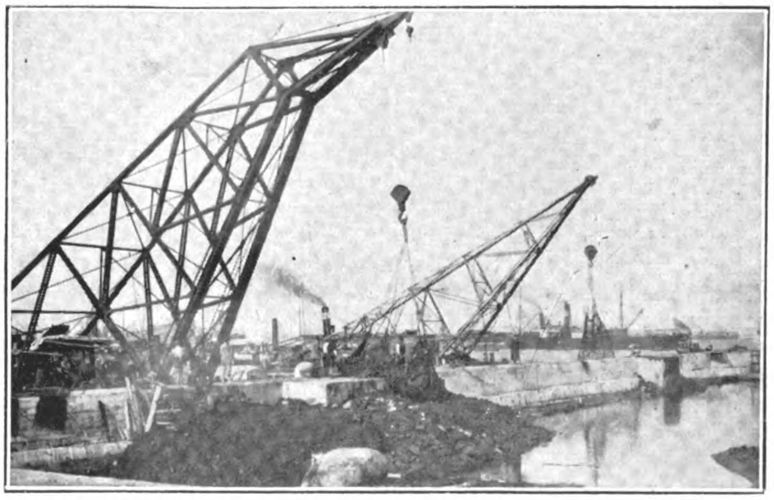


Floating Concrete Mixer, 240 cubic yards per day capacity, working on Quay Wall

As a result of his recommendations the immediate repairs to the Yokohama quay wall were carried out by sinking reinforced concrete caissons in site and filling them with concrete. These caissons were first built on shore and floated to their place in the wall. The foundation under the caisson was dredged, the caissons then loaded and sunk to the proper position and the interior filled with concrete. Before these caissons could be sunk in place the bottom had to be cleared of the old quay wall blocks and débris in order to prepare a foundation. Many of these blocks weighed 160 tons and had to be broken up by dynamite and then lifted out to be employed on other foundation work or for repairing the breakwater. In carrying out this difficult work a dipper dredger and a rock cutter was employed, as shown in the illustrations accompanying this article.

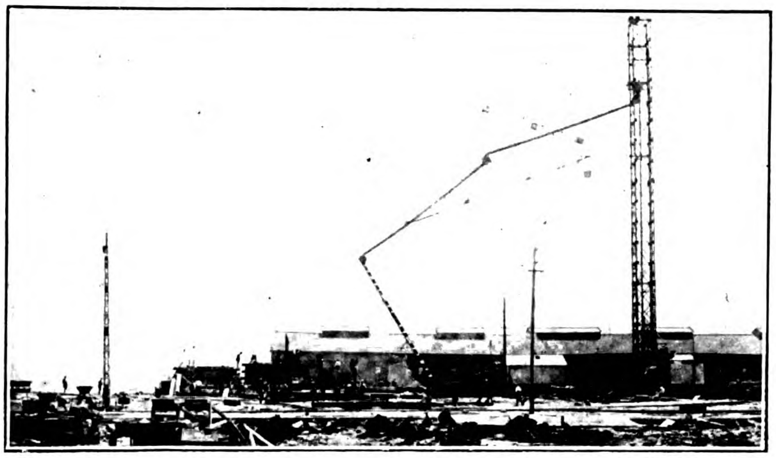
The general reconstruction of the quay wall under this system is shown in Fig. 7. The caissons were sunk to the hard clay strata, and after being filled with concrete were backed with an earth fill on a concrete foundation extending to a retaining wall. The caissons were then tied together with steel girders 55-ft. long, 4-ft. high and weighing 8½ tons each. In all, twenty caissons were employed for this particular work, each 50-ft. by 17-ft., and 171 girders. The latter were made at Yokohama dockyards. This system was applied to the reconstruction of Quay Walls Nos. 9, 10 and 11.



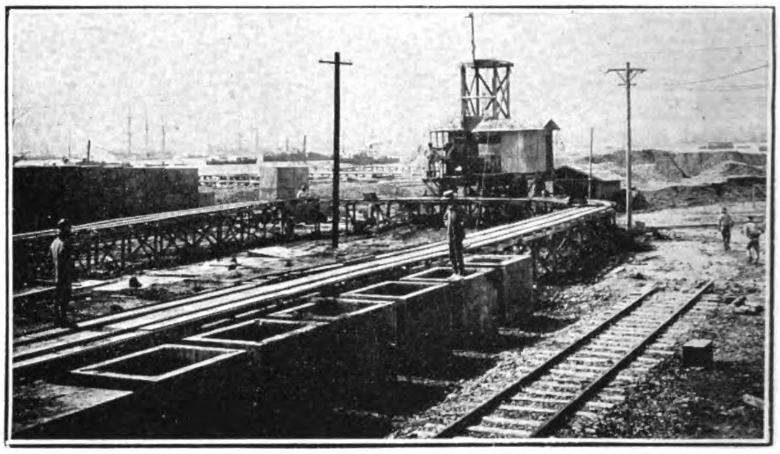


Back Filling on Quay Wall, using Floating Crane and Basket Net of 16 cubic yards capacity per batch

For the reconstruction of Quay Wall No. 4 the same system was employed, the caissons being 51-ft. long, 16-ft. wide and 24-ft. high, each weighting 430 tons. These were built in the dry docks of the Asano Shipbuilding Company at Tsurumi. Bottomless caissons were also used in the reconstruction of this quay, each weighting 27 tons. In places where the old foundation held, but



Reinforced Concrete Cellular Block-making Yard

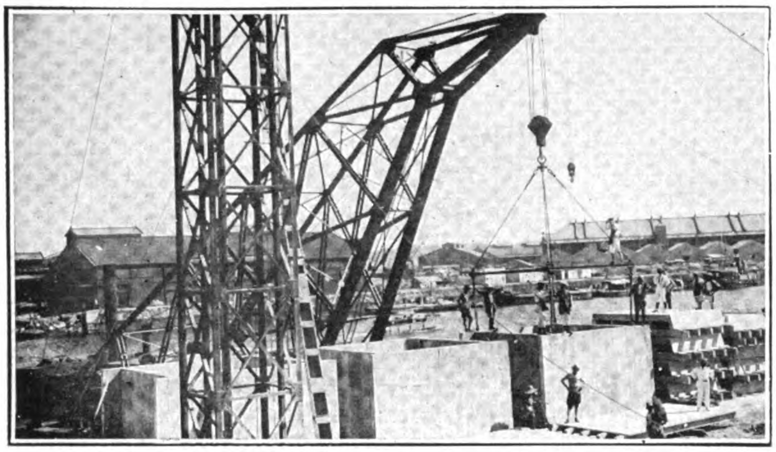


Concrete Block-making Yard

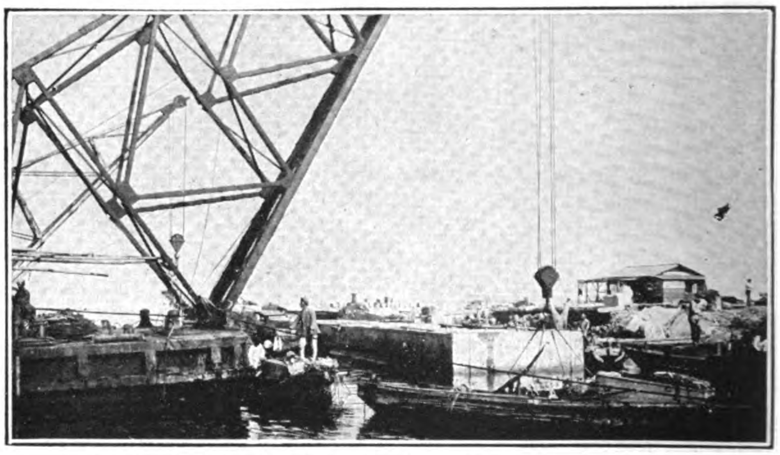
the quay wall slid out and overhung without falling into the water, as shown in Fig. 8, the restoration was carried out by using the cellular or hollow bottomless block type of quay wall. These blocks, weighing up to 50 tons each, are moulded on shore and loaded on lighters by means of a floating crane and carried to the site and placed in position by the crane. Their interiors are then filled with concrete and the vertical joints stiffened by concrete. The horizontal joints are stiffened by steel bars or old rails, in consequence, the wall when completed is one mass. The wall is fixed to the ground by concrete placed in front and back in order to guarantee stability.

In further extension work to Yokohama Harbor the engineers will adopt the multiple arch caisson type quay wall as shown in Fig. 9. This design will be adapted for such sites where the bed is not so hard. The reinforced concrete caisson has a cylindrical wall whose horizontal section is a multiple arch. The water pressure on the outer surface will act normally on the wall and the resultant pressure line pass through the neutral axis of the arched wall. In consequence of this the water pressure on the wall in its floating stage will give a uniform compressive stress, causing no bending movement, with a consequent saving in reinforcing bars, thus permitting the wall itself to be made very thin. Only a small amount of steel is required to resist the internal stress of the concrete wall owing to its setting, shrinkage and temperature change; also against the expansive force of the filling material in the caisson. The depth of draught will be considerable under that of the rectangular type of caisson. The execution of the work is simplified and the cost of construction much cheaper. On the base of the caisson many longitudinal grooves are moulded in order to increase the friction when the space between the base and the foundation is filled with cement mortar by a grout mixer. The holes providing sluice valves in the base of the caisson will be used not only to fill the mortar, but also to pour water in the chamber when the caisson is required to be sunk in position.

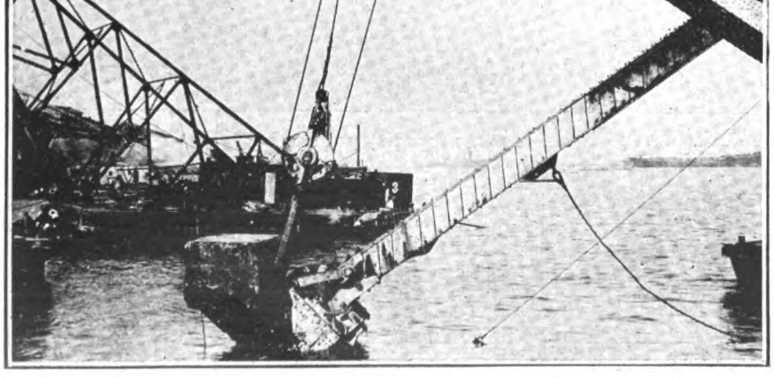
Another type of quay wall that will be employed for rapid work in the extension of Yokohama harbor is what is known as the Pre-Cast Buttress Wall. The general plan of this type is shown in Fig. 10. The buttress wall sections, weighing 50 tons each, are



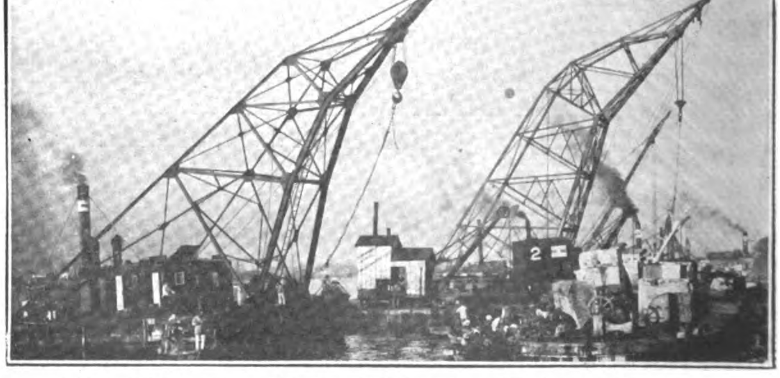
Reinforced Concrete Cellular Block (16-ft. × 16-ft. × 9-ft.) placed in position by Floating Crane



Laying Cellular Blocks in Site by a 50-ton Floating Crane



Digging up the old Concrete Blocks of Destroyed Quay Wall by a Dipper Dredge

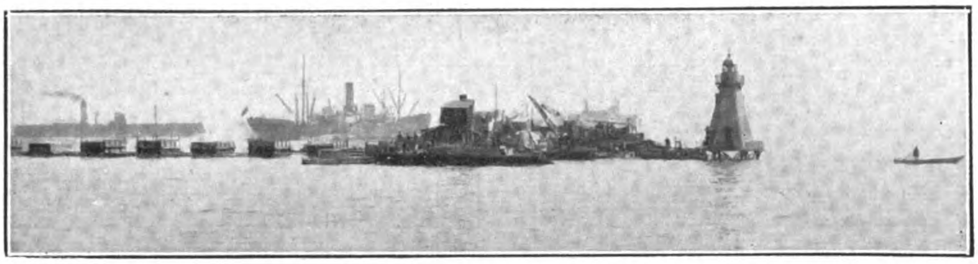


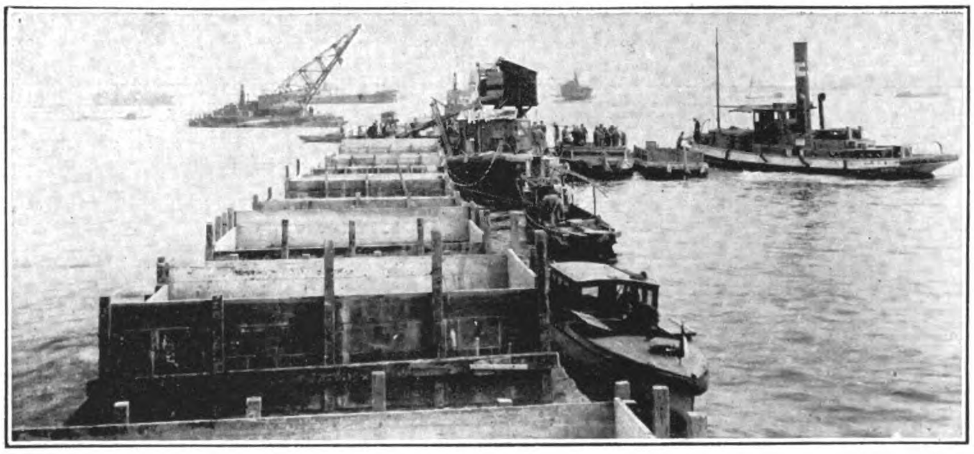
Using Old Concrete Blocks of Failed Quay Wall to make New Foundations

moulded on shore and then placed in site by a floating crane and barge. Each wall will be fixed with cement mortar, which is filled in a canvas bag placed in the vertical groove. This type, if properly designed, can be made proof against ordinary earthquake shocks, and is very cheap when a floating crane of ample capacity is employed.

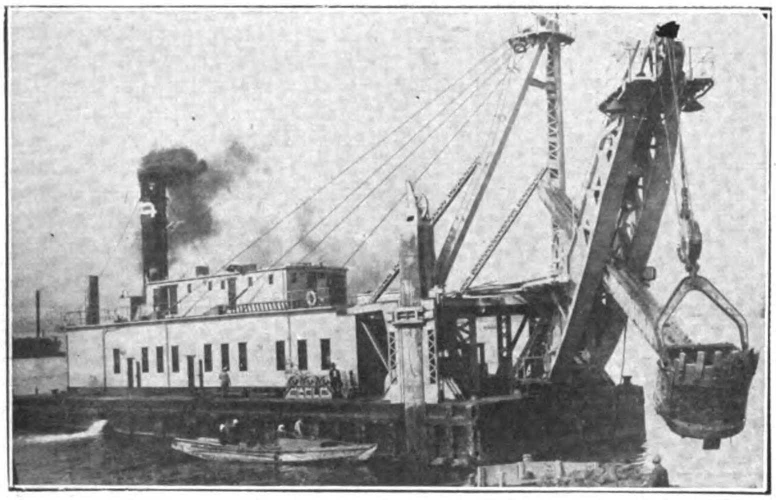
A general résumé of the work attached to the restoration of Yokohama harbor shows a great improvement over pre-quake facilities. Quays Nos. 4, 9, 10 and 11 have been lengthened 48-ft. each, adding 2,632 *tsubo* of reclaimed land to the area of the Customs compound. Before the quake, the cargo sheds were only 84-ft. wide. These have been rebuilt from 108 to 120-ft. wide, materially increasing the storage space. The depth of water has also been increased from 32 to 34-ft. by advancing the quay walls, the water depth alongside Quays 9, 10 and 11 having been increased from 24-28-ft. to 26-30-ft., permitting the largest steamers to dock.

During the earthquake the entire breakwater sank an average of eight feet, the worst damage being at the east end, where 3,000-ft. fell, and at the north end to an extent of 1,580-ft. The foundations did not break or fall, and only

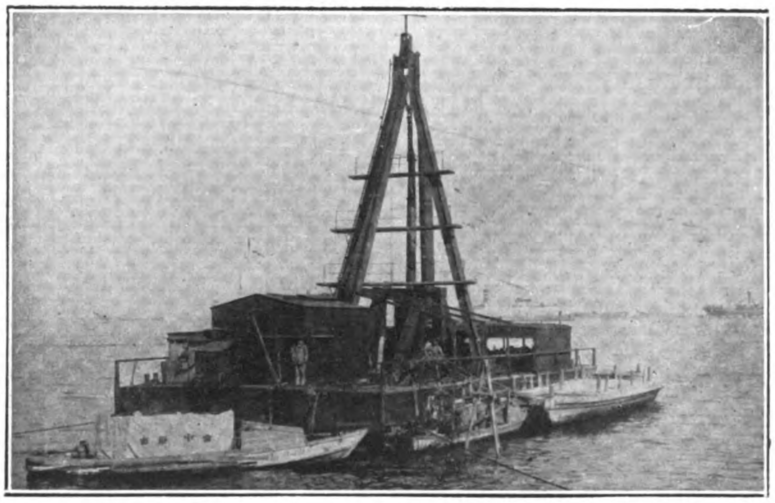




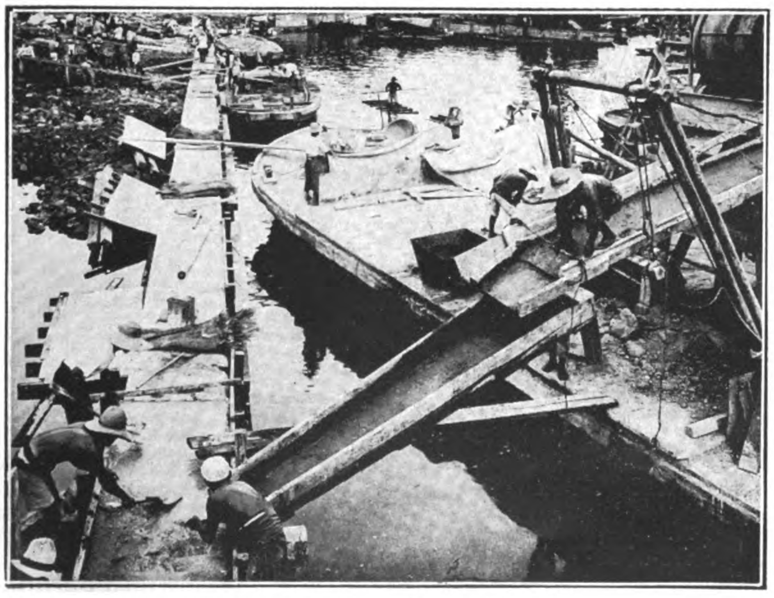
Repairing the Breakwater



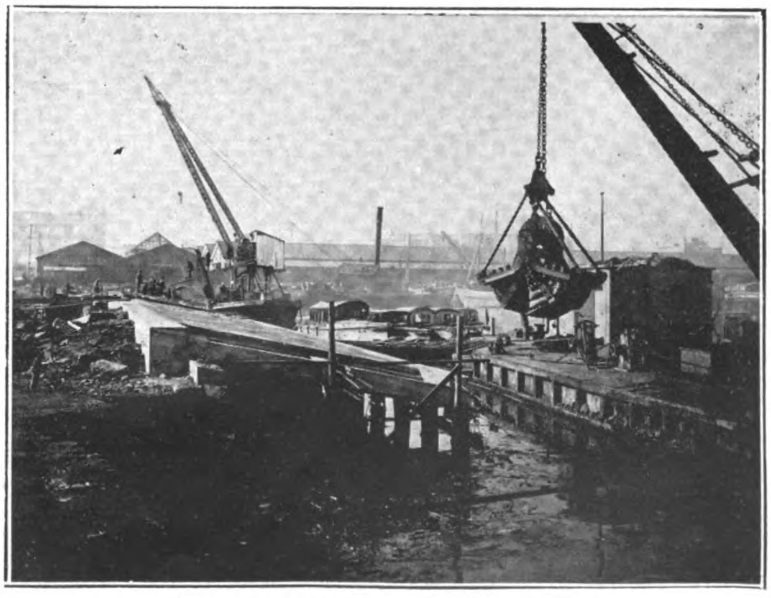
American Dipper Dredge (6 cubic yards bucket) at work in Yokohama Harbor Restoration



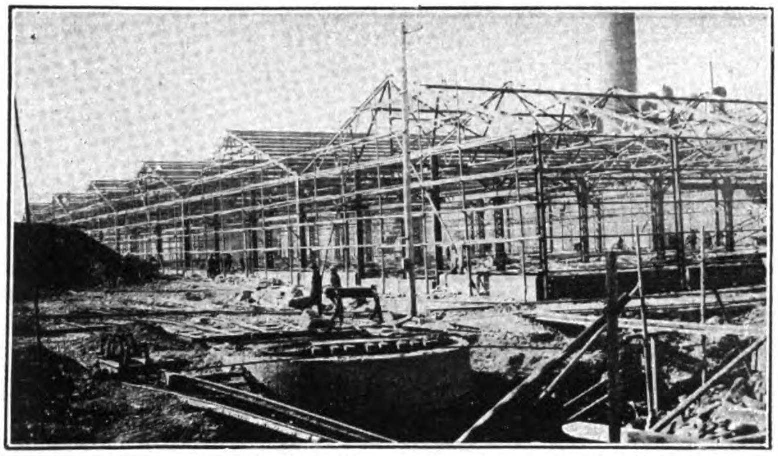
15-ton Rock Cutter made by Lobnitz & Co., Ltd., of Glasgow, on Reconstruction Work in Yokohama Harbor



Concreting of Barge Wharf



Priestman Dredger at work



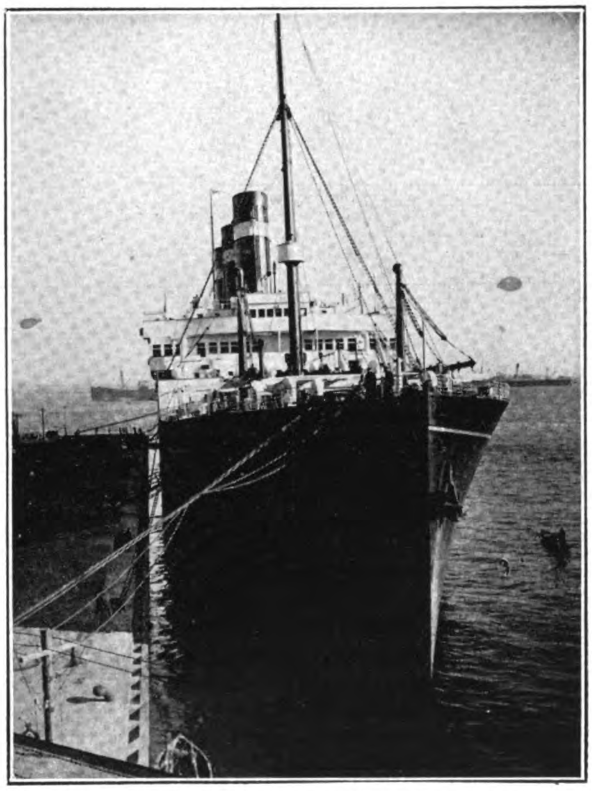
Reconstruction Work on Customs Warehouses in Yokohama

where they were laid direct on the sea bottom did they sink. All the failed sections fell out toward the sea. Where square blocks were used the whole wall fell, but fortunately the greater part of the wall held, and repairs were confined to building a new wall on both sides of the fallen parts, filling in the space with concrete. The height of the repaired breakwater is now 8-ft. above low tide level and 15-ft. wide across the top. Much of the stone used in repairs came from the old quay walls. Work on the breakwater was commenced in November 1923 and carried on without a break until it was completed in 118 days.

The restoration of the quay walls and cargo sheds was commenced in December 1923 and entirely completed by the end of April 1925. In May 1924 the restoration of Quay No. 9 was completed, and in September of the same year it was possible to moor the Taiyo Maru, the largest steamer of the Toyo Kisen Kaisha, alongside. A brief outline of the damages and work on each quay follows :

No. 1 Quay : Only 318-ft. of this quay wall remained undamaged, but the slope had been increased to such an extent that the whole wall was condemned as dangerous, and completely rebuilt to the same plan.

No. 2 Quay : The upper courses of concrete blocks in this wall were thrown down into the water, and the entire wall must be rebuilt. A concrete foundation, 18-ft. high and 8-ft. wide, will be laid on the hard clay strata, and the support walls bound together with cement poured into place through canvas pipes.



The T. K. K. Steamer Taiyo Maru Moored at the New Quay Wall

No. 3 Quay : The original foundation for this quay wall remained intect and was employed for building the new wall. It was first necessary, however, to remove all the old blocks to clear the site for the new bottomless caisson type of wall, 442-ft. long.

No. 4 Quay : The same general type of reconstruction was followed in rebuilding No. 14 Quay wall, which was extended 38-ft. in length and 8-ft. in width. It is now 684-ft. long. As shown in Fig. 11, an entirely new wall was erected. The fallen blocks were realigned so as to form part of the new foundation, a new outer footing laid, and the caissons plared on this foundation. These caissons, ten in number, 51-ft. long, 16-ft. wide and 24-ft. high, weighing 430 tons each, were built in the drydocks of the Asano Shipbuilding Company at Tsurumi, floated out and towed to site. Bottomless caissons, weighing 27 tons each built at the concrete yard operated by the Harbor authorities, were also used in the reconstruction of this pier. The space between the new and old quay walls has been filled in with earth, in all 4,380 cubic *tsubo.*

No. 5 Quay : Will be rebuilt like No. 3 and lengthened 48-ft., using the old foundation.

No. 6 Quay : The wall of this quay was shifted 6-feet, the second and third course of stone being forced out and thrown down. Repairs have followed the same lines as those for No. 3.

Nos. 7 and 8 Quays : The old foundations had to be cleared away and the repairs made the same as No. 3

Nos. 9, 10, 11 Quays : These three quays were completely wrecked and have been entirely rebuilt. To prepare the foundations the enormous blocks of the old wall, weighing 160 tons, had to be broken and removed. The sand and rubble was then dredged to the hard clay strata on which the caissons rested. On these were laid the steel beams to support the floor of the new piers. These piers have been extended 48-ft. in length, increasing the depth of water alongside at low tide to 26-30-ft. The details of this work are clearly shown in Fig. 7.

No. 12 Quay : In restoring this pier it has been lengthened 60-ft. The broken wall was not disturbed, but the bottom was dredged to the hard clay strata and the old stones used for the foundation, on which caissons were placed and the concrete super-structure erected.

No. 13 Quay : This quay is only used for lighters, and very little changes have been necessary

In addition to the extensive damages to piers and warehouses, all the shore landing places and protection embankments (buildings) were completely destroyed. To date about 5,000-ft. of bunding has been repaired. Both bridges on the new harbor compound were badly damaged. The steel superstructures remain, but

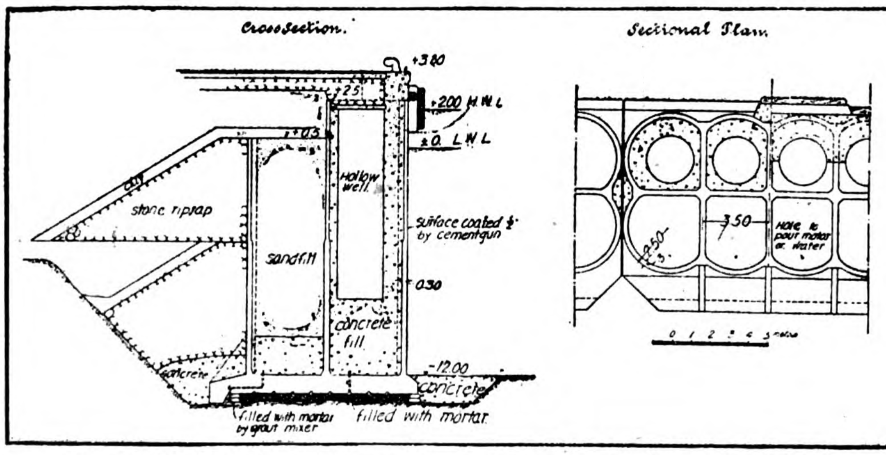


Fig. 9: Multiple Arched Caisson Type of Quay Wall to be used in Future Extension Work of Yokohama Harbor

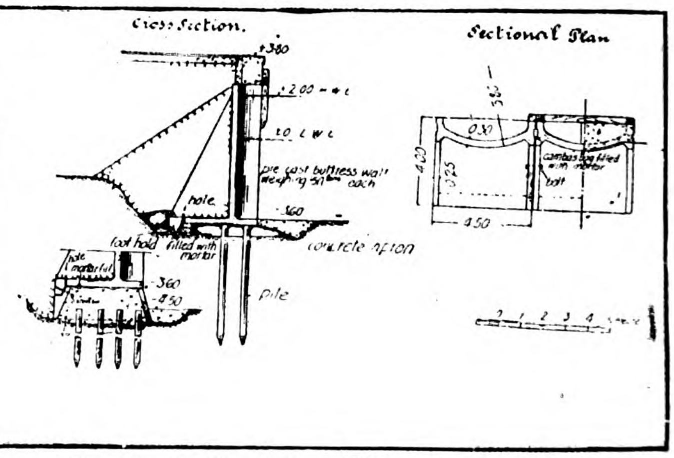
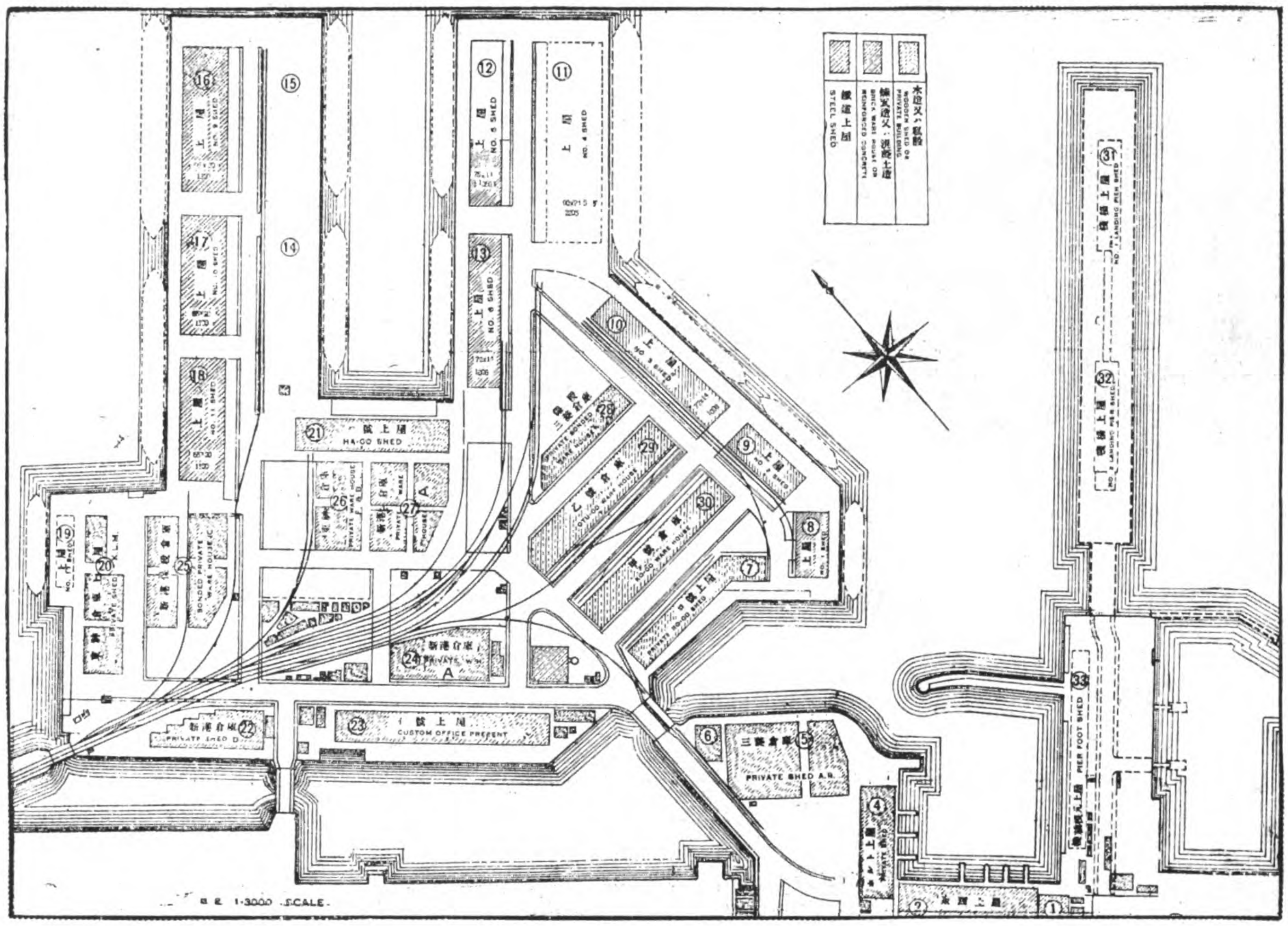
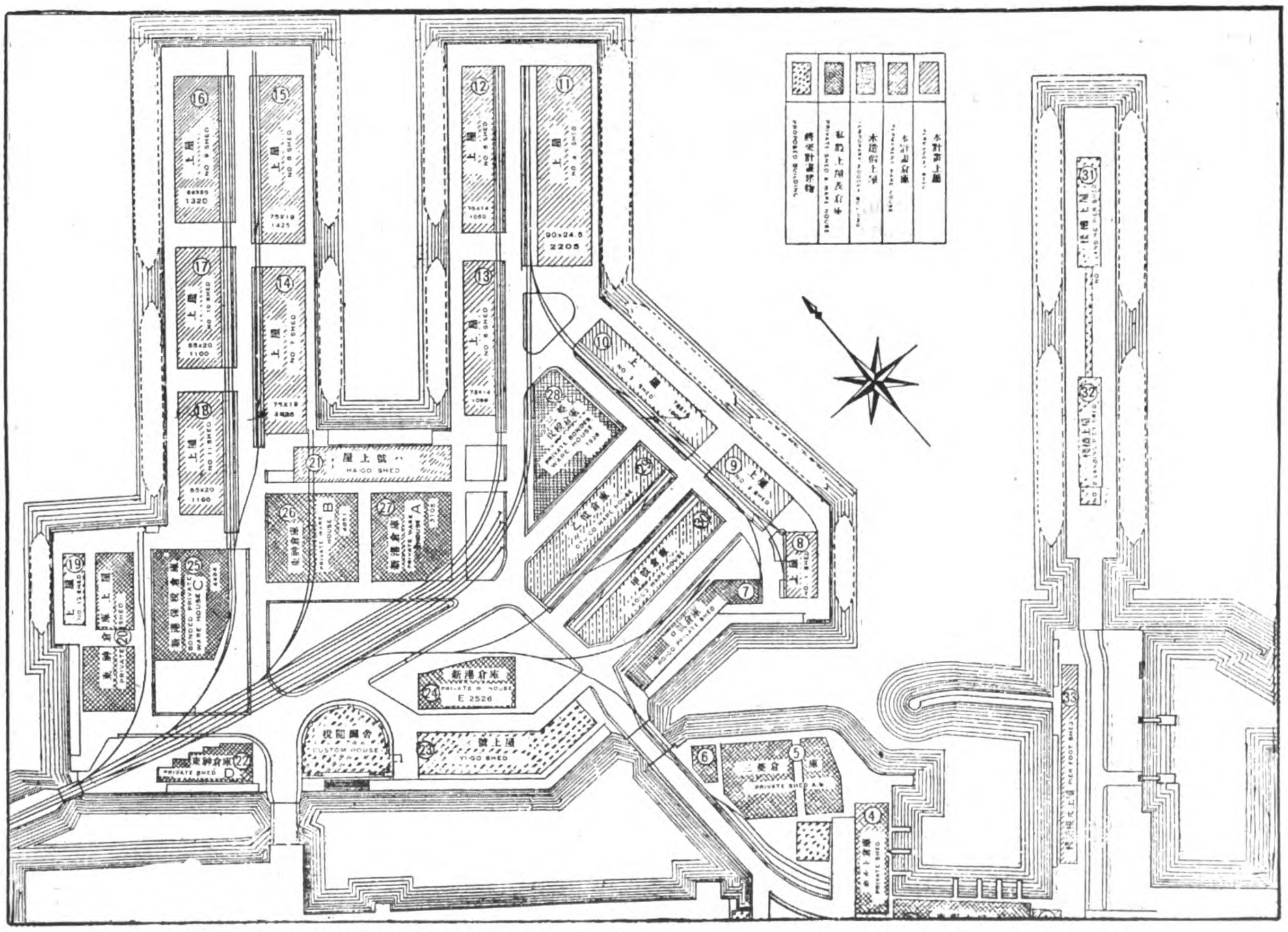


Fig. 10: Pre-Cast Buttress Wall used in Minor Wharf Construction in Yokohama





Plans Showing Present (Top) and Proposed Future (Bottom) Accommodations of Yokohama Customs Compound

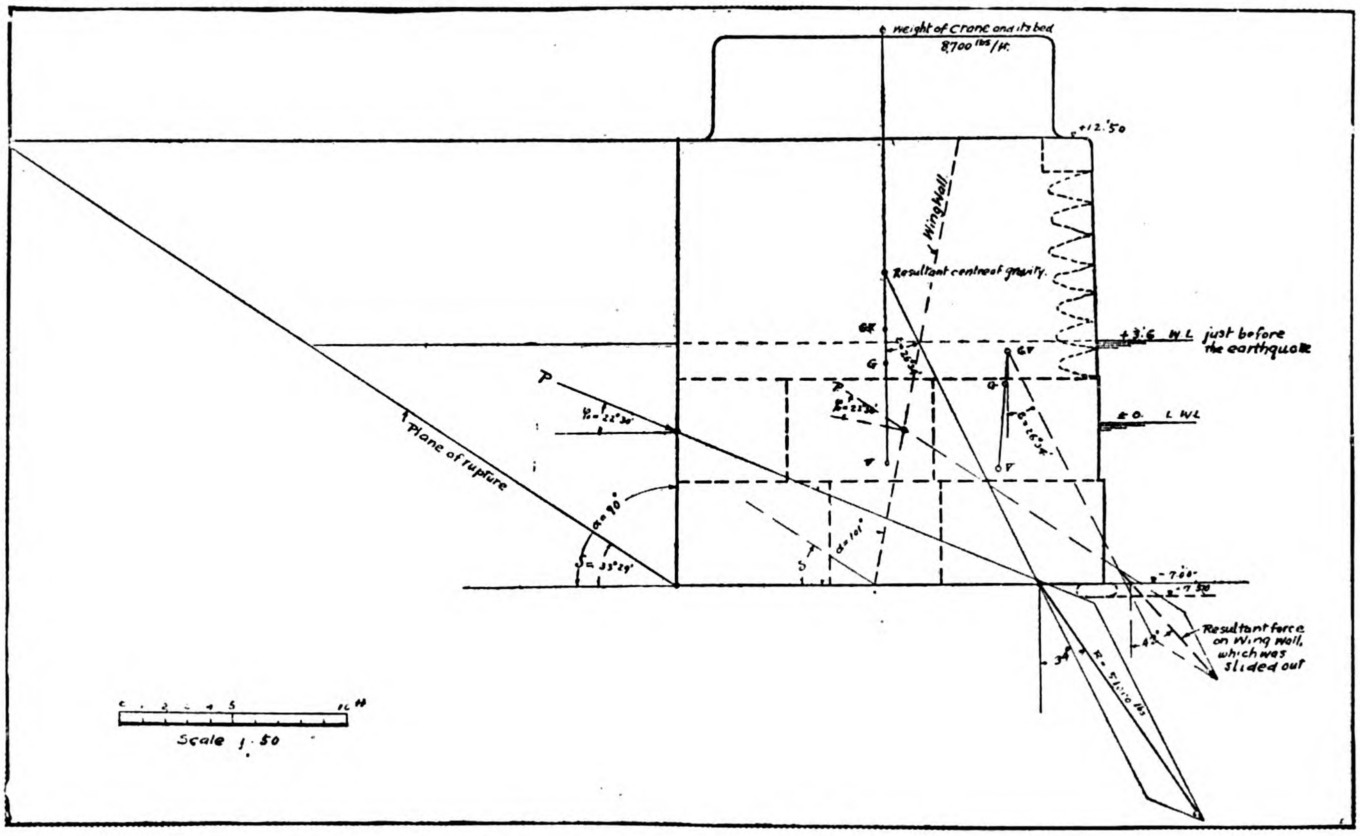


Fig. 5: Force Diagram for the Stability of Crane Base.

the pier foundations shifted. These were finally repaired in July 1924.

One of the greatest dangers to navigation was the large number of lighters and launches with their cargoes which were burnt during the conflagration and whose haulks littered the channel and harbor bottom. By May 1924, 348 sunken lighters and 79 other vessels, besides an enormous amount of cargo and other materials, had been dredged up, and 1,200,000 *tsubo* of bottom cleaned.

The equipment of the Harbor Board fared the same general fate as other property, the engineers facing the job of reconstruction with only 30 lighters, 5 Priestman dredges, 7 small launches and 2 concrete mixers. Since then three floating cranes, two additional Priestman dredges, one American dipper dredge, the Lobnitz rock cutter, five huge concrete mixers, one launch and 33 lighters have been acquired.

The cost of restoring Yokohama harbor to date has been Y.16,000,000, of which Y. 4,600,000 was expended on machinery, materials and labor on the quays alone.

Much has been done, but much more remains to be done. The docks are sewed by ten miles of railways which are still unusable owing to the repair work going ahead. Nineteen electric and three steam cranes must be replaced and many other refinements of transportation and cargo handling installed.

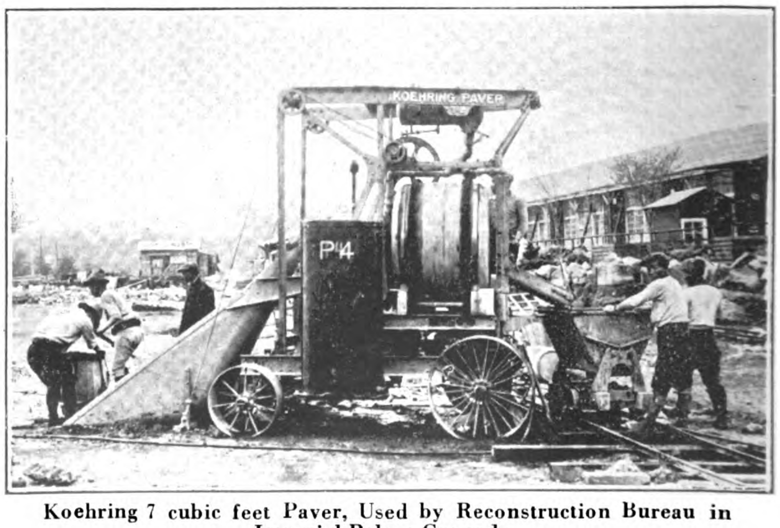
The work of the harbor engineers has re-established the port of Yokohama as the gateway to Tokyo and assured its place as the premier foreign trade center of the empire. The latest figures show that the total import and export trade of Yokohama for the period between May to December 1924 was Y.893,257,000 against pre-earthquake figures (September 1922 to April 1923) of Y.988,-689,000. But this is only the beginning of a development plan that is destined to elevate Yokohama into the premier port of the Far East.

All the buildings in the Yokohama Customs compound were either shaken to pieces by the earthquake or burned down in the fire, but by the end of March 1925, with the exception of some of the warehouse facilities, the entire equipment was about as it was before the disaster. Half of the quay warehouses had been restored, and all roads and bridges and drainage equipment were completely rebuilt. Temporary buildings, however, to tide over until permanent structures could be erected, now house the Customs officers.

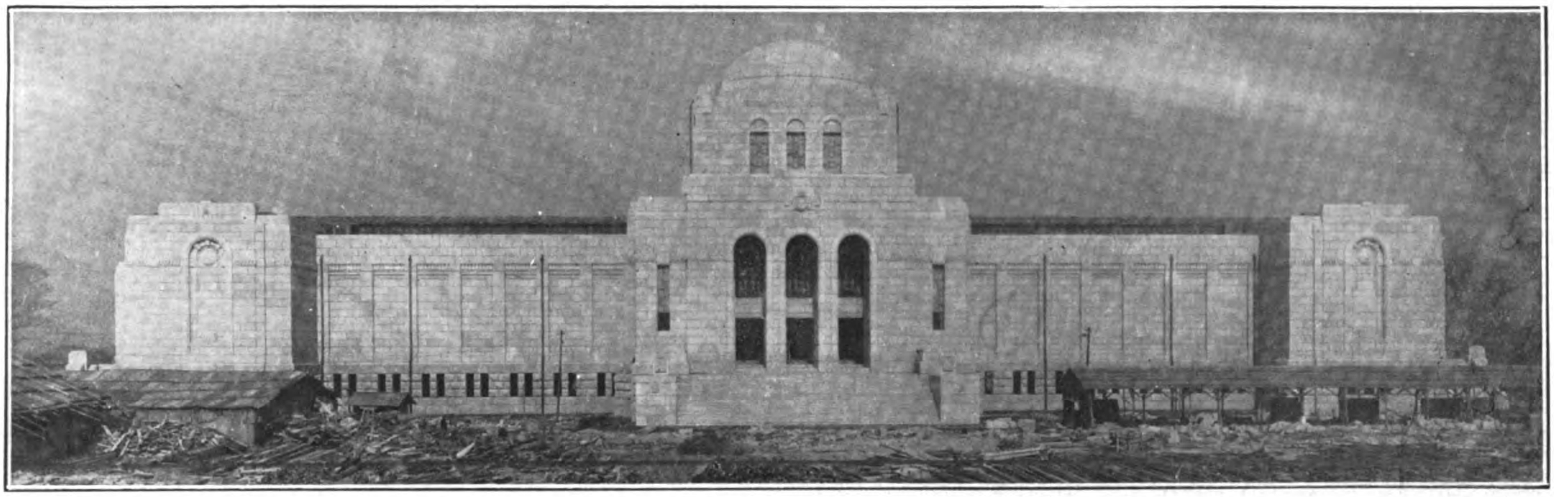
All the travelling cranes on the wharves at the time of the earthquake fell over, the 50-ton fixed cranes being broken and rendered useless. The power plant was wrecked, and more than 3,000 lighters moored within the compound were burned. It was impossible after the earthquake to land cargo direct from steamers.

The Customs House equipment is under the jurisdiction of the Department of Finance, while the Department of Home Affairs has charge of the Harbor Works. In 1923-1924 the Department of Finance spent Y.600,000 on necessary repairs to the compound, and the Diet appropriated in July last Y.5,285,000, to be expended over the period 1924-1928, on repairs and improvements to the Customs House equipment in Yokohama.

The steel frame warehouses, although damaged in the earthquake, have all been repaired without great difficulty and expense, so it has been decided to build all new warehouses entirely of steel and iron sheets. The power plant will soon be operating again.



Koehring 7 cubic feet Paver, Used by Reconstruction Bureau in Imperial Palace Grounds.



Art Gallery and Museum in Meiji Park, Erected by the Okura Building Co., Ltd.

In Memory of A Beloved Ruler

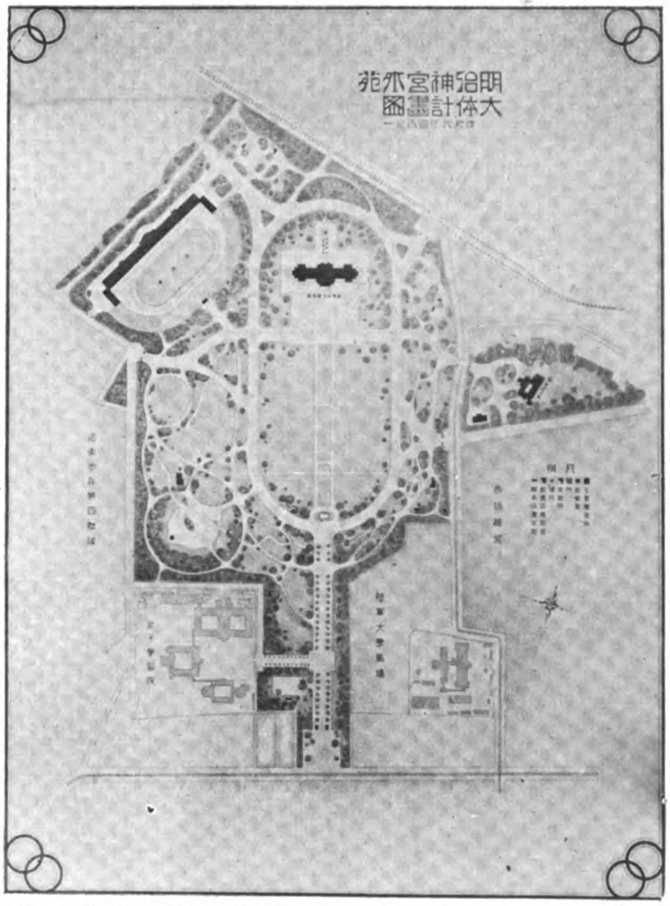
The Beautiful Memorial Park of Emperor Meiji the Great

THE Emperor Meiji is dearly enshrined in the hearts of the Japanese and revered by his people to a greater degree than any ruler of modern times. Under his guidance Japan rose from the obscurity of feudalism to one of the first Great Powers of the world, due in great part to the wise and benevolent statemanship of this paternal sovereign. He is spiritually sanctified in the solemn and simple grandeur of the Meiji Shrine, completed some time ago, but as a further memorial to his greatness, and as a mark of especial esteem on the part of the Japanese, it was decided to erect a magnificent piece of work in which all his subjects should share as a permanent monument to the Emperor Meiji the Great.

The plans for this great public work includes a large tract of land adjoining the grounds of the Meiji Shrine, which will be made into a huge park with suitable buildings of both practical and æsthetic value as typifying the great industrial growth of the empire under his rule and at the same time emphasize the moral and artistic progress made during the era of Meiji. The buildings are to be a hall to commemorate the establishment of the Constitution, to be known as the Kempo Kinen Kan; another building as a tribute to the virtues of the Emperor Meiji, which will be called the Seitoku Kinen Kan; a large art gallery and museum, an athletic field and a special building to perpetuate the memory of the structure built in the parade ground in 1912 from which the body of the Emperor was borne to its final resting-place in the Imperial mausoleum at Momoyama.

This memorial is to be built from funds which were given by Japanese from every walk of life. The land is an Imperial grant given the memorial in 1916. The plans were completed and actual construction work begun in February 1917 and the whole was to have been finished in 1924. The buildings under construction were undamaged by the earthquake, but work was delayed. The grounds were thrown open to refugees and barracks erected for their use, which further hindered the progress of construction.

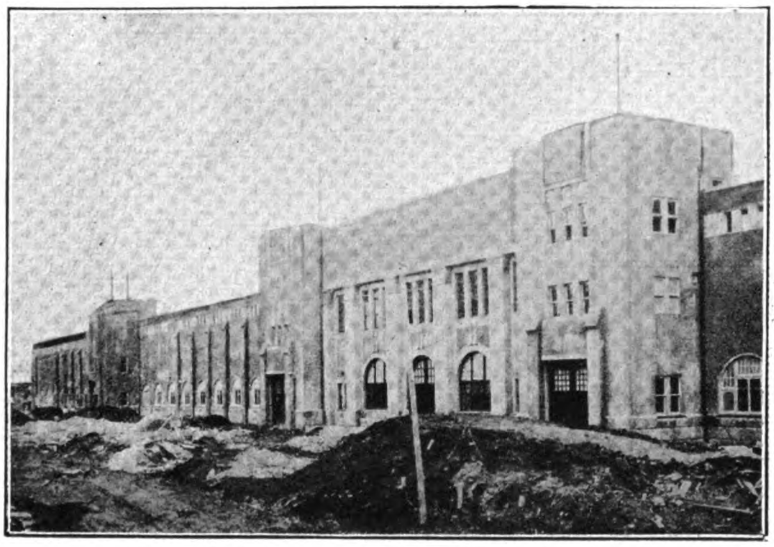
In spite of these handicaps the beautiful art gallery and the athletic grounds and stadium were completed in October 1924, and work on the Seitoku Kinen Kan is practically finished at the present time. The art gallery is one of the most beautiful buildings in Japan built in the western style of architecture, as are all the other structures in this memorial, although pure Japanese Shinto architecture characterizes the buildings of the Meiji Shrine nearby. The majesty and dignity of the art gallery are indeed a fitting tribute to the great Emperor.



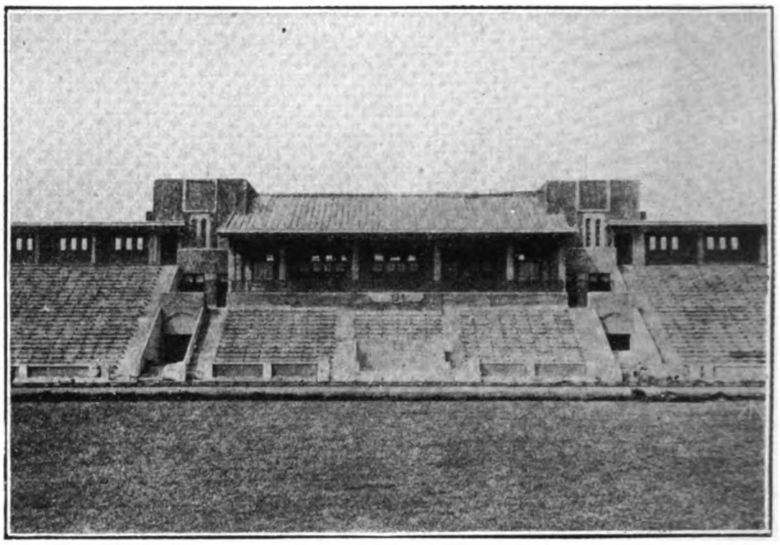
General Plan of the Meiji Shrine Park in Tokyo, with Art Gallery as Central Figure and Stadium to the Left.

In keeping with the spirit of the Meiji Era, which means the Era of Enlightenment, the finest athletic field and stadium in the Far East was made a part of the Meiji Memorial. Here the youth of Japan may show their progress in healthful physical competition and develop a hardy and strong manhood as the Emperor would have wished. The stadium covers an area of 360,000 square feet, while the field has an area of 2,980 *tsubo*, with 941 *tsubo* of stands and 2,770 *tsubo* in terraced turf bleachers. The outside track is an oval 400 meters in length. The cost of this project alone amounted to Y.1,053,000.

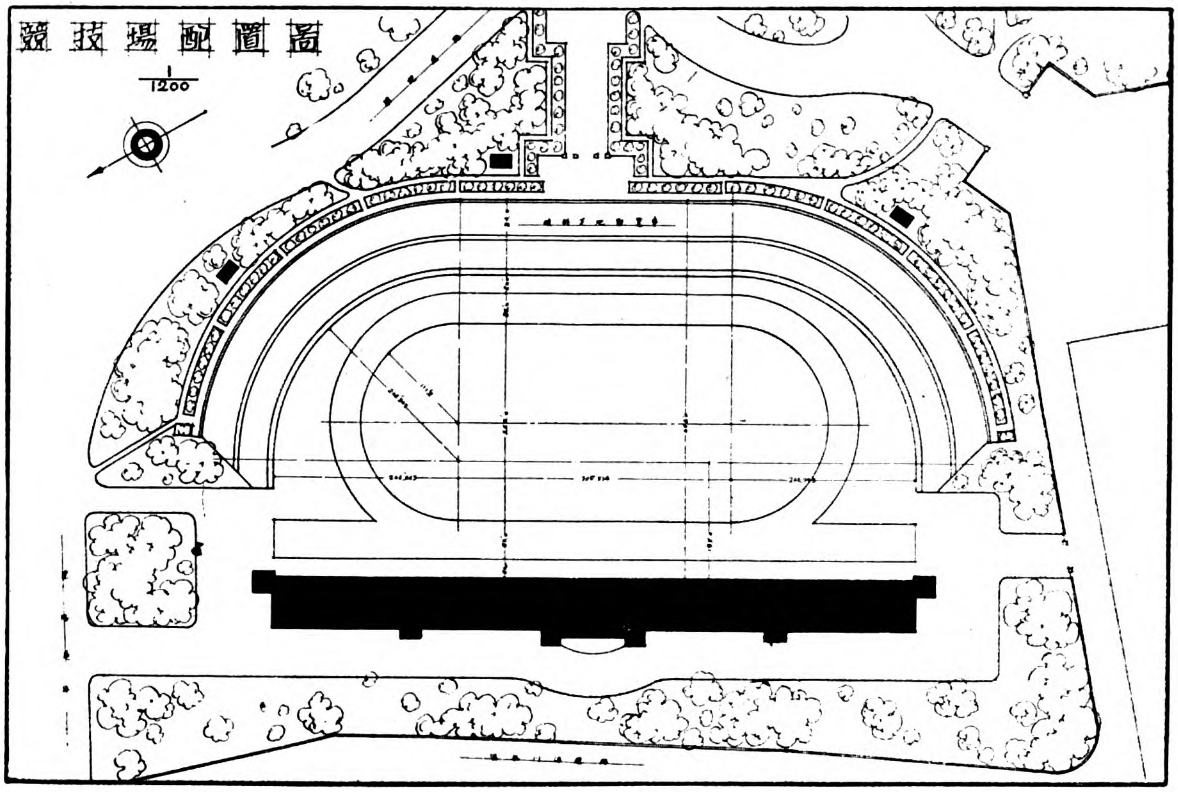
All the stands and buildings are of reinforced concrete, the main grand stand being 60-ft. wide and 768-ft. long. There are twenty-six tiers of seats accommodating 20,000 people, while the terraced bleachers, built up in the form of a bowl, will accommodate 50,000 more, a total seating capacity of 70,000 people, which compares favorably with any of the stadiums in the United States or Europe. Under the central part of the grand stand are locker and dressing rooms, two bath rooms,



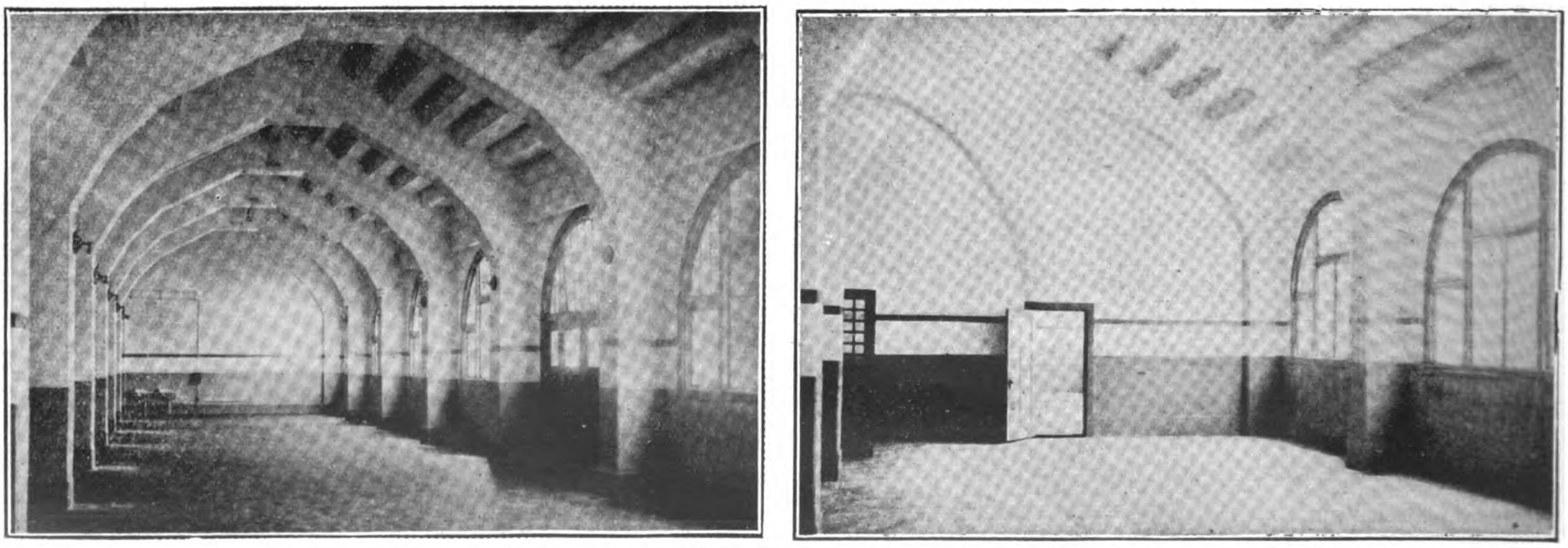
Rear View of West Stadium Stand



Grand Stand of Stadium



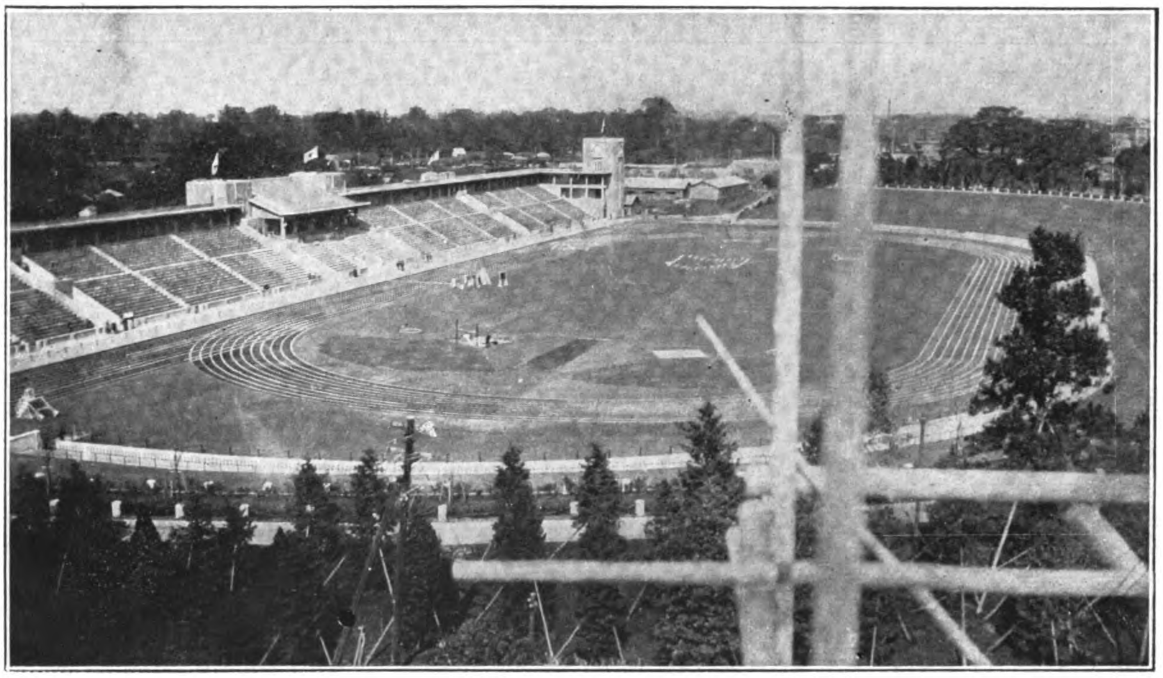
General Plan of Stadium Grounds



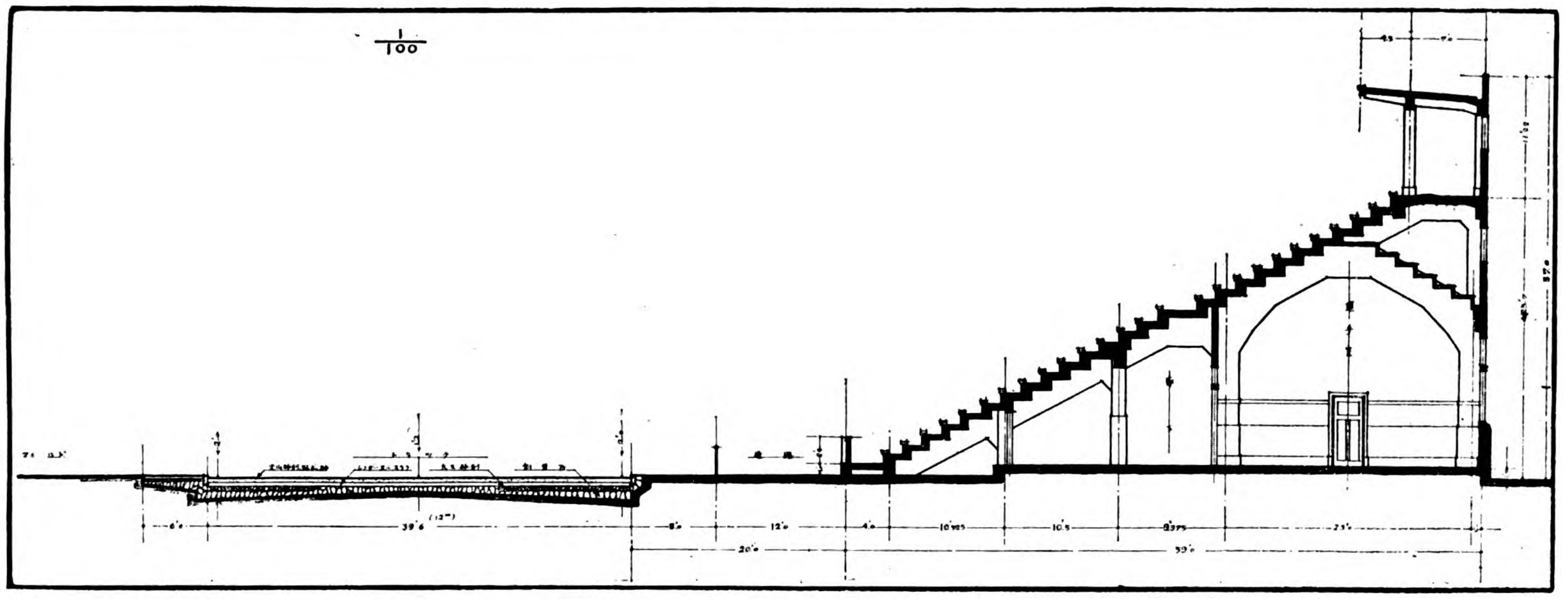
Gymnasium and Dining Hall under the Stadium Stand

four training rooms for rub-downs and massage, and a large dining room. Special facilities are provided for every kind of popular sport, such as baseball, football, cricket, tennis and track meets. With this field Japan is provided with suitable equipment to stage the International Olympic Games when it is her turn to do so.

The large grounds of the memorial will be made into a spacious park, planted with all kinds of native trees and shrubbery. Wide paved roads and concrete sidewalks connect the various buildings, which, together with a beautiful approach avenue lined with Icho trees, will make a most pleasing *ensemble*. Thus one of the beauty spots of the empire is the permanent memorial to the beloved Emperor Meiji and to the spirit of progress in the Japanese people of which he was the sponsor.



Grand Stand and Oval at the Meiji Shrine Stadium



Elevation of Stadium Stand

O.S.K. To Raise Loan of Y.20,000,000

To Open Route Between Dairen and Hongkong with Eight New Steamers.

THE Osaka Shosen Kaisha recently announced its plans to float another debenture issue of Y.20,000,000, partially to convert a previous issue which is about to mature, and more particularly to improve its service on routes in China. This plan is to come up for approval at the semi-annual general meeting of the shareholders on July 27. Preliminary negotiations have already been made with the Sumitomo Bank for the acceptance of the new debentures.

A part of the funds are to be used to meet payments on the ninth debentures, the term of which expires on September 1 next year. The remainder will be devoted to inaugurating a service between Hongkong and Dairen, via Shanghai. This plan was adopted following a report made by Mr. Murata, the managing director of the company, who made a trip to China to investigate the conditions. For the new China coastal service the company will have seven or eight steamers, each displacing about 2,500 tons.

Despite the prevailing depression, the Osaka Shosen Kaisha netted profits totaling Y.1,511,000 in the first half of this year on which the company is to declare a dividend of 7 per cent. The business of the company was specially favorable during the first three months of the past term, according to the report. Due to the depression in the foreign trade, and more recently because of the strike in China, the favorable returns fell off towards the end of the term, and the company is being forced to use Y.700,000 out of its reserve funds in order to pay out the 7 per cent. dividend.

The balance sheet of the company during the first half of 1925, in units of Y.1,000, follows:

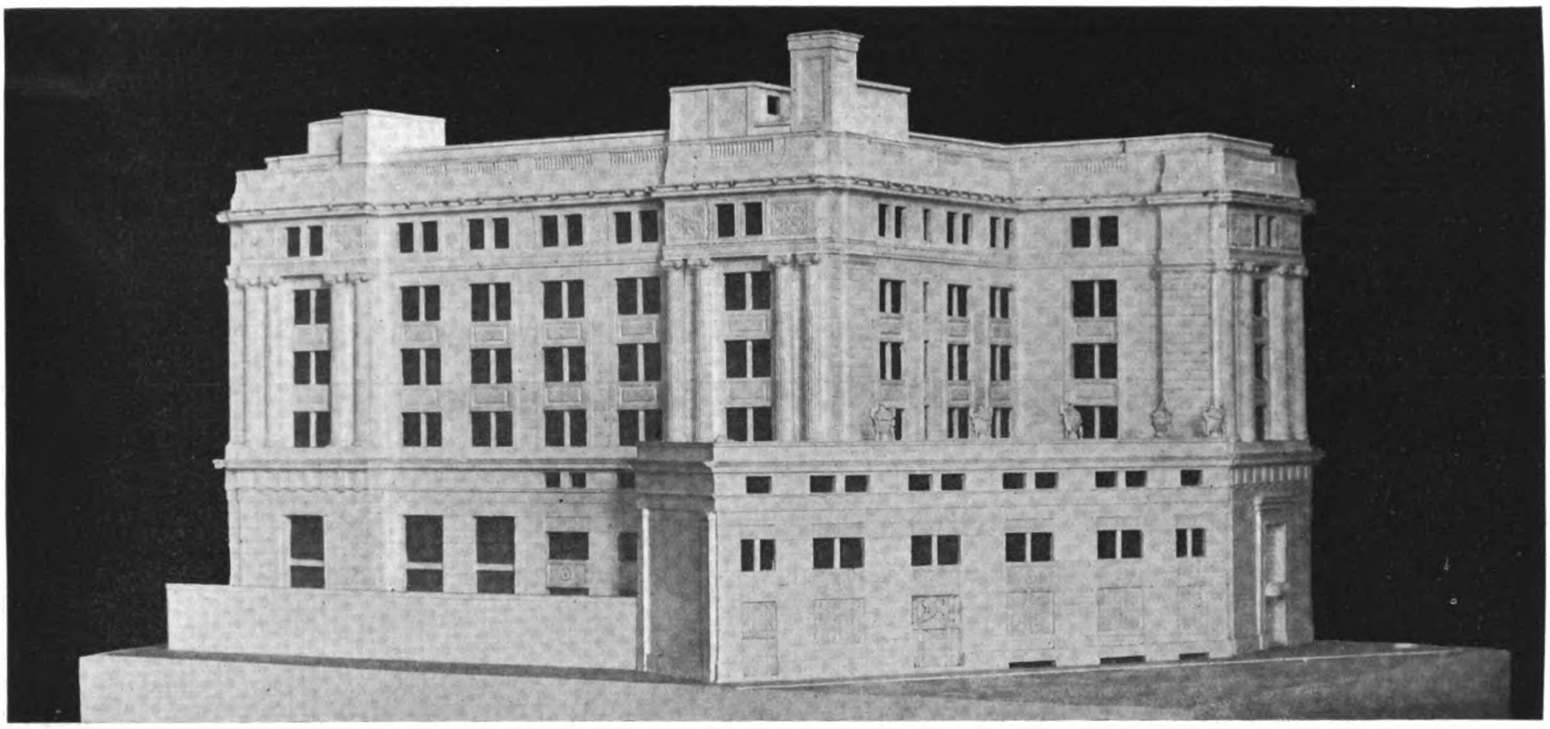
Total	Y.31,718	Y.28,120
Total expenditure	25,617	22,370
Profits	6,101	2,750
Reserve funds	4,590	4,590
Net profits	1,511	1,160
Balance brought in	86	114
Reserve funds disposed for dividends	700	1,000
Dividend (7 per cent.)	2,187	2,187
Balance forward	110	86

Front View of the New Yokohama Specie Bank Building at Tokyo from Architect's Model

The Palatial Executive Office of the Yokohama Specie Bank at Tokyo

ONE of the most artistic of the many new and handsome bank buildings in the financial district of Tokyo is the magnificent structure now in process of erection for the Yokohama Specie Bank, one of the strongest and most widely known monetary institutions of Japan. Since its foundation in 1880, the head-office of the bank has been located in Yokohama, but with the development of the capital into the financial and commercial centre of the empire, the Tokyo branch together with the Executive Office of the bank gradually assumed a greater importance than the head-office at Yokohama. Commencing with a modest capital of Y.3,000,000 for the purpose of encouraging and financing Japan's foreign trade, the Yokohama Specie Bank has increased its capital from time to time to cope with the constantly expanding trade of the empire, until to-day it has a paid up capital of Y.100,000,000 and a reserve fund of Y.80,500,000. More than half of the foreign bills of exchange, representing an equal proportion of Japan's import and export trade, are handled by this bank whose forty branches and more than five hundred correspondents cover every important city in the world.

The old Japanese style building which housed the Tokyo branch for many years became totally inadequate to handle its growing business, so the directors decided to erect a modern edifice equipped throughout with the most approved and up-to-date conveniences. The drafting of the plans was entrusted to Mr. U. Nagano, a well-known Japanese architect, who designed a steel framed, reinforced concrete and granite faced building in the Greco-Roman style of architecture. The building is six stories above and two

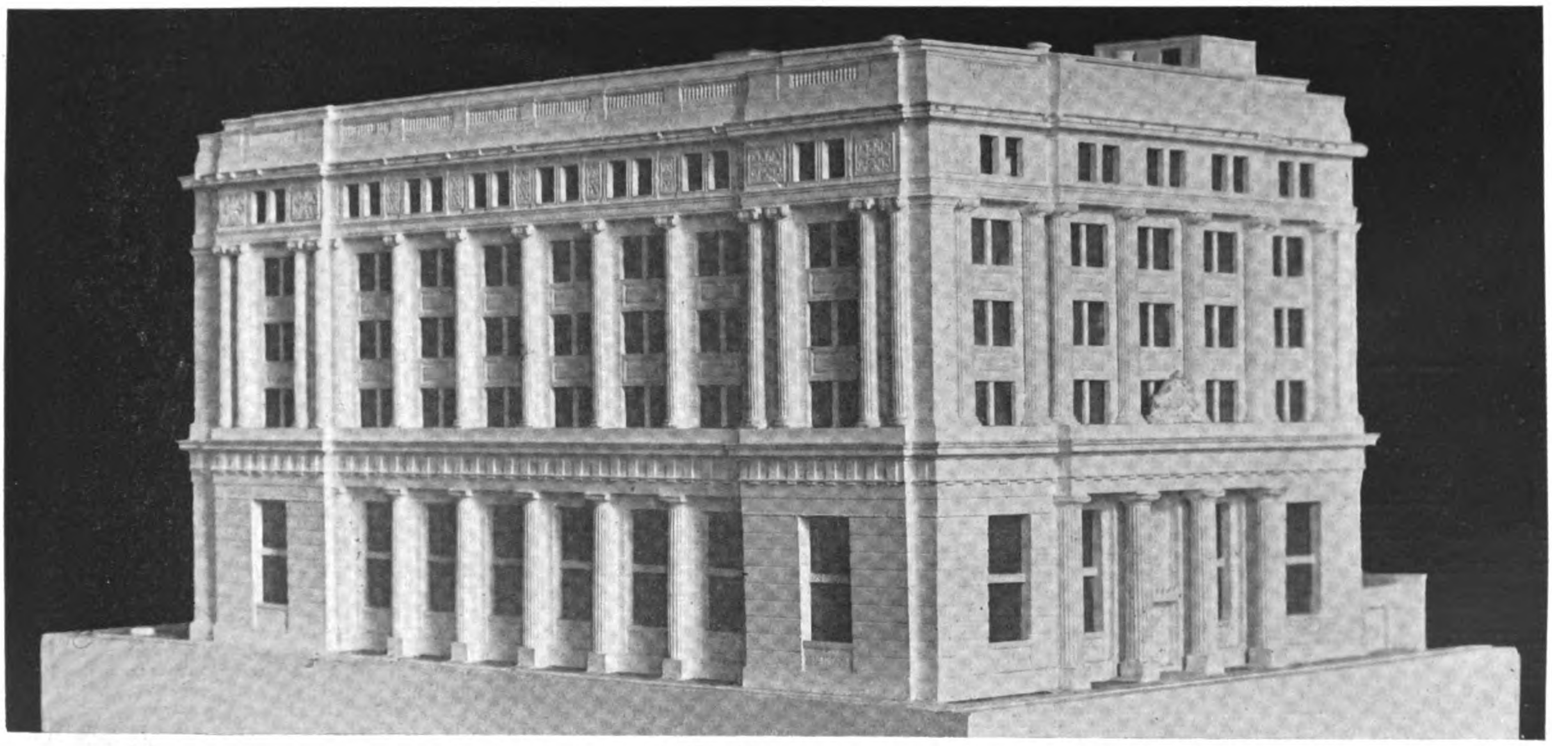


Rear View of the New Yokohama Specie Bank Executive Office

stories underground, having a ground area of 676 *tsubo* and a total of 5,013 *tsubo* of floor space. The height from the street level to the cornice is 102-ft., and 117-ft. to the highest point. This is the first building to be constructed in Tokyo with more than one underground story in order to provide ample space for safe deposit vaults for various purposes.

Owing to the nature of the soil in the Nihonbashi district, the foundation work was exceptionally difficult. Before work could be started, it was necessary to dig a wide trench around the site and build a concrete retaining wall to protect the main excavation from flood water and caving in. After completing this retaining wall, the main excavation was carried down to bedrock by means of mechanical excavators. The total excavation was 4,358 cubic feet, and 1,268 cubic feet of concrete and 163 tons of steel were used in the foundations. The contractor for the foundation work was the Kashima Gumi.

The steel frame and all iron used in the construction of the building (3,127 tons) was supplied by the United States Steel Corporation and erected by the Okura Engineering Co., Ltd. Every part of the steel frame is encased in fire-proof ferro-concrete and all floors, main walls and partitions are of the same construction. The outer facing of the building and the columns is of Kita-Kishima

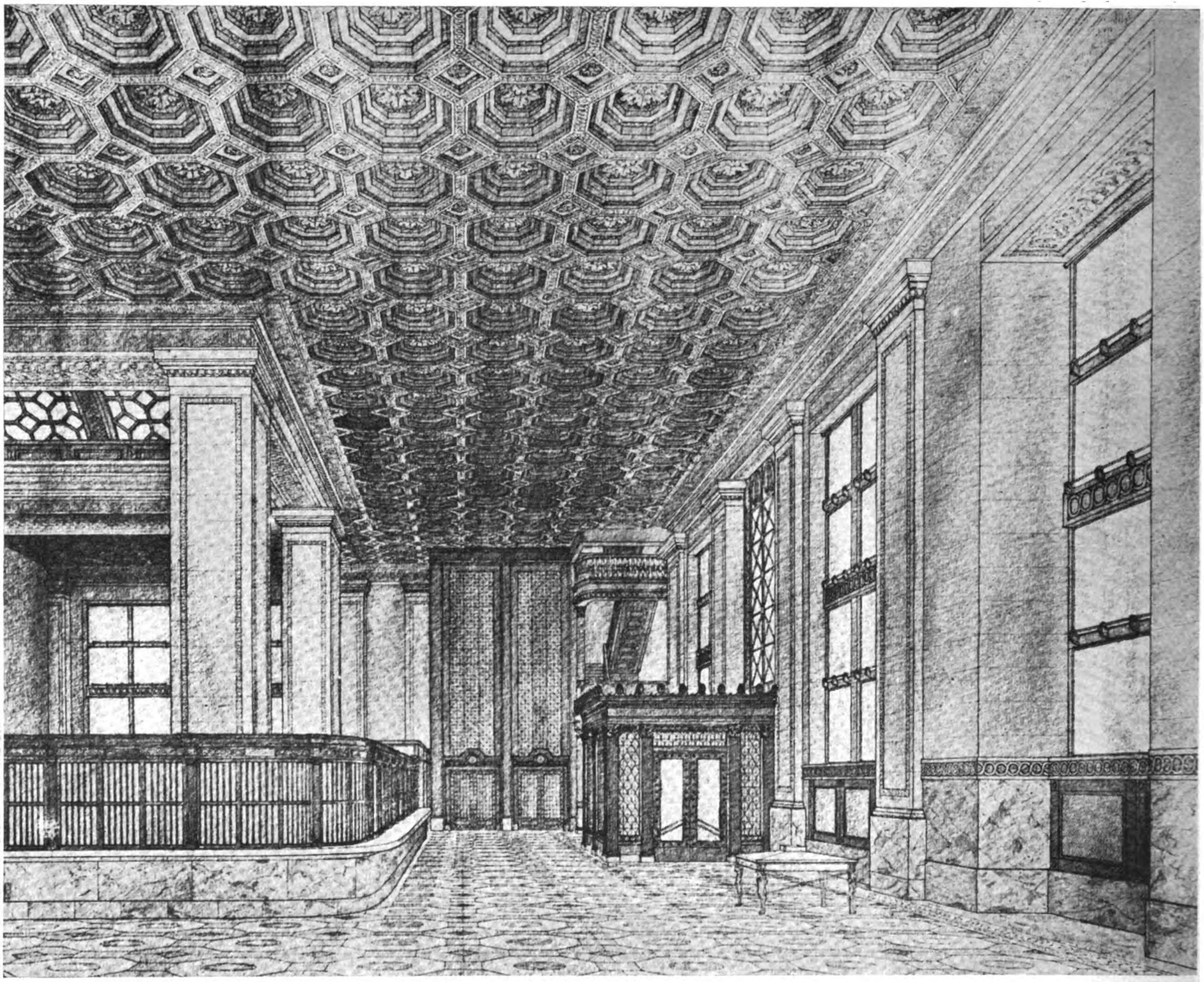


Front and Side View of the New Yokohama Specie Bank Executive Office

granite, an exceptionally fine building stone which was also used in facing the new home of the Yokohama Specie Bank in Shanghai. For cutting and working this stone a special plant comprising five cutters, surfacers and seven drills operated by two air compressors (50 and 35 h.p. respectively) was purchased from the Trow & Holden Company of America. The illustrations on page 453 show the compressed air drills, surfacers and cutters in operation at the quarry and the method of transporting and unloading the stone from the barges at the building site. The masonry contract has been carried out by the Kashiwagi Gumi.

of which, 11,756 square feet are from the Henry Hope Company, Ltd., of England and 5,834 square feet of Japanese make. As an extra protection against fire reaching the building from the outside during a general conflagration, rolling iron shutters *will* be fitted to 92 places.

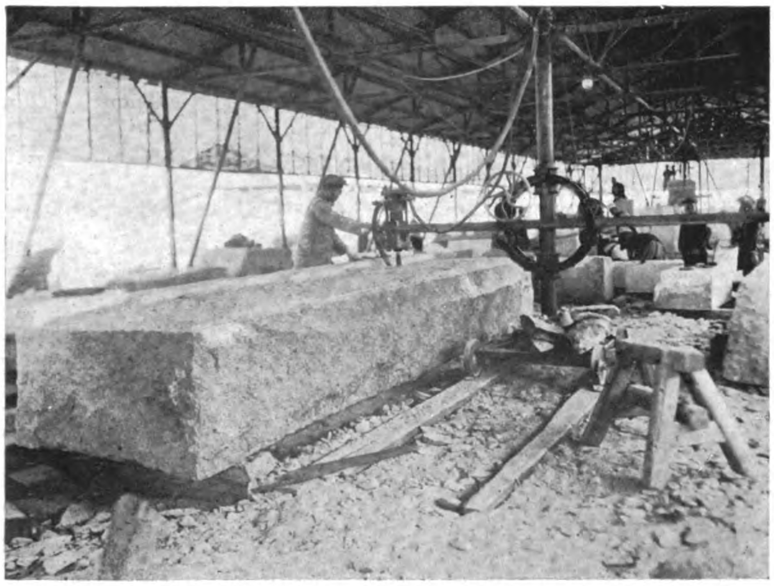
Foreign style plumbing with flush toilets, hot and cold water, wash rooms and lavatories of Japanese ware will be installed on every floor. The contract for this work together with the electric wiring and fittings, interior finish, and the vault doors and safety deposit boxes has not yet been awarded.

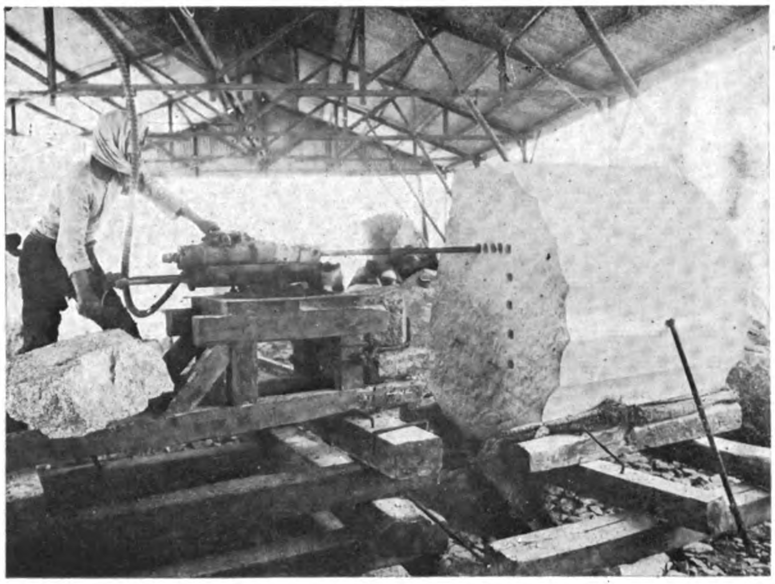


The New Yokohama Specie Bank Tokyo Branch Office: Detail of the Banking Floor from Architect's Drawing

All construction work is being carried out by sub-contractors under the direct supervision of the architect. The reinforced steel material has been furnished by the Truscon Steel Company, of Japan. The four elevators are from the A. B. See Elevator Company. The American Radiator Company, through their agents, (Takata & Company) have the contract for heating and also a ventilating system which will serve the main banking room and the underground floors. Windows will be fitted with steel sash,

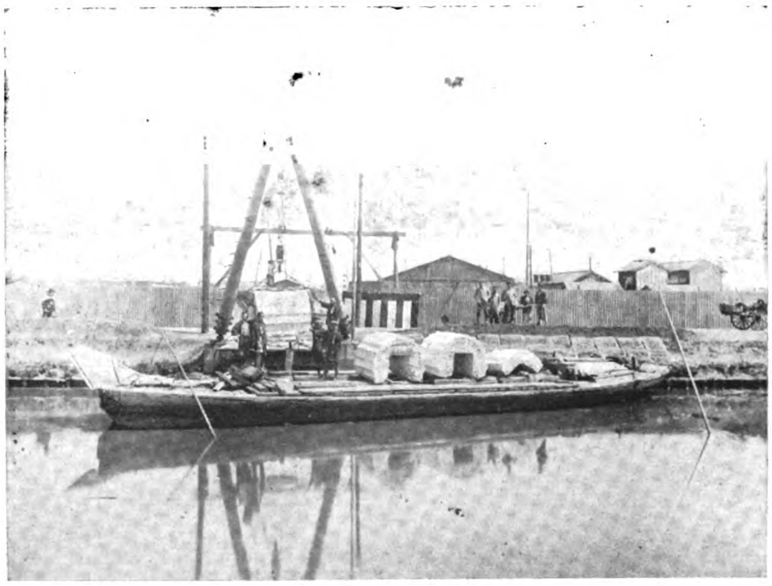
Work on the building was commenced in October, 1920 and considerable progress had been made when the earthquake and fire devastated the city and the immediate district surrounding the bank building. This compelled a suspension of operations for ten months during which time a careful study was made of the effect of the quake on other modern steel frame structures. The unprecedented violence and severity of the shocks compelled a readjustment of accepted ideas of earthquake proof construction, enabling



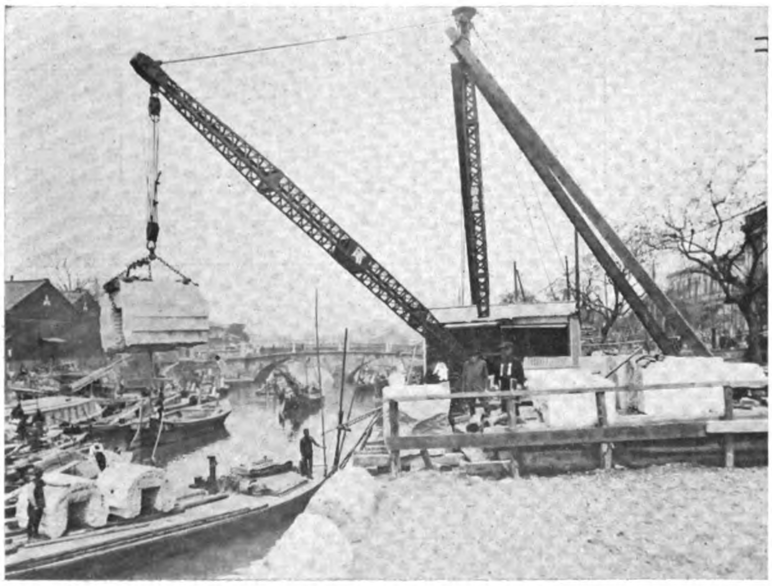


Compressed Air Stone Cutters and Drills Shaping the Pillars

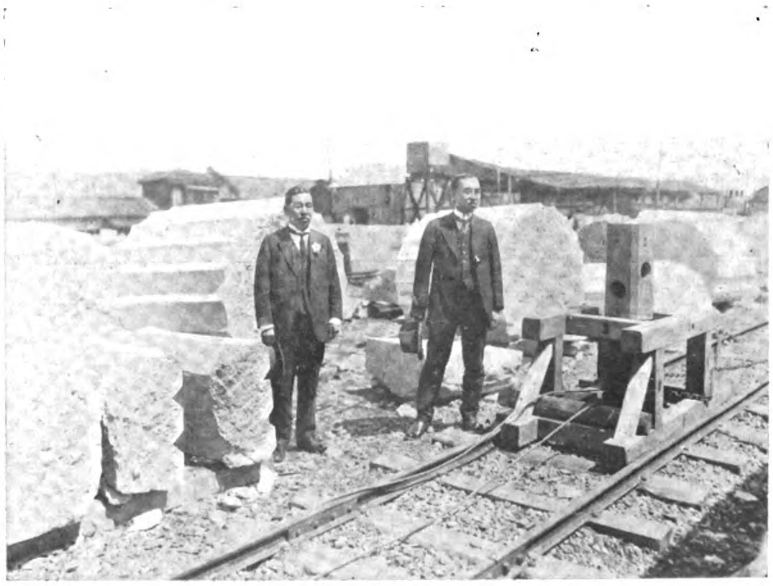
Fine Cutter for Curving



Loading the Stone on Barges at the Quarry



Unloading Stone at the Building Site



The Architect, Mr. Nagano

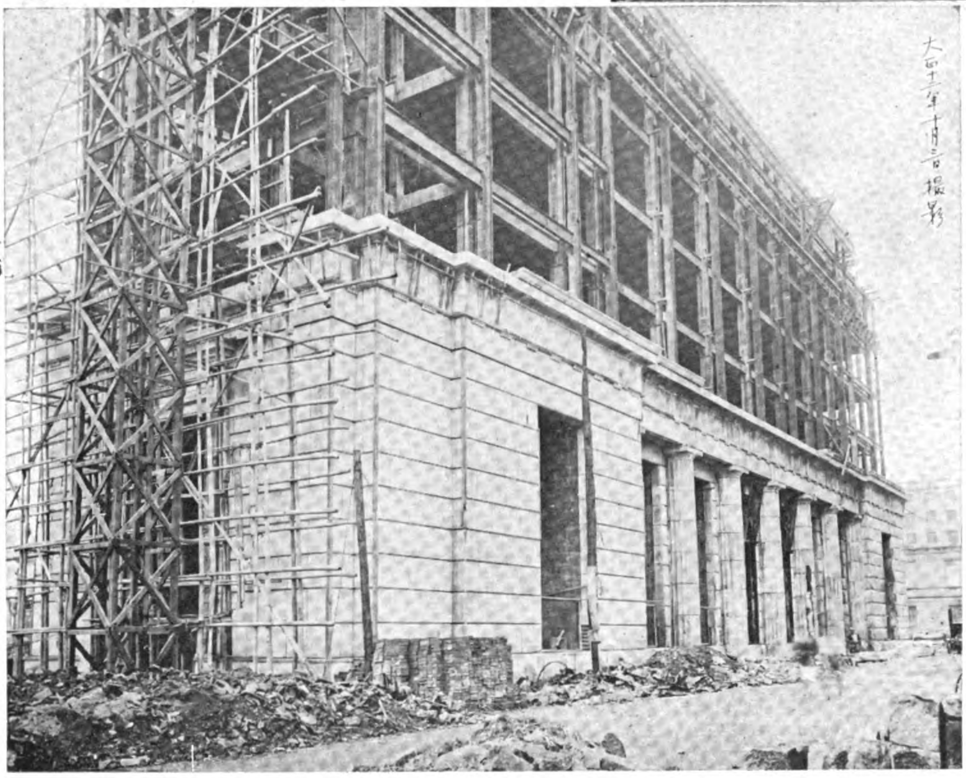
CUTTING THE DIMENSION STONE FOR THE NEW YOKOHAMA SPECIE BANK BUILDING

A Special Stone Cutting Plant Operated by Compressed Air was Imported from America to Facilitate Cutting the Hard Granite used in Construction

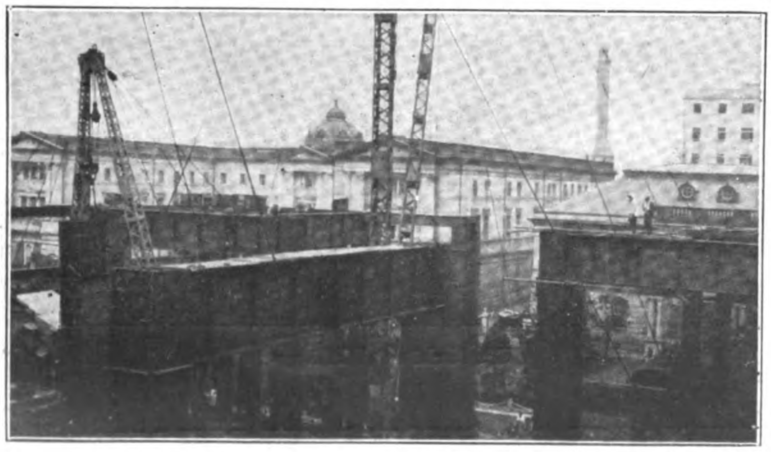
the architect of the Yokohama Specie Bank building to adopt designs and precautions that provide an even greater measure of structural stability with a consequent added protection for the lives of the occupants of the building and safe keeping of the books and securities in the deposit vaults.

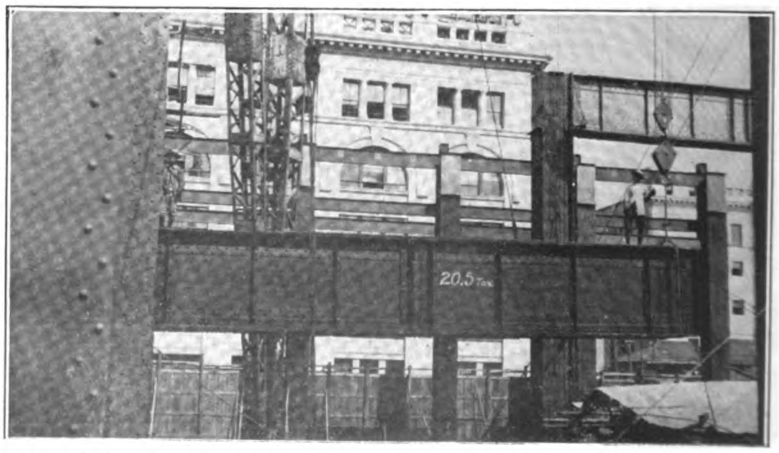
As a result of these observations, all the exterior piers around steel columns, interior columns and connecting girders are entirely covered with concrete thoroughly reinforced around and through the columns and longitudinally. Solid reinforced concrete walls are built between columns and around elevator shafts, stair wells, pipe and vent shafts. Owing to these additions to the original plans, the estimated cost of the building (Y.6,000,000) has been increased by Y.800,000, making a total of Y.6,800,000.

New Yokohama Specie Bank Building in Process of Erection. All the Steel Work was furnished by the United States Steel Products Company



Another View of the Yokohama Specie Bank in Process of Construction





ERECTING THE STEEL WORK FOR THE YOKOHAMA SPECIE BANK

Showing Bank of Japan in Background

Showing Mitsukoshi Building in Background

THE MITSUBISHI BANK

A solid granite edifice that has defied every earthquake shock. One of the most impressive financial structures in the world.
Dr. Kotaro Sakurai, Architect.

The Mitsubishi Bank

IN the center of Marunouchi, the heart of modern Tokyo, the Iwasaki interests have erected a great Bank building which in substantial construction and architectural beauty has set a standard by which all buildings erected in Tokyo will be judged in future. The pure classic architecture of the building makes it in appearance more like a temple of commerce than a banking house. Built of white stone in a city where the smoke nuisance is almost unknown, it attracts every eye that passes.

The building houses the head office of the Mitsubishi Bank, and covers an area of 30,508 square feet. With its basement and four office floors the total floor space is 105,336 square feet. The foundations are concrete laid on wooden piling, sunk fifty feet below the surface.

The building is built of American steel, with an outer facing of white stone known as Inada-Mikage marble. The inner walls are brick or hollow tile, absolutely fireproof, and all floors are reinforced concrete. This flat roof is made of five layers of asphalt and malthoid, over which concrete tiles are laid.

The main banking office is worthy of the finest traditions of banking architecture anywhere in the world. The room is vast and spacious, 140-ft. long and 70-ft. wide, with a ceiling 45-ft. wide. Including the loggia, the room is 176-ft. long and 31-ft. wide. The walls and floors are of marble, and the panelling is mosaic.

Magnificent bronze doors made by the Jackson Company of America are provided for the three entrances to the banking room. In design and finish of workmanship they are equal to the best examples of medieval art, harmonizing with the architecture in absolute perfection. The counter of the banking office is made of Mikage stone highly polished, and the bronze grille which surmounts it is made by the Jackson Company. The waiting-room is finished in especially imported Verona red marble.

The safe deposit vault is one of the finest in the world. It is equipped with 3,578 boxes, large and small, made by the Mosler Safe Company. There are five steel reinforced vaults which house the safes of the bank, two of them on the main floor and three in the basement. The finest vault, the case vault, is equipped with a special Chubb door, having three Chubb time locks.

The main banking office and the vaults are heated and ventilated in the most modern American manner. The office rooms are heated by a low-pressure steam system. The Otis Elevator Company has installed two passenger elevators, one freight elevator, and one dumb-waiter in the building.

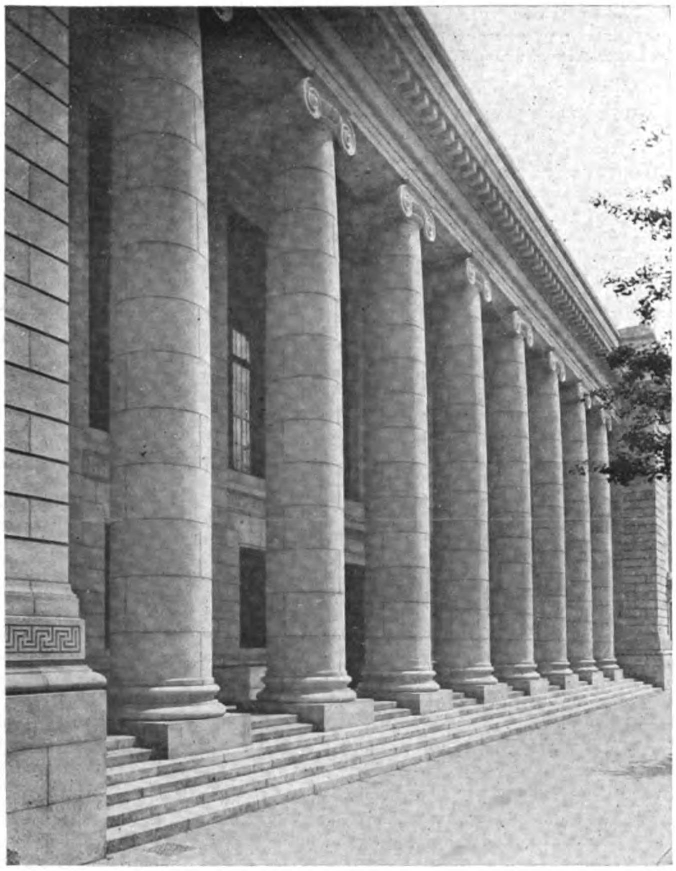
The first and second floors contain the offices of the directors and the directors' room, finished in marble and teak, with floors of mosaic tile.

Throughout the building the lighting is indirect, and the main banking office is lighted through an ornamental stained glass ceiling by which 100 X-ray light reflectors pour their soft light. The brackets and light stands in this room are made of bronze and were all imported from America.

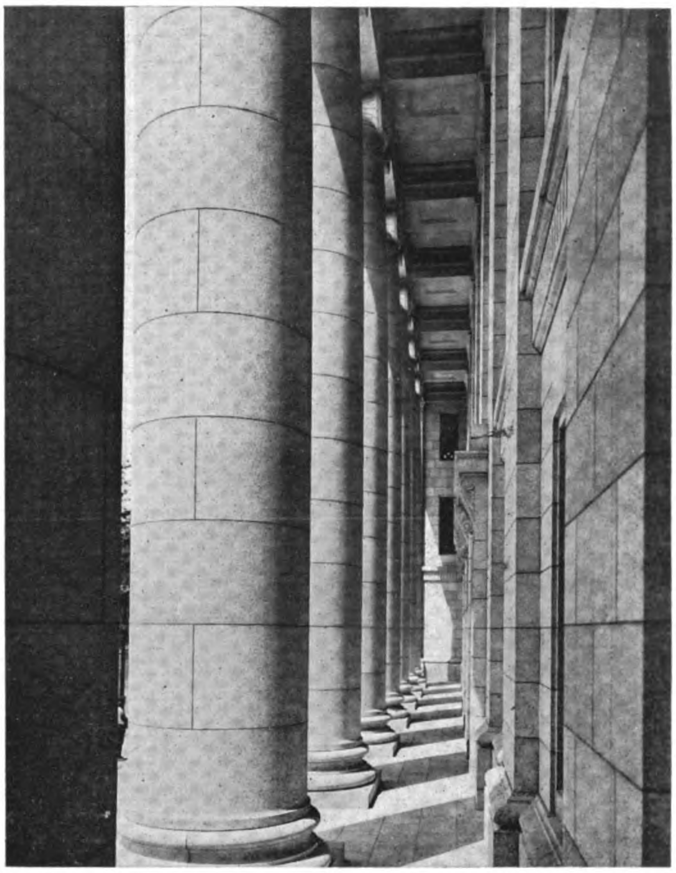
There are seventeen hydrants installed in all parts of the building served by a $7\frac{1}{2}$ h.p. turbine pump installed in the basement. In the same room a 3 h.p. pump supplies all the water for sanitary purposes, and discharges the refuse water into the city sewer system.

This building, which is a credit to its owners and the city of Tokyo, was designed by Dr. Kotaro Sakurai, who is also in charge of the designing of many of the new Government buildings to be erected in Tokyo under the Reconstruction plans.

The Main Banking Room of the Mitsubishi Bank, Tokyo

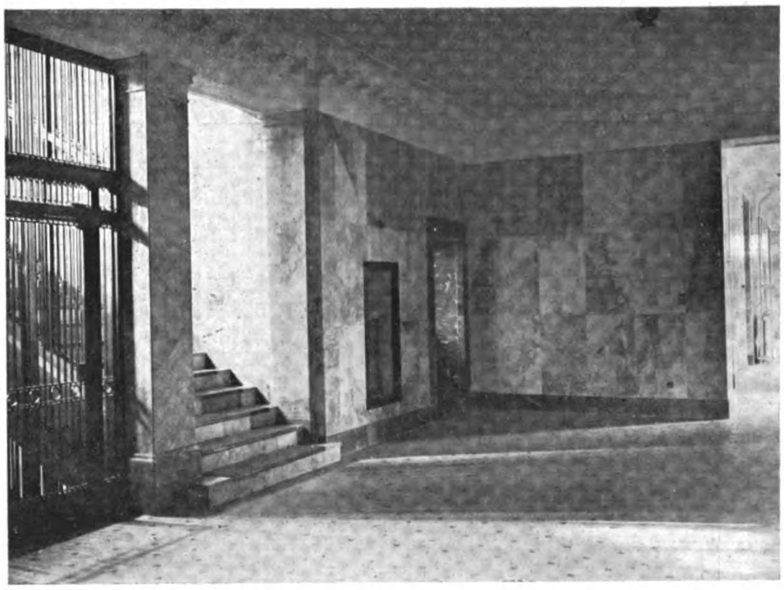


The Mitsubishi Bank Building, Tokyo

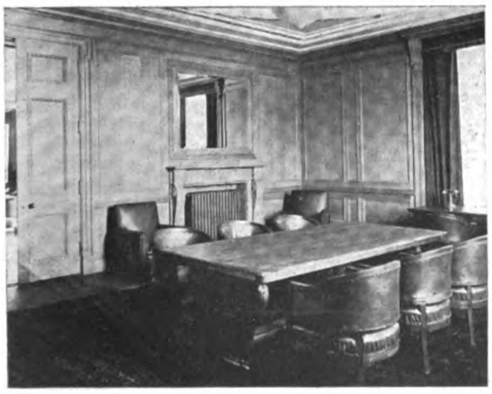


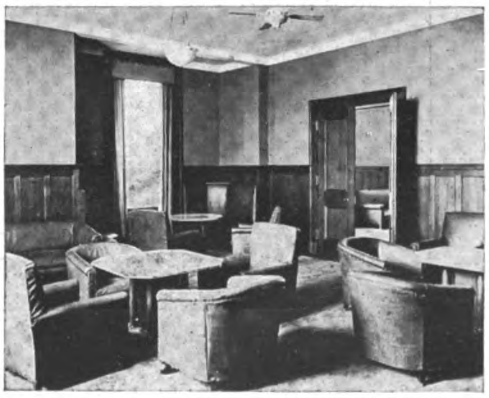
The Colonnade of the Mitsubishi Bank

Interior of Banking Room



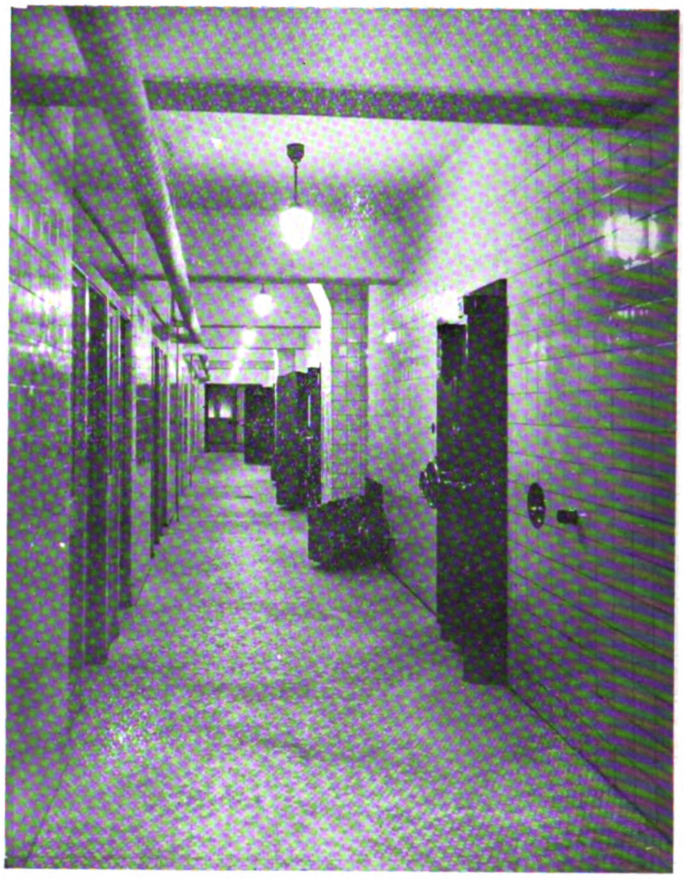
Stairway and Hall



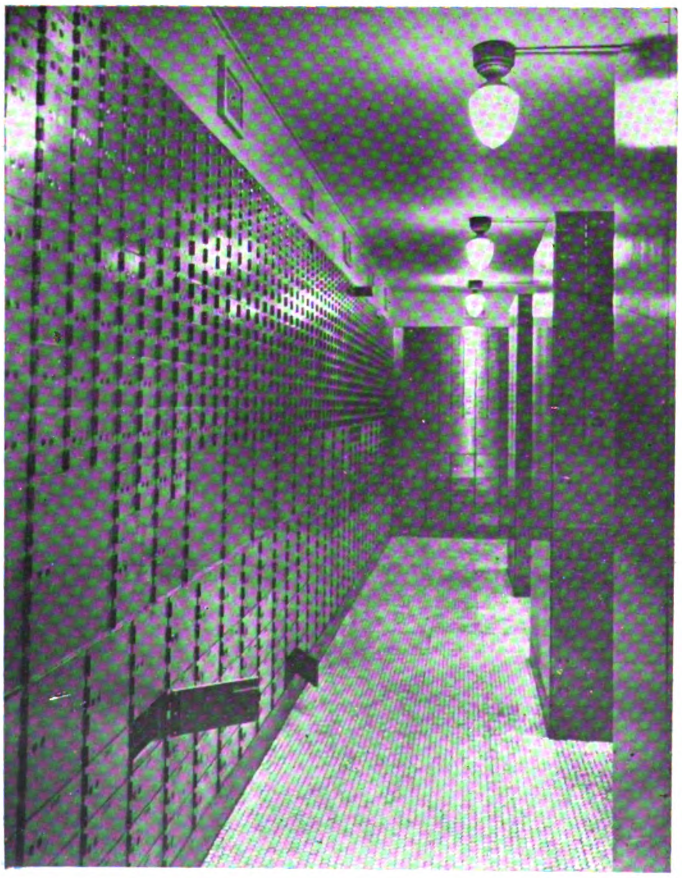


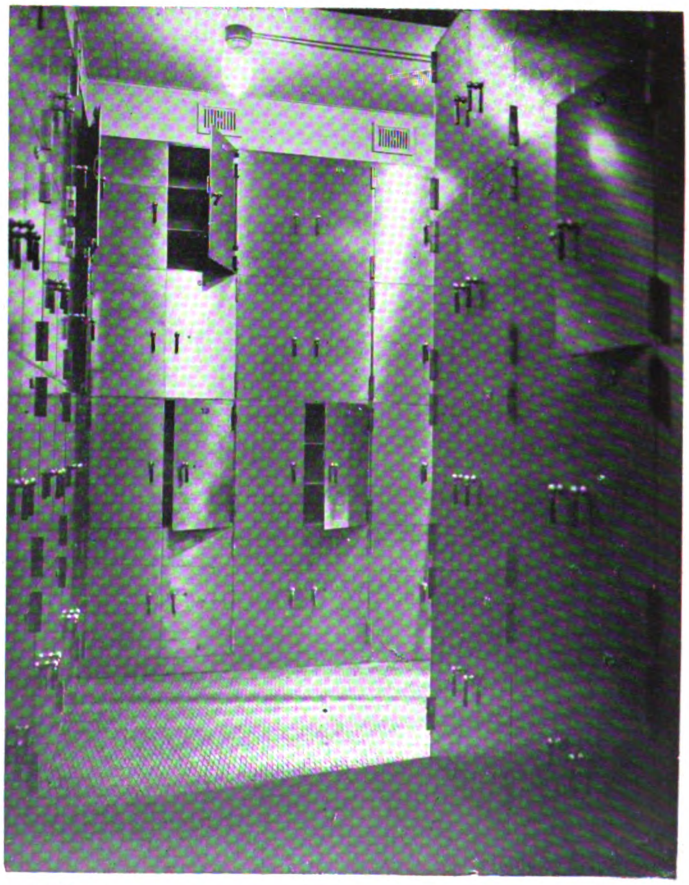
Directors and Board Rooms

THE MITSUBISHI BANK BUILDING, TOKYO

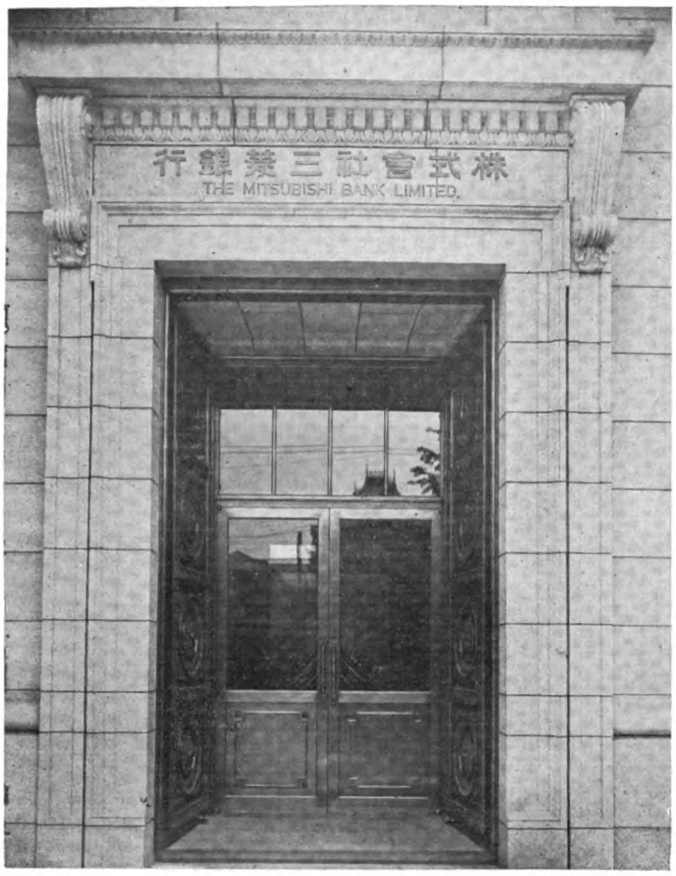


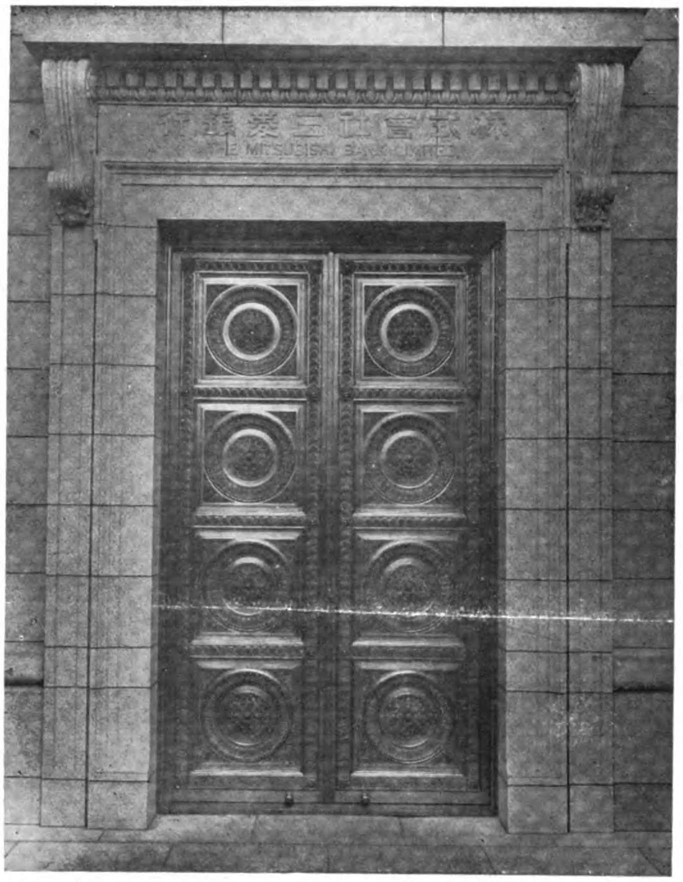
Vault Galleri





Interior of Safe Deposit Vaults





MAIN ENTRANCE TO THE MITSUBISHI BANK
The Heavy Bronze Doors made in America cost $45,000

Foreign Borrowings of Japan

By Elgin E. Groseclose, special agent, U.S. Government Finance and Investment Division

THE first large-scale flotation of Japanese bonds in the United States occurred in 1905, when New York shared with London, Paris and Berlin in an issue of £25,000,000 for the consolidation and redemption of the fourth and fifth issues of Exchequer bonds. A previous loan of £10,000,000—the first foreign borrowing of the Japanese Government—had been raised in London in 1899 for the purpose of meeting the expenditures required for the construction of railways, steel manufacturing, and the extension of the telephone system.

During 1905 Japan also raised £60,000,000 in two issues of £30,000,000 each, to meet the extraordinary expenses of the war with Russia—the first jointly in New York and London, and the second in London, New York, and Germany.

Loan for Reconstruction Purposes Floated in United States in 1924.

At various times in 1907, 1910, 1913, and 1920 Japanese loans were placed in London and Paris. In 1924 a $150,000,000 loan was floated in New York for reconstruction purposes following the earthquake. This was the first Japanese governmental loan expressed in dollars. At the same time £25,000,000 were raised in London. Of the $150,000,000 loan an amount of about $25,000,000 was sold abroad, largely in the Netherlands, and approximately $66,000,000 of the loan were used to retire previous issues.

Industrial and Private Issues Offered.

The first Japanese industrial loan publicly offered in the United States was a Government-guaranteed issue in 1923—that of the Oriental Development Corporation—for $19,900,000. In 1924 two issues were floated, one of the Industrial Bank of Japan for $22,-000,000 and one of the Great Consolidated Daido Electric Power Co. for $15,000,000; and, recently, a $15,000,000 loan was offered for the Toho Hydro-Electric Corporation. Although the Government has announced its intention of seeking no further loans abroad this year, large sums are being sought by private corporations, particularly hydro-electric enterprises.

Total Debentures of Bank and Corporations Summarized

Since the earthquake the amount of loans floated at home and abroad has increased tremendously. According to an investigation made by the Industrial Bank of Japan, the total debentures issued by banks and corporations in 1924 amounted to 931,542,000 yen, compared with 282,661,000 in 1923. The totals for each year since 1912 follow:

	Yen
1912	15,650,000
1913	38,504,000
1914	6,961,000
1915	48,688,000
1916	47,860,000
1917	57,606,000
1918	78,529,000
1919	141,669,000
1920	142,780,000
1921	216,750,000
1922	173,150,000
1923	282,661,000
1924	931,542,000

Foreign Borrowing an Advantage—Need for Capital.

The advantage of foreign borrowing is indicated by the high interest rates prevailing in Japan. The average rate of interest on current deposits throughout the country has risen gradually from 3.2 per cent. in 1912 to 3.6 per cent. in 1921; on savings deposits, from 4.8 per cent. to 5.1 per cent.; on loans, from 9 per cent. to 10.9 per cent.; and on discounted bills, from 8.8 per cent. to 10.7 per cent. Call money during 1924 reached its highest in January, at 9.67 per cent., and the lowest in June, 4.01 per cent.

The situation of Japan financially is similar to that of the western United States in its early days. A vast development is under way, for which the domestic supply of capital is insufficient. This handicap was accentuated by the earthquake and fire of September 1923, and the restoration work consequent will require enormous expenditures for some time to come.

The New Building of the Industrial Bank of Japan: A Reinforced Concrete Structure Erected by the Obayashi Gumi which withstood the Earthquake without the Slightest Damage

The Industrial Bank of Japan

ONE of the most modern-equipped bank buildings in Asia is the handsome new edifice erected by the Industrial Bank of Japan in the heart of Tokyo's financial district, next door to the Bankers' Club. This building was only completed on June 15, 1923, a month and a half before the earthquake, and came through the severe shaking up and fire without a crack or damage of any kind, a high tribute to the quality and excellence of the work of the Obayashi Gumi, its designers and constructors. The building is seven stories and basement, 98-ft. 6-in. high from the ground to the eaves, covering 561 *tsubo*, with 4,171 *tsubo* of floor space.

In preparing the foundations, the site was excavated for 14-ft. 6-in. below the street level, and Douglas fir piles 45-ft. long driven down to make the foundation for concrete. The entire structure is of reinforced concrete, with a curtain wall up to the second story of granite, and above this American *terra cotta*. The inner walls are of hollow fireproof brick, metal lath and mortar. The floor and roof are of concrete, all covered with linoleum except the main banking and customers' rooms, which are laid with mosaic. The roof is covered with three layers of Rubberoid roofing, over which tiles are laid.

The windows and doors are of fire-resisting wired glass, with plate glass in all outside windows. Doors are made of teak or cherry wood, and all hardware is American. The heating apparatus is a low-pressure steam system with boiler in basement. The 1st, 2nd and 3rd floors are equipped with apparatus for supplying warmed or cooled fresh air. To cool the air an artesian well was sunk which can supply about 400,000 gallons daily. There is one tank on the roof which regulates the supply of water at high pressure for fire-fighting apparatus and for sanitary purposes. Water for the kitchen and dining-room also comes from the roof tank. Another storage tank for hot water is also built on the roof.

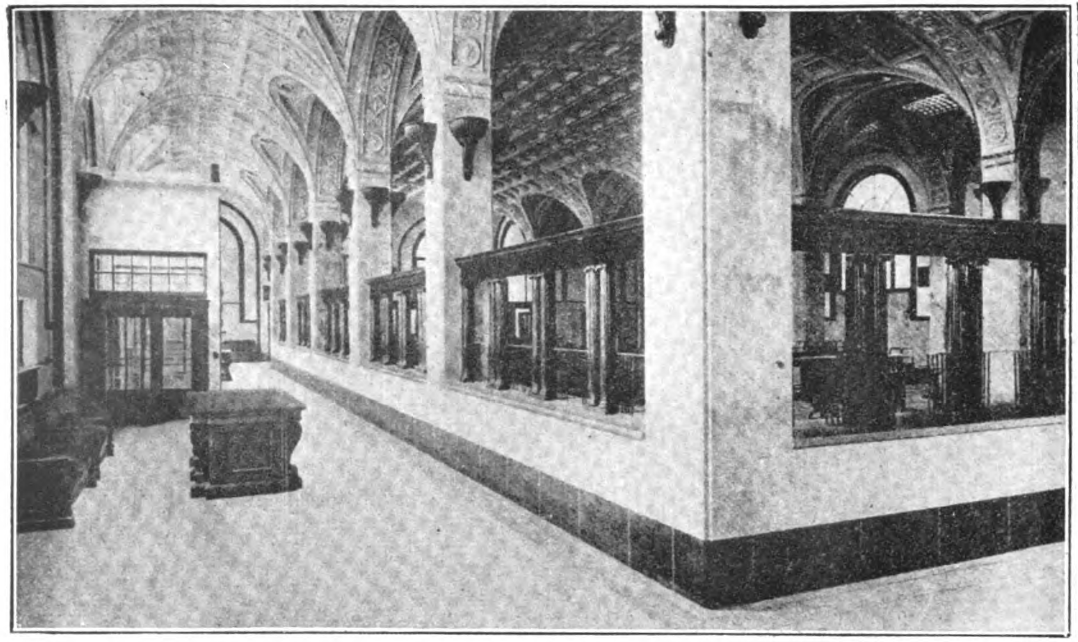
All sewage is discharged into a septic tank in a separate building, where the purified sewage is carried into the city sewers. Each floor has connections for an electric vacuum cleaner, and a pneumatic carrier is installed between the business office and the third floor bureau of accounts. There are five elevators for the public, each 2,000 lbs. capacity, speed 300-ft. a minute, and one lifting 5,000 pounds. There is also one Japanese-built freight elevator and Japanese-made dumb waiters equipped with speaking tubes.

An American mail shute is on all floors. Electric power for the building is supplied by the Tokyo Electric Light Company, the equipment consisting of a step-down transformer, reducing from 330 volts to 210 and 105 volts ; 758 lights, equivalent to 8,000 ten c.p. lamps; 500 light switches ; and 37 electric motors supplying 229 h.p. power.

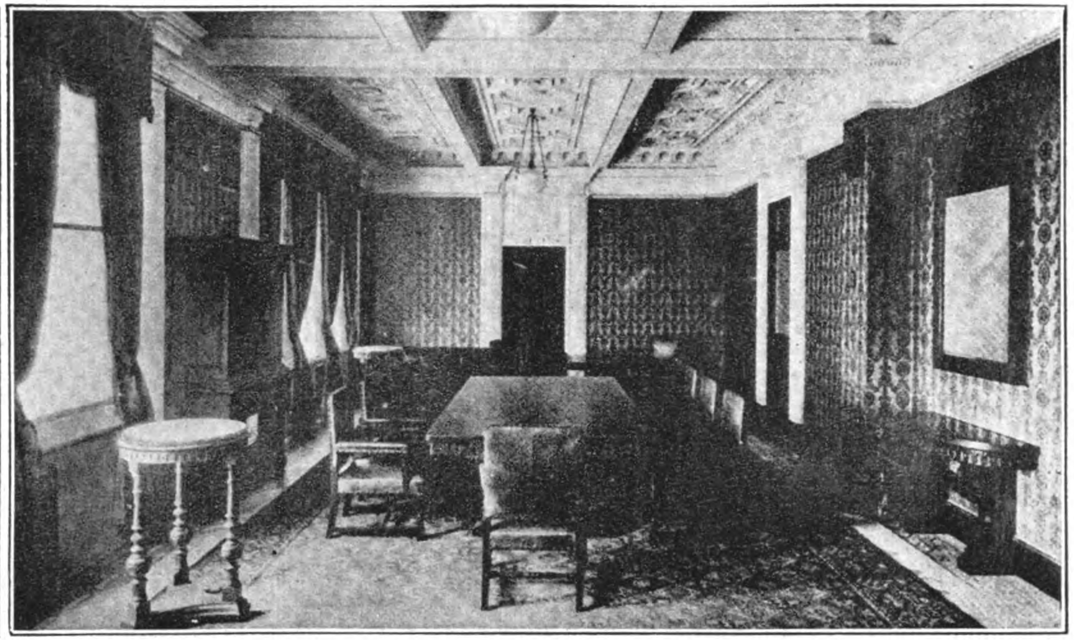
There is also electric heating equipment for emergency and after office hours, and 13 electric hot-water heaters. The Bank office is equipped with cables for 250 telephones, also one master magneto electric clock of Swiss manufacture, and 89 others. The cash safe is 20-ft. wide, 35-ft. long and 9-ft. high, with a door which is 18-in. thick, and the safe deposit vaults are 20-ft. wide, 45-ft. long and 9-ft. high, and have a round door of the latest pattern, 23-in. thick. 1,600 safe deposit boxes are provided. All safes have time locks of the most up-to-date construction.

THE NEW HOME OF THE NIPPON KOGYO GINKO

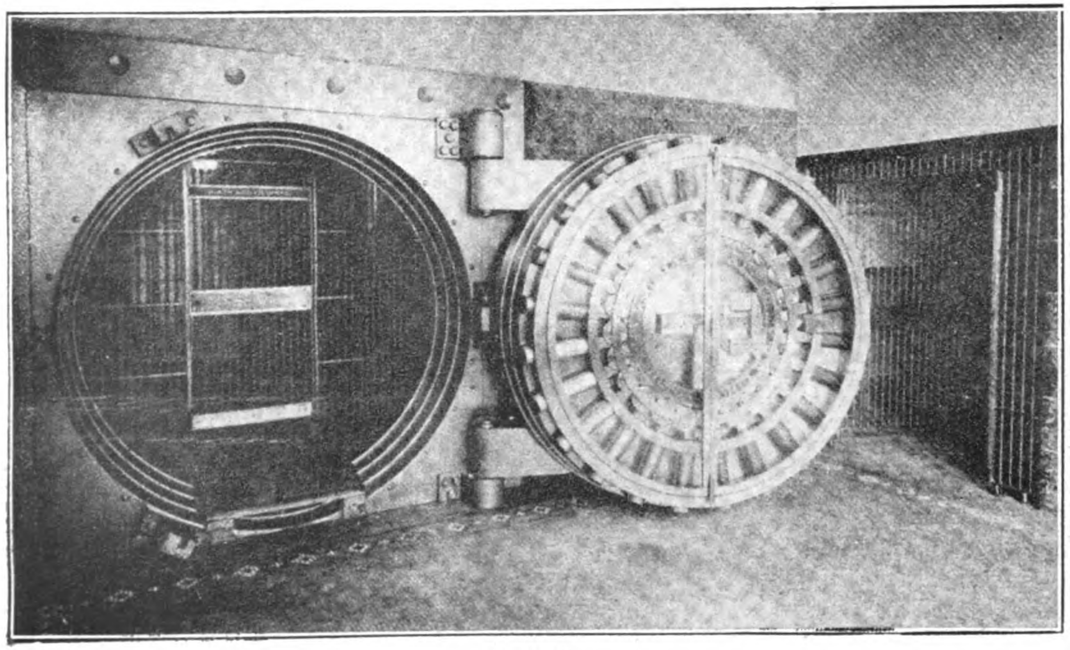
(INDUSTRIAL BANK OF JAPAN)



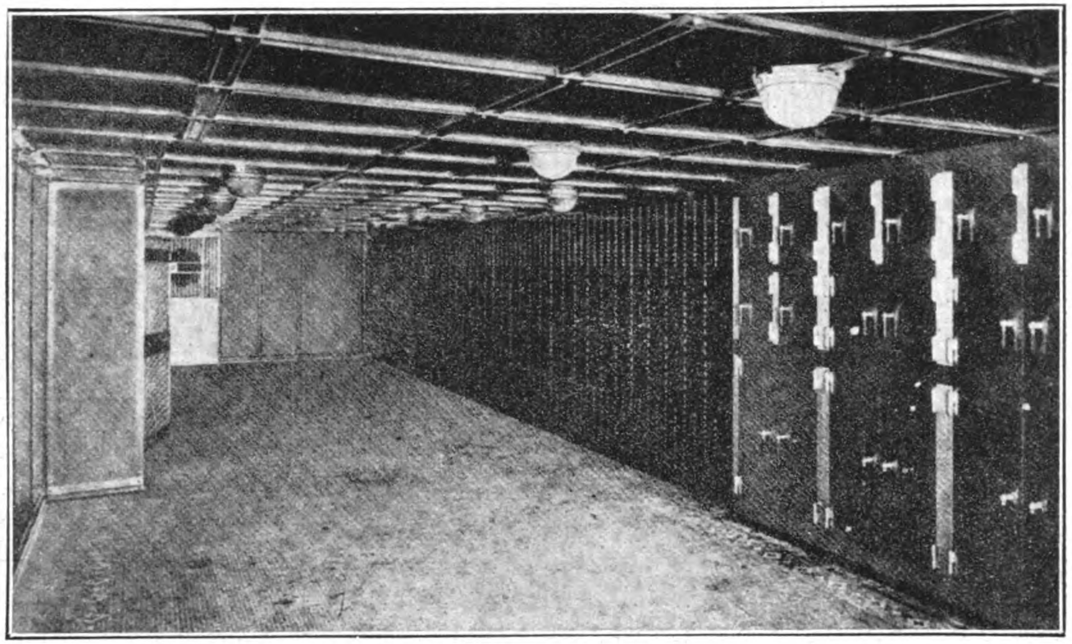
Banking Floor



Board Room



Vault Door



Safe Deposit Boxes

Building Construction for the New Tokyo

By R. F. Moss, Associate Member, American Society of Civil Engineers; Vice President, Truscon Steel Company of Japan, Tokyo

IMMEDIATELY following the great earthquake and fire of September 1st, 1923, it was my privilege to make a detailed examination of a large number of structures in the zone of the great catastrophe, including some structures destroyed by the earthquake, some destroyed by the fire, some that came through both ordeals undamaged, and others in various states of partial destruction from both causes. Since then our company has had a committee continually working on the investigation of building construction suitable for a country of severe earthquakes, and in this work we have accumulated a very large amount of data, but most of this is of a technical nature and not suitable for an article of this kind. Many of the conclusions reached, however, can be stated in non-technical language, and it is the purpose of this article to present a non-technical discussion of the general problem of building construction, both fireproof and not fireproof, suitable for such a country as the part of the Empire of Japan that is subject to destructive earthquakes.

I will take up first the way in which an earthquake does damage to building construction generally, pointing out some of the lessons that follow naturally from an analysis of this kind, and then proceed with the lessons learned from detailed observations of buildings in the earthquake zone.

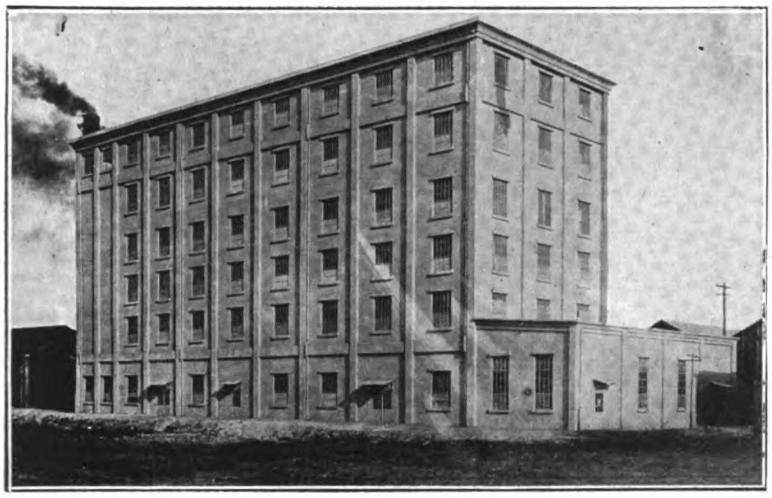
An earthquake consists of vibrations, both horizontal and vertical, in the earth's crust. These horizontal and vertical vibrations may occur simultaneously, and the horizontal vibration may occur in several directions during the same earthquake. The amplitude, that is the maximum horizontal movement in any direction, may in the case of destructive earthquakes be as much as eighteen inches. It varies considerably for different localities during the same earthquake, and varies in the same locality according to the hardness of the earth's crust at any point, the amplitude, and therefore the severity of the earthquake, being generally greater in soft than in hard soil. Seismologists and engineers rate the severity of earthquakes by acceleration, this meaning of course the rate of increase in the velocity of the earth's surface at the point under observation. In the downtown part of Yokohama the maximum acceleration during the great earthquake was about eleven feet per second, the time between successive shock waves about one and a half seconds, and the maximum amplitude about fifteen inches. This means roughly that a given spot on the earth's surface, quiescent to begin with, attained a velocity of three or four miles per hour, slowed down to quiescence again, moving about fifteen inches in the process, then reversed its direction and repeated the process back to the starting point, all in one and a half seconds. I give the velocity in miles per hour rather than in feet per second because it is easier to understand velocity when expressed in that way.

Iwai Office Building, Yokohama.
Reinforced concrete skeleton construction with concrete joist hollow floors and roof, and with metal lath and plasterceilings; continuous reinforced concrete foundations without piles. Reinforced concrete walls and partitions. Contents and all interior wood work destroyed by fire and building settled appreciably, but no structural damage done.

The vertical movement and acceleration is usually from one-sixth to one-third as much as the horizontal. If we compare the vertical acceleration to the acceleration caused by the force of gravity, we find that the former is seldom, if ever, greater than about one-tenth as much as the latter. The horizontal acceleration may, however, be as great as four-tenths of the acceleration caused by gravity. The really destructive portion of an earthquake seldom lasts longer than about ten seconds.

Now if we consider the probable effect of these movements on a building of any kind, we immediately see that the vertical movement can hardly cause any damage at all. Buildings are necessarily designed to resist vertical forces and are nearly always designed with what we call a " factor of safety " of at least three, by which we mean that each part is proportioned to resist a force at least three times as great as the force of gravity can bring to bear on it. Inasmuch as the vertical part of the earthquake exerts a force of not more than one-tenth the force of gravity, it is clear that this part of the earthquake cannot harm any properly designed building. It is also clear that there can be no appreciable difference in the lifting of different parts of the same building by the vertical vibrations, because the earthquake wave length varies from thirty to three hundred miles. We may therefore, with perfect safety, eliminate the vertical vibrations from further consideration.

Taking up next the horizontal movement we can see that any movement of the earth must necessarily be, at least partly, transmitted to the foundation of the building, which will move in the same direction and with approximately the same acceleration as the earth surrounding it. The inertia of the upper portion of the building tends to make it stay in its original position, and the walls and columns are suddenly called upon for the strength necessary to overcome this inertia and move the building with the foundation. Successive shock waves follow, each moving the foundation horizontally, forward and backward, the walls and columns having to perform the work of moving the part of the building that is above them with each successive horizontal movement of the earth. As the walls and columns of each floor have only to do the work of moving that part of the building which is above them, it follows that the walls and columns of the first floor will be called upon to resist forces greater than those which must be resisted by the walls and columns of the second floor, and that these in turn must resist forces greater than the forces to be resisted by the walls and columns of the third floor, etc.; these forces decreasing from a maximum just above the foundation to nothing at the roof. It also follows that the greater the weight of the floors and roof, the greater will be the work to be done by the walls and columns, and therefore the greater the strength required in these parts of the



Toa Flour Company, Factory Building, Tokyo.

Reinforced concrete skeleton construction with concrete joist hollow floors; reinforced concrete mat foundation supported on wood piles under whole building. Very soft soil. Reinforced concrete walls painted with "Stonetex." No damage of any kind.

structure. If the combined strength of the walls and columns at any level is great enough to move that part of the structure which is above them, they will stand, otherwise they will fail, either wholly or partly.

In a number of buildings in the Marunouchi district of Tokyo the greatest damage was usually found between the second and third floors, and the question naturally arises as to why the greatest damage was not between the first and second floors if that is where the greatest forces are to be resisted. The answer is that the walls of the first floor are usually made of well laid stone and are strong enough to do the work that they are called upon to do, that is, to move the part of the building above them, but the walls of the second and higher floors, made of brick or terra cotta, which are much weaker materials, were in some cases not strong enough to move the part of the building above them. In such cases the maximum damage was usually observed just above the junction of the stronger and the weaker wall material.

Now with regard to floors, my observations lead me to believe that no building earthquake failure was started by a floor failure but that in every case of a damaged building the failure started in a column or wall failure, and this is easy to understand because the floors are in the same plane as the damaging horizontal motion. The tendency is to move them horizontally, but there is very little tendency to distort them. If the vertical motion were sufficiently severe to cause damage, we would expect it to occur in floors, but I have already shown that this is impossible.

From this reasoning it follows that in designing buildings to resist earthquakes, the floors should be made just as light as it is possible to make them without sacrificing other important qualities, such as fireproofness, permanence, rigidity, etc., but that walls and columns *must* be made strong enough to do the work that they will some day be called upon to do, namely, to move the weight of the whole of the construction that is above them, in any horizontal direction and at an acceleration that should be determined by experts for each locality.

If we attempt to ascertain how much of the work of moving the weight of the portion of the building that is above any level is done by the columns and how much is done by the walls, we immediately see that it must nearly all be done by the walls or the walls will fail, especially in the case of steel frame buildings, as the following reasoning demonstrates. Columns, whether of steel, wood, or reinforced concrete, no matter how strong, always have a certain amount of elasticity, and when a (vertical) column is suddenly called upon to resist a violent horizontal movement, it must necessarily deflect more or less, the amount of the deflection depending on the stiffness of the column. Now, no matter how small this deflection is, the work of resisting the shock, that is of moving the upper portion of the building, must necessarily be at once taken up by the masonry walls because the masonry walls are in intimate contact with the steel columns on all sides and are always, necessarily, stiffer than the columns.

Observation supports this reasoning completely. The Yuraku and Yusen Buildings have columns as strong as any I have ever seen, having been designed especially to resist earthquakes, but the walls of these buildings were damaged in the same way and to approximately the same extent as were the walls of the Marunouchi and Kaijo Buildings where the steel columns were very much lighter. Our examinations of many buildings showed conclusively that the extent of the damage depended inversely on the strength of the walls.

The principle—Light floors and strong walls—is by far the most important consideration in the design of buildings to resist earthquakes. The whole question of proper design rests on this principle.

From the reasoning given above it is also clear that the attachment between the floors and the walls must be strong enough to enable the latter to move the former when the earthquake comes. Many buildings failed from the lack of sufficiently strong connections to enable the walls to transmit the earthquake motion to the floors and roof. Brick walls with floors supported on steel or wood beams and with roofs supported on steel or wood trusses, proved to be a very dangerous type of construction, and the reason for this is that it is very difficult to make a strong connection between such different materials. As far as possible the construction should be homogeneous, for example, steel columns with steel beams, reinforced concrete columns with reinforced concrete beams, etc. The connection between the different parts *must* be adequate.

Keeping in mind the above reasoning it also follows naturally that large open floor spaces in multiple story buildings should be avoided whenever possible, and when large floor spaces cannot be avoided, special precautions should be observed in the design of the walls and columns. The reason for this is that when floor spaces are large, it is difficult to provide sufficient wall strength to move them. For the same reason it is dangerous to build multiple story buildings with too much window area in the outside walls. Wall strength is an absolutely necessary and glass will

Yokohama Y. M. C. A. Building.

Reinforced concrete skeleton construction, with concrete joist hollow floors and with metal lath and plaster ceilings; continuous reinforced concrete foundations on wood piles; brick curtain walls plastered and painted with "Stonetex." Contents and all interior wood work destroyed by fire, but no structural damage done.

not provide it. These principles will have an important effect on the future design of factory buildings. Owners of such buildings will have to arrange their manufacturing processes so as to allow their floor space to be divided into smaller units by strong partitions. In this way only can safety be assured.

The correctness of the principles thus arrived at has been well established by detailed observation on many buildings, and these principles will undoubtedly be followed in the design of future buildings in the earthquake zone.

With regard to foundations, the available evidence indicates that buildings on strong pile foundations received more shock than buildings on the so called mat or floating foundations, but that greater vertical settlement occurs in buildings on the latter type. In the case of buildings on floating foundations there is probably a considerable amount of slipping between the foundation and the earth directly beneath it, which would reduce the amount of horizontal motion in the building. The crushing of side-walks around buildings, noticed in many places, is evidence of this slipping. I understand that this slipping between the earth and the foundation has long been recognized by architects in Japan, and that it is an old practice to put a layer of sand below the foundation to facilitates lipping and thus reduce shock. Inventors have attempted to utilize this principle by putting buildings on ball or roller bearings, but so far no one has evolved a practical design. If it could be worked out it would undoubtedly nullify the effect of the dangerous horizontal vibrations.

Mitsubishi No. 27 Building.

Reinforced concrete skeleton construction with concrete joist hollow floors and metal lath and plaster ceilings; continuous reinforced concrete foundations; reinforced concrete walls; metal lath and plaster partitions. No damage of any kind.

There is no question but that a certain amount of this slipping occurs, and this being the case it is clear that all parts of the foundation should be so well connected together that all parts will move as a unit, and that there will be no difference in the displacement of the different parts. In this, also, observation supports theory, and we find that generally buildings on continuous reinforced concrete foundation stood the effects of the earthquake better than buildings erected on isolated pier foundations.

Taking up next the behavior of different kinds of building materials, our observations show that well laid stone of good quality suffered very little. The behavior of brick walls seemed to depend entirely on the workmanship and quality of the brick and mortar. In Yokohama, brick buildings generally collapsed. In Tokyo, where the shock was less severe, brick buildings generally stood, if of first class workmanship. Terra cotta and hollow tile suffered severely. This is to be expected as these materials have very little structural strength. Structural steel buildings generally stood the earthquake shock but suffered severe damage unless built with strong masonry walls and partitions. This type of construction, however, was generally badly damaged or destroyed by the fire unless fireproofed with reinforced concrete. No other fireproofing material was equally effective.

Reinforced concrete buildings seemed to stand the combined earthquake and fire test better than any other type, with the possible exception of steel frame buildings with reinforced concrete walls, floors, and column fireproofing. Of a total of 593 reinforced concrete buildings investigated in the city of Tokyo, 7 collapsed, 13 were damaged so that they had to be pulled down, 42 suffered severe but reparable damage, 69 suffered small damage, and 462 were not damaged at all. In Yokohama, nearly all of the buildings that remained after the earthquake and fire were reinforced concrete. When we consider that reinforced concrete is a comparatively new type of construction, that very little knowledge of proper anti-earthquake designing methods existed prior to the earthquake, and that the usual method of specifying and making concrete mixtures is very defective, this is really a very remarkable record, and it is easy to understand why Tokyo architects are practically unanimous in their choice of reinforced concrete as the best for important structures of all classes.

At this point I went to digress for a moment to take up the method of specifying concrete mixtures. The usual method is to specify by volume of contents, for example, one part of cement, two parts of sand and four parts of gravel or crushed stone. If measured as packed by the manufacturer, a cubic foot of cement weights about 95 English pounds. If the same cement is emptied into a box and turned over once or twice with a spade, a cubic foot may not weigh over seventy-five pounds. A 1:2:4 mixture with ninety-five pounds per cubic foot of cement will make good concrete, but a 1:2:4 mixture with seventy-five pounds per cubic foot of cement is very much weaker and will produce very defective concrete of not much structural value. When we consider that the practice of measuring cement by loose volume has been the rule rather than the exception in Japan, we marvel that reinforced concrete came through the recent ordeal with the remarkable record that it did. Architects and engineers should always specify cement in concrete by weight, and should see that the cement is measured in this way on the job. This involves the employment of honest, reliable constractors, and it involves a rigid system of inspection by trained inspectors, who cannot be bought, on every construction job. To secure this kind of inspection it will be necessary to employ higher grade men, and to pay higher salaries than has been customary in the past. To do this it may be necessary for architects to increase their scale of fees. If this is found to be the case, the fees should be increased fearlessly, for only by so doing will the true interest of the building owner and the public be served.

I believe that many buildings which otherwise would have stood, were wrecked because poor workmanship or defective material allowed failure to start at some weak column or wall, thus throwing additional strain on the adjacent parts and allowing failure to proceed progressively until the whole came down.

It is obvious that poor workmanship can ruin the work of the best designer, and it follows that good honest workmanship is just as important as correct design. I therefore consider honest, first class workmanship, to be another of the important principles absolutely necessary to secure earthquake resisting structures, and that it is the duty of every architect, contractor, and owner to see that he gets it. It is the duty of the Building Inspection Department of the city to see that buildings are actually constructed in accordance with approved plans. It is useless to set high designing standards and then, through lack of proper inspection, allow contractors to erect buildings in some entirely different way. To make possible the inspection necessary to accomplish this the city may have to enlarge greatly the Building Inspection Department. If necessary this should be done, for in no other way can further disastrous earthquake losses of both life and property be avoided.

For the floor construction of first class buildings reinforced concrete or reinforced concrete on steel beams fireproofed with

reinforced concrete are the only two types of construction that stood both the earthquake and fire, and of the two, the straight reinforced concrete design seems preferable because of the tendency of the concrete fireproofing to crack away from the flat, bottom sides of steel beams and thus leave the beams exposed to fire. When this happens the steel beams may become red hot, lose their strength and collapse. Of all types of concrete floor construction, the type made of joists with hollow spaces between them and with a metal lath and plaster ceiling below, seems to best fill the exacting requirements of lightness, strength, rigidity, and fireproofness. It is light, averaging only about sixty pounds per square foot in weight against an average of more than one hundred pounds for solid beam and slab construction, and its depth gives it the necessary strength and rigidity. The plastered ceiling was usually badly damaged where the fire was hot, but in nearly every case it remained in place long enough to protect the concrete construction above it. The air spaces between the joists no doubt contributed largely toward insulating the concrete against the heat of the fire.

The accompanying pictures of the Toa Flour Company Factory Building, Mitsubishi No. 27 Building, Iwai & Company Office Building, and Yokohama Y.M.C.A. Building, all illustrate this type of construction. The first two, in Tokyo, were not damaged at all; the latter two, in Yokohama, were burned out but suffered no structural damage.

For windows, wire glass set in steel sash stood the fire test better than steel shutters. In many cases the steel shutters buckled and allowed the heat to get in. In a few buildings the heat was sufficiently intense to melt glass, and in such localities both steel shutters and wire glass failed. There is another important reason for favoring steel sash with wire glass, and that is that windows are very much more apt to be shut when the fire comes. They must be closed every night and therefore must be kept in working order, whereas shutters are usually considered as emergency equipment and are not used often enough to keep them in proper condition for quick use when the emergency comes.

The roofs of nearly all important buildings were of prepared roofing felt covered with either gravel or flat tiles. Of the two, the roofs covered with tile stood up best, but the gravel covering was also effective when thick enough. Metal roofs should have felt between the metal and any supporting wood work to insulate the wood from heat transmitted through the metal. Ordinary clay tile (kawara) failed utterly, and the rapid spread of the fire and consequent loss of life was largely because a great deal of the tile had been shaken off the roofs by the earthquake, leaving the wood framing exposed. Asbestos cement tile is greatly supperior because it is light, and each tile is attached so that it cannot be shaken off.

The important principles in the design and construction of buildings to resist earthquakes and fires may then be summed up as follows:

Light floors
Strong walls and columns
Adequate connection between parts
No large unsupported floor spaces
Connected foundations
Good workmanship
Steel windows with wire glass
Light roof covering that will not shake off.

The fire hazard may be greatly decreased by the use of metal trim, metal doors and metal furniture in first class buildings.

The foregoing discussion refers principally to first class fireproof buildings. Besides these there must always be a large number of buildings, principally residences, that cannot be made fireproof on account of the expense involved. For these also ways and means of decreasing danger, both from earthquakes and fires, must be devised. We have spent some time on this question and find that, while the danger from fire can never be completely eliminated, it can be greatly decreased, and that such buildings can be designed and constructed so that they will be almost free from earthquake damage.

In the first place the ordinary tile (kawara) roofs should not be allowed at all. As explained above, the tiles are never in place when they are most needed, after a severe earthquake, and at such a time the unprotected roofs form a terrible fire hazard. The great weight of this type of roof also violates the first principle of correct design, that is, light floors and roofs. If each tile could be fastened in place, and the rest of the structure designed strong enough to transmit the earthquake motion to the roof, such roofs would be reasonably safe, but I do not believe that the city can enforce even the provision of the new building code requiring individual fastenings for each tile. Hundreds of inspectors would be required, and the city cannot afford to organize an inspection department sufficiently large to handle such detailed inspection of thousands of small buildings.

Two better methods suggest themselves, namely, asbestos cement shingles, and flat roofs covered with prepared roofing and flat tiles or gravel. Either would be far superior to the ordinary clay tiles (kawara). Of the two the flat roof seems the ideal solution, especially in crowded districts, because the flat roof could be used as a working space or as a roof garden, made attractive with plants and flowers, where the children could play, and where the whole family could enjoy themselves on hot summer evenings. It seems strange that such a practical and obvious solution should not have already been adopted.

In the framing of small buildings great improvement can be made, both from the standpoint of earthquake resistance and economy, by the adoption of the so called balloon type of framing, and particularly by the use of nails instead of the elaborate mortise joints so commonly used in Japan. The balloon type of framing is economical both in lumber and in carpenter work, and this type of construction properly fastened together with nails is stronger and stiffer than the ordinary framing used here. It is fully described in text and handbooks on building construction, so I will not go into details here. The Japanese type of framing was developed when carpenter labour was cheap, but this is no longer the case, and a more economical solution is an economic necessity. I do not believe that balloon type framing requires more than half the labour required for the ordinary type of framing now in use, and I am confident that it will produce a structure much more capable of resisting earthquakes.

For the outside walls of such buildings, better earthquake resistance and much better fire protection can be had by the use of metal lath and cement stucco instead of thin boards now commonly used. This construction, while more expensive, would also be more permanent. The same construction could also be advantageously used for inside walls instead of the bamboo lath and earth plaster walls now used, thus greatly decreasing the fire hazard. This type of wall and partition construction is practically useless for resisting either earthquake or fires.

There is one precaution that should always be taken in building outside walls of this kind, however, especially in a country of frequent rains, and that is that all stucco walls and preferably all concrete walls should be waterproofed. This protects them from cracking due to expansion and contraction caused by alternate wetting and drying, and from the damaging effect of frost on wet walls. There are two ways of doing this, first, by mixing waterproofing material with the concrete or stucco, and second, by applying a paint especially prepared for cement surfaces, after the concrete or stucco has hardened and dried. Of the two methods the second is superior because concrete and particularly stucco frequently develops small surface cracks in drying, and if the paint is applied after the drying process is complete, these cracks are filled up.

It would also be desirable, from the standpoint of reducing the fire hazard, if the under floors of residences, that is, the floor under the floor mats (tatami) and the roof under the prepared roofing, could be built of reinforced metal lath and concrete supported by light steel or wood beams instead of wood boards as usually constructed. This would give a cement floor surface which would be covered with floor mats (tatami) in Japanese-style houses, or over which a wood finish floor could be laid if desired. A house built with wood balloon framing, flat concrete roof covered with prepared roofing, cement plaster and metal lath walls and ceilings and with concrete floors, would be an ideal construction for resisting both earthquakes and fires. While such construction cannot be classed as fire-proof, it is very nearly so, and would burn very slowly, even in a conflagration.

The suggested improvements for non-fireproof residence construction may therefore be summarized as follows:

Balloon framing.
Flat concrete roofs.
Metal lath with waterproofed cement stucco outside walls.
Metal lath with cement plaster inside walls and ceilings.
Reinforced metal lath and concrete floors.

For one-storey factory buildings, where large open spaces are required for manufacturing processes, the obvious solution would seem to be steel frame construction with roofs of steel sheets, either galvanized or made of a non-corrosive steel alloy and painted, and with walls of the same material, or preferably of metal lath and water-proofed cement stucco. This construction is non-combustible but not fireproof. It is fairly safe from exterior fire damage, and will stop the spread of fire, but can be completely destroyed by an inside fire if the contents include a sufficient quantity of inflammable material. The inflammable material in such buildings should therefore be reduced as much as possible, and when it is impossible to keep inflammable contents so low that no serious damage can result from their combustion, the building should be protected by an *earthquake-proof* sprinkler system. Cost considerations usually rule out the possibility of effective cross connection of foundation in such buildings, but all foundations should be connected along each wall line and should be designed so safely that they can never be overloaded. Such buildings may be damaged by a severe earthquake, but if properly designed the damage will be small.

With regard to the question of the maximum height of buildings to be allowed in future, there has been some talk sbout limiting height to two or three stories. I regard this as unreasonable because buildings of all heights up to eight stories successfully withstood the earthquake forces. Many buildings only one and two stories high failed. Height, within the reasonable limit of one hundred feet already established by the Building Code, apparently had nothing to do with it. The proper procedure is : first, to recognize the forces to be resisted ; second, to design all structures to resist these forces, and last but not least, to see that the workmanship is of the quality planned and specified by the architect. We should recognize walls as being an integral part of the structure, not simply an ornamental dress to be hung on after the structural part is finished, and make our designs accordingly. We should aim to make our structure as nearly monolithic as possible, remembering that where different kinds of material join we usually have a place of weakness and therefore of danger. Witness facing tiles dislodged from walls all over the city, bricks separated from steel framing, etc., and compare these to the behavior of such monolithic structures as the Mitsubishi No. 27 Building, the Toa Flour Company Building, the Iwai Office Building, and many others. If we follow this procedure I see no reason why we should not continue to erect buildings to the present limit of one hundred feet in height.

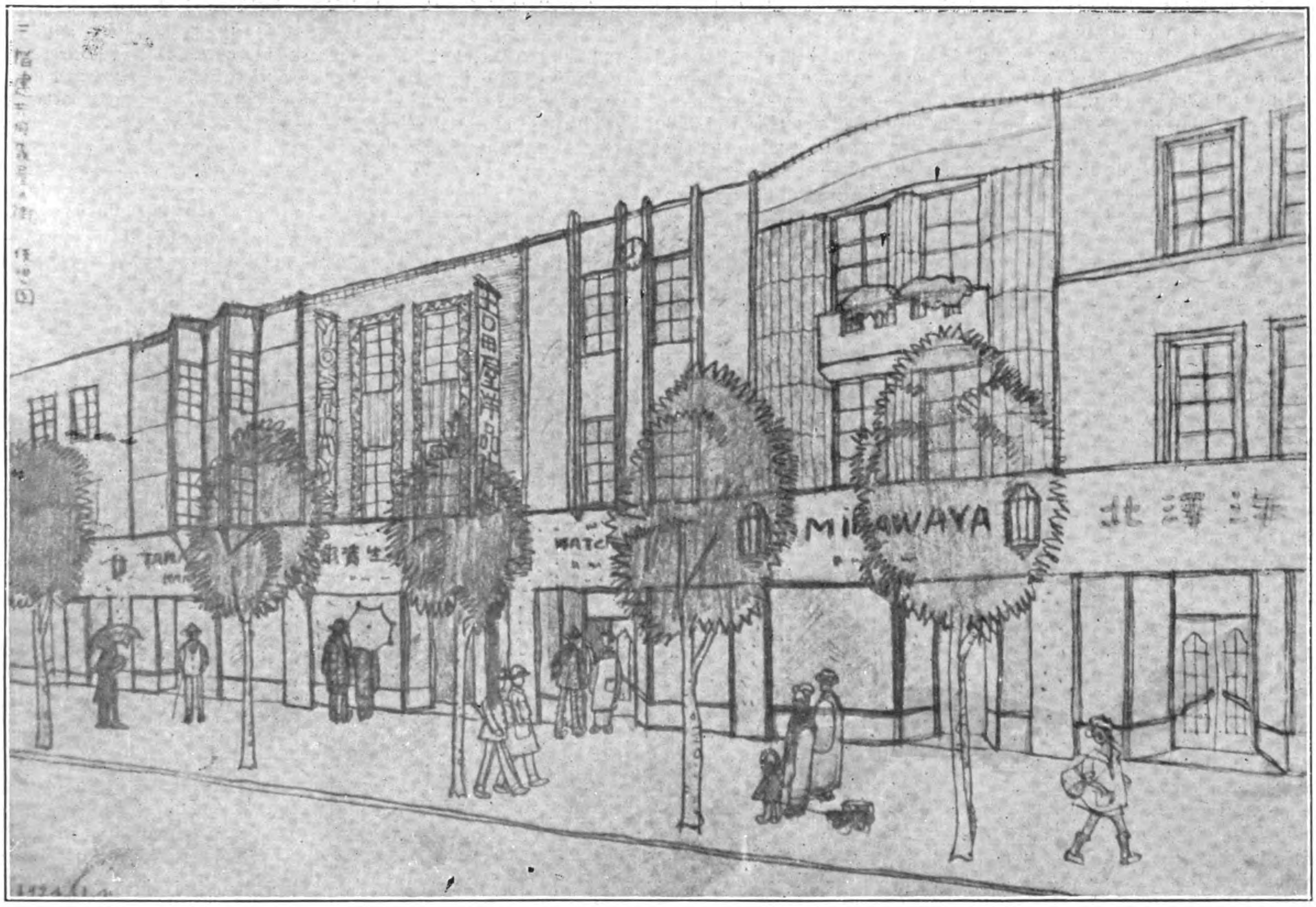
In the immediate future, in the study of methods of design and in the drafting of revised building codes, attention is very apt to be concentrated on earthquake resisting qualities to the exclusion of other equally, if not more, important features, such as fireproofness, permanence, and cost. Destructive earthquakes are rare visitors, but fire, rust, decay, and the necessity of making every commercial structure pay for itself, are things that are always with us and they should by no means be forgotten. If all owners could afford to build structures like the Mitsubishi Bank, the problem would be easy, but this is, unfortunately, not the case. With billions of yen in property values destroyed, the necessity for economy will be more pressing in future than in past, and will demand strict attention in every design.

Fortunately, the lessons of the earthquake do not rule out the economically designed structure but are rather to the contrary. They tell us, for instance, to avoid all unnecessary ornamentation because it is dangerous when it breaks off and falls down, and also because it loads the structure with additional weight which the walls and columns must move. They tell us to avoid all attempts at massive effects, but to make out structures light and strong which will also make for economy.

I do not believe that architects will continue to design large steel frame structures in Tokyo. They resist earthquakes very well when the walls are properly designed and built as an integral part of the structure, but many steel frame buildings which came through the earthquake intact were so damaged by the fire that they had to come down. Unless such structures are properly fireproofed with concrete, an no other system of fireproofing stood both the earthquake and the fire, they will very probably fail. If fireproofed with concrete, they are uneconomical when compared with the straight reinforced concrete design. The field for structural steel in Japan will be limited to buildings which do not require fireproofing and this field will necessarily be comparatively narrow.

As I said in the beginning of this article, our company has had a committee working on the problems that I have discussed, and in this work we have collected a large amount of data. We want to make these investigations and this data serve a useful purpose, not only to ourselves but to the public generally, and to this end we offer the use of this information freely. We would expect to derive not only pleasure but mutual benefit from a discussion of these problems with anyone interested in them.

A Triumph for Steel and Concrete: The Famous Ryogoku Wrestling Hall in Honjo. Interior woodwork destroyed by the fire, but no structural damage done



Rough sketch showing types of new reinforced concrete business and residence buildings to be erected along the main thoroughfares of Tokyo acting as fire prevention walls against the spread of conflagrations

Helping the Small Property Owners to Rebuild

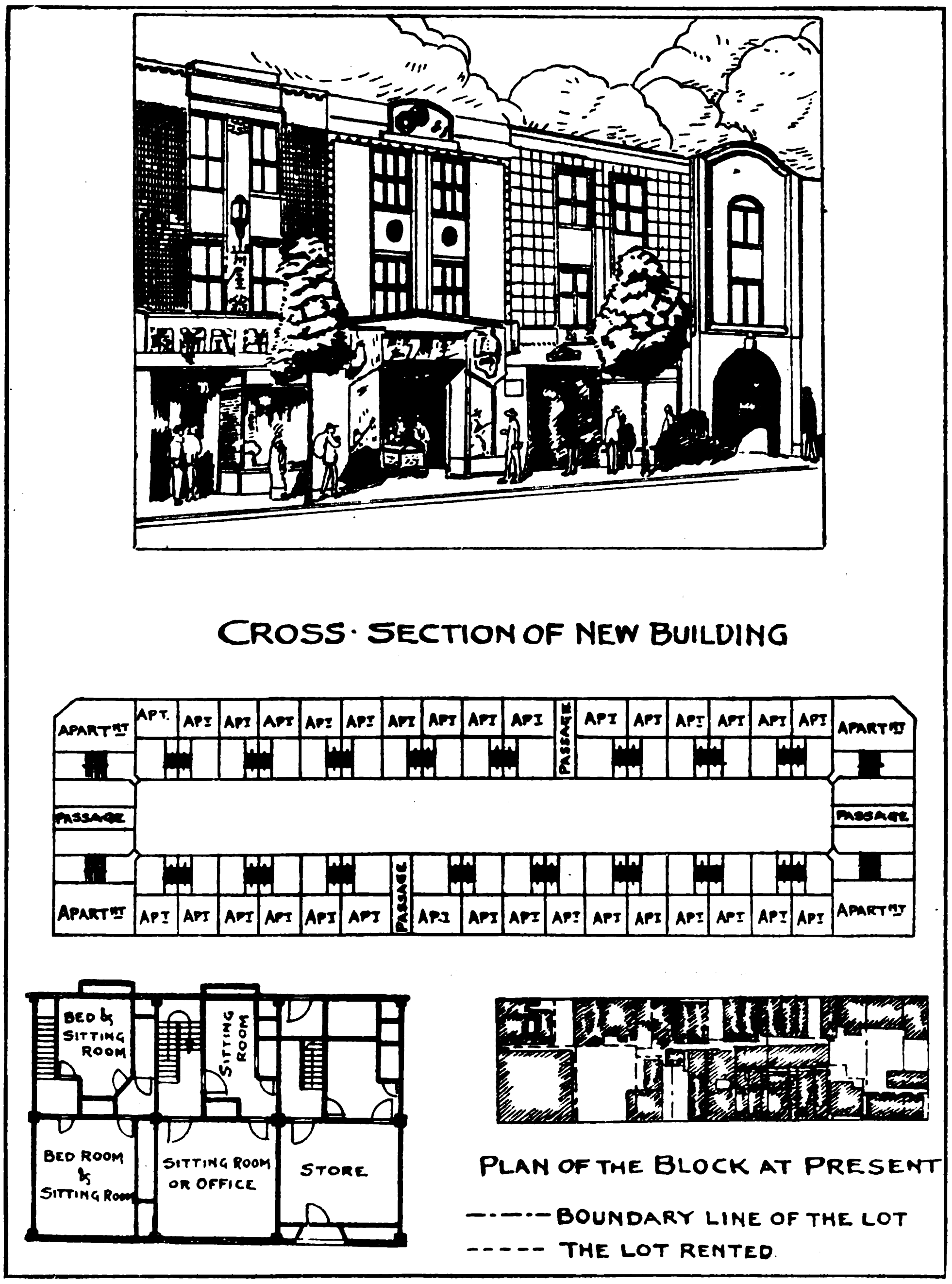
The Imperial and Tokyo City Governments Will Advance Yen 60,000,000 to the Reconstruction Building Company, Ltd. for Assisting Straitened Property Owners to Erect Fire-proof Structures

THE greatest sufferers from the quake and fire in the devastated districts were the small property-owners whose houses and shops were completely destroyed and on which they failed to collect insurance. The insurance companies, whose main assets also disappeared in the general conflagration, being unable to meet their obligations to the policy-holders, left the latter to face the problem of rebuilding with the inadequate ten per cent. on the total value of the policy finally paid by some of the insurance companies, or with a further call on their own private resources. When the Government authorities issued the rebuilding regulations providing that all edifices in certain districts and along both sides of the main thoroughfares must be of modern fire-proof construction, it increased the difficulties of these distressed owners in obtaining the capital necessary to comply with the new law.

The ashes of the burnt districts had hardly time to cool when multitudes of these small holders were erecting temporary shelters on the site of their old homes, and as the days passed the first rough shacks were superseded by fairly comfortable and presentable quarters. The majority of these structures, however, remain as temporary makeshifts, to be pulled down at the proper time to make way for permanent fire-proof buildings as provided for in the reconstruction program. For the great majority of this class the expenditure for temporary construction has been a severe strain on their slender resources, and unless substantial aid is tendered by the Government the erection of permanent fire-proof buildings will be indefinitely postponed.

The reconstruction authorities have laid down definite regulations for the erection of fire-proof buildings not only in the central financial and business district, but along the main arteries of traffic extending out into the suburbs. The latter are designed to serve as fire-shields and confine a conflagration within certain limits. The city of Tokyo has been destroyed and rebuilt many times in its history as the result of these general conflagrations, and as long as the erection of the old style of flimsy wooden buildings is permitted by the authorities it is only a question of time when another fire will get beyond control and reduce the city to ashes. Extreme measures were therefore imperative to mitigate as far as possible the spread of these fires, and as a partial remedy the city is to be divided into fire zones protected by a wall of concrete or other fire-resisting material built into the houses forming the boundaries of these districts.

The original fire zoning regulations were promulgated one year before the earthquake (September, 1922), and covered only 687,000 *tsubo* of the city's area. Taking advantage of the opportunity caused by the disaster of the following year, this area was extended to 1,519,000 *tsubo*, of which 1,158,000 *tsubo* had been devastated by the fire. Excluding public and other buildings covering 164,000 *tsubo*, which withstood the fire and quake, there remained some 636,000 *tsubo* of which at least 70 per cent. will be utilized for building sites. This leaves about 442,500 *tsubo* on which buildings may be erected. Estimating three stories to each building this makes a total of 1,335,600 *tsubo* of floor space to be erected.



Sketch showing further types of reinforced concrete business and residence edifices designed by the Reconstruction Board to act as fire prevention walls along main business streets. This also shows the general floor plan and block arrangement of the new building system compared with the old style block of wooden houses

Outside of this fire-proof area an additional 3,964,400 *tsubo* of floor space was destroyed in the fire, of which, at least ten per cent. (396,400) will be rebuilt with fire-proof material, making a total of 1,732,000 *tsubo* of floor space for Tokyo that must be rebuilt in fire-proof materials. In Yokohama, fire-proof construction will be about 20 per cent. of that in Tokyo, or some 346,000 *tsubo*, a total for both cities of 2,078,400 *tsubo*. The estimated cost of construction of each building is about Y.350, per *tsubo* of site, calling for the sum of Y. 242,480,000 to carry out the fire-proof construction program.

As it was manifestly impossible for the impoverished small property owners to find the money on reasonable terms for reconstructing their buildings in accordance with the regulations laid down by the reconstruction board, their situation made a profound appeal to the sympathies of the financiers and authorities. The best solution seemed to lay in the organization of a building and loan company somewhat along the lines of those operating in the United States, and a plan was developed by Viscount Shibusawa, Mr. Jonnussuke Inouye and Mayor Nakamura, in which the national government would carry the initial burden of finding the finances for carrying the scheme into effect through the medium of a private company responsible to the city authorities. Largely through the instrumentality and influence of these leaders of Japan's financial interests, working in close accord and harmony with the Mayor, the plan received the sanction of the municipal assembly and the imperial government.

The proposed Reconstruction Building Company is to be organized with a capital of Y. 20,000,000 and conceded special powers to issue bonds to the extent of Y.100,000,000. Of this amount, the imperial government will subscribe for Y.60,000,000 through the Municipality of Tokyo on the condition that Y.50,000,000 be allotted for the rebuilding of the capital and Y.10,000,000 for Yokohama. In addition to this direct financial assistance from the government, the company is empowered to raise a further Y.40,000,000 on its own initiative and security. During the first five years it is estimated that at least Y.20,000,000 loaned to private individuals for the erection of buildings will be repaid with interest, increasing the capital resources of the company to Y.140,000,000 half of this amount (Y.70,000,000) is to be invested in new construction to be repaid in installments extending over a period of twenty years, or, according to the special terms of the individual loan contract. The other half will be loaned to responsible parties for erecting their own buildings. When consruction is undertaken by the company on behalf of the property owner, the latter will pay one-tenth of the estimated cost in advance and the balance in regular installments for the duration of the loan. The limit of loans to those who elect to construct their own buildings is 70 per cent. of the value of the property.

Although entrusted to private management, the company is to be a semi-official enterprise closely identified with the national and municipal governments through a contract under the terms of which the national treasury issues the loan to the public and lends the proceeds to the municipality, which, under the terms of another contract, engages to lend the funds to the company under the following general conditions:

The City of Tokyo will lend to the company the sum of Y.50,000,000 to be obtained from the proceeds of various imperial government issues to be known as Reconstruction Savings Bonds. The first installment of these loans will be issued sometime in the fiscal year 1924-25 and thereafter on such suitable occasions as may be determined by the mayor of the city of Tokyo. The actual amounts raised by the national government and handed over to the municipality must be paid into the treasury of the Reconstruction Company, the municipality paying the national government the same rate of interest as carried on the face of the bonds and charging the same rate of interest to the company. (The interest rate is not specified in the contract as this obviously will be determined at the time the various installments are placed on the market). Repayments are to be made by the company through the municipality at the due dates on which the national government is called upon to redeem its obligations, the Mayor being empowered in every instance to set the date for the company to repay these outstanding installments.

According to the terms of the contract, the activities of the company are confined (1) to the construction of buildings in the burnt districts for the account of property owners, who are to repay the costs in twenty years and (2) to make loans to responsible individuals who desire to undertake construction of fire-proof structures on their own account, said structures to conform to the regulations. Such loans are also to be repaid in twenty years. The amount of the loan for the purposes of construction under the first heading is to be determined by the actual cash outlay, embracing the costs of plans, building materials, contractors charges, inspection and other legitimate building expenses. To this is to be added the lease of land, insurance during construction, with interest on same until the building is handed over. The subsidy granted by the government for fire-proof buildings (if any) is to be deducted from the actual expenses.

In the case of individuals who prefer to do their own construction with loans advanced by the company, they must provide firm and negotiable security. Loans, however, will be made against the actual value of buildings according to work completed. In all cases where the company advances the funds for construction under the first clause, the rights of ownership are vested in the company until all installments are paid, however, if suitable liquid security is offered before the expiry of the loan, the building will be turned over to the new owner. Fire insurance in companies approved by the mayor must be carried on all buildings owned by the company and on which it has advanced loans and should he deem it necessary, he may demand that the city be placed in immediate possession of all rights of ownership of all buildings constructed under the provisions of clause one.

In the case of non-payment of the loans on buildings coming under the head of clause 2, the company will immediately transfer its security to the municipal authorities. Further, the mayor is empowered at any time to call upon the company to transfer to the city all the securities on outstanding loans, and should he decide that these are insufficient, the company must make good the deficiency. The company must also make full monthly reports to the mayor, accompanied with statements and vouchers.

The contract also provides that when the profits of the company are under ten per cent. dividends will be limited to 8 per cent. the balance being placed to a reserve fund for equalization of dividends. When the profits exceed 10 per cent. dividends of ten per cent. may be declared and any surplus shall be paid half to the shareholders and the balance placed to reserve for the repayment of capital advanced by the city.

The Municipality reserves the right immediately to cancel the contract and demand immediate repayment of all sums lent to the company in the event that the terms of the contract are violated, and should the city sustain damages arising out of the violation of the contract, the company is to be held directly liable for indemnity. As long as the company lives up to the letter and spirit of the contract the latter will remain in force even after the capital to be advanced under its terms and all interest charges are repaid. The contract is to be registered and its provisions made public. The repayment of the sums advanced being part of the contract, should the company at any time default on its payments, the city will take compulsory measures to protect its interests. On the other hand, should the company urgently require capital to carry out its program, the municipality may extend the time for the repayment of any installment. Other methods of financial assistance to the company may be considered by the municipality, such as guaranteeing its loans or in other ways, when such assistance is warranted. If payments are postponed, the interest charges and date of redemption will be determined in each case by special agreement. The contract is to become effective when it is approved by the Municipal Assembly and a general meeting of the shareholedrs of the company. However, should the national government decline to carry out its part of the obligation, the contract will become null and void.

The contract places the general supervision of the scheme under the mayor of Tokyo, giving him absolute powers to act in any matter affecting the stability of the enterprise. The actual direction of the company is to be entrusted to some highly placed business executive whose name will be a guarantee to the government and people that its operations will be carried out on a non-political basis and in strict compliance with the terms of its contract with the city.

Baron K. Nakajima (president of the Furukawa Electric Company), has been prevailed upon by those responsible for the organization of the company to accept the presidency.

Restoration of a Factory Plant in Japan

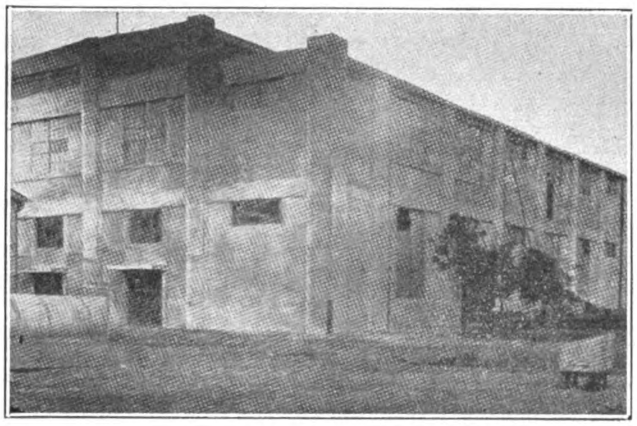
T. Tsumori, Tokyo Electric Co., Ltd.

THE earthquake of 1923 wrought havoc with our factory buildings at Kawasaki, and for the time deprived Japan of one of its most important sources of incandescent lamps.

Temporary measures were immediately undertaken for restoring production of this important staple, and within six weeks after the disaster we were turning out lamps in even greater volume than our normal rate of production.

In the year 1924 the time had passed for temporary readjustments, and the age of restoration came. We devoted ourselves to permanent reconstruction, with the result that by the end of the year our factory buildings were completely restored.

The first large one to be completed was a warehouse of reinforced concrete, three stories high, covering an area of 542 *tsubo* (19,512 sq. ft.). The next to be completed was a machine shop of reinforced concrete, two stories high, area 200 *tsubo* (7,200 sq. ft.). The third building of this type, which contained the lamp factory, offices and storage, is a three-storey reinforced concrete building of 432 *tsubo* (15,552 sq. ft.).



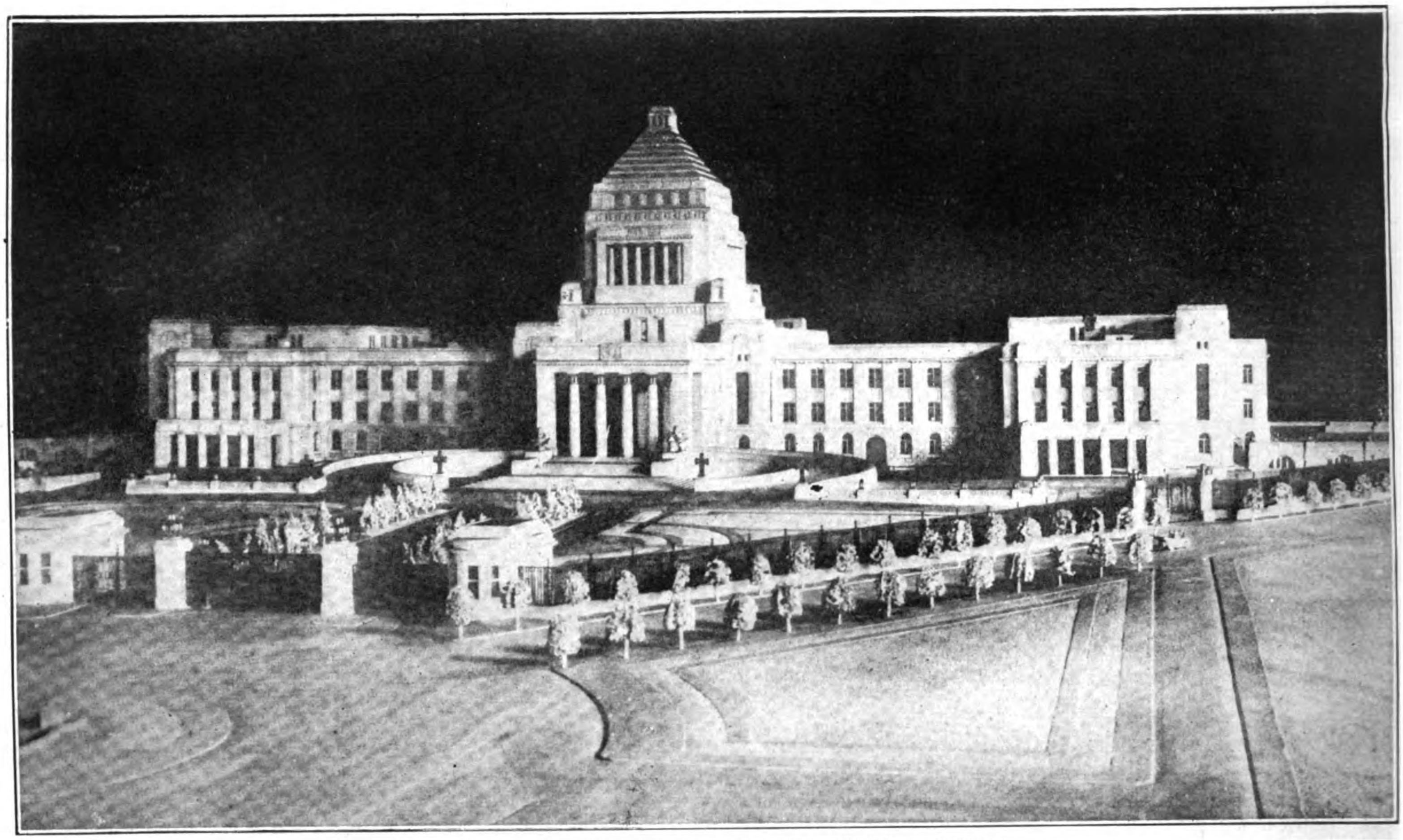
One of the New Buildings

Further, as a supplement to the collapsed buildings, several new wooden buildings were built, including a warehouse of 286 *tsubo*, a laboratory of 178 *tsubo*, and machine shops of 480 *tsubo*. The first of these was completed in February, and the other during May 1924.

Regarding the manufacture of lamps and other products, admirable concentration of energy was made both by officials and employees, resulting in the quick restoration of the manufacturing capacity. Under the disordered conditions immediately after the catastrophe they made special efforts for this purpose, with a strong sense of responsibility for the providing of light in Japan. These special endeavors, combined with the valuable help so kindly given, directly and indirectly, by the General Electric Company, enabled us to see a splendid success in finishing the necessary repairs of the up-ground and underground equipments and preparations for the production so quickly that we could recommence the manufacture of lamps from the 2nd October, say only 31 days after the quake.

On the part of various lighting companies, their restorations were also speendid, which fact, together with the progress of the restoration of the damaged cities and towns, caused a great increase in the demand for lamps. But as our production capacity was very well restored, we could fill all these demands and could well promote the reputation of the " Mazda."

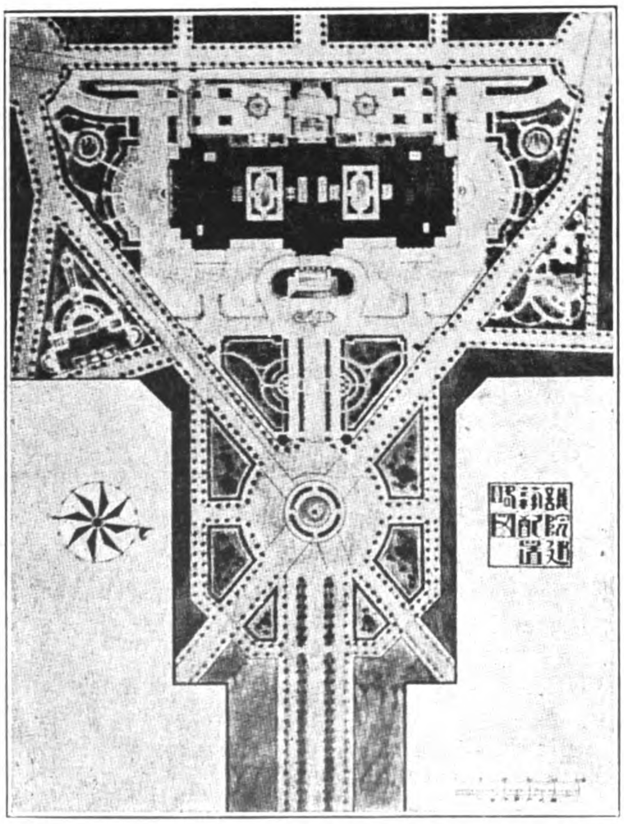
In our Research Laboratory all restorations were completed, and even a remarkable improvement and development were made in the equipments for the research and production of radio apparatus, radio receiving and sending vacuum bulbs, and we are now well prepared both in respect to production capacity and unique skill to meet the growing demand.



The Capitol of the Rising Sun: The New Diet Building at Tokyo

Architecture and the Buildings of New Tokyo

THE new Tokyo will be a replica of any one of a dozen western cities. The simple, refined and beautiful architecture so representative of the spirit of Japan will give way before the more utilitarian ideas of Western efficiency, combined with such structural modifications imposed by the lessons of repeated earthquakes and fires. If Tokyo is to remain the capital of Japan, the flimsy wooden houses must be superseded by fire-proof structures of brick, stone, steel and concrete. Tokyo will endure, and it is only necessary to make a hasty trip through the stricken city in order to visualize what it will look like in the future, a typical Western metropolis, with business blocks, office buildings, Government offices, department stores, banks, small shops and standardized apartment houses of steel and reinforced concrete differing little in outward appearance to similar structures in any American city. On all sides such edifices are now rearing their roof lines, indicating in the most positive manner the style of buildings that will eventually fill in the gaps to make a finished city.



The Park and Approaches to the New Capitol at Tokyo

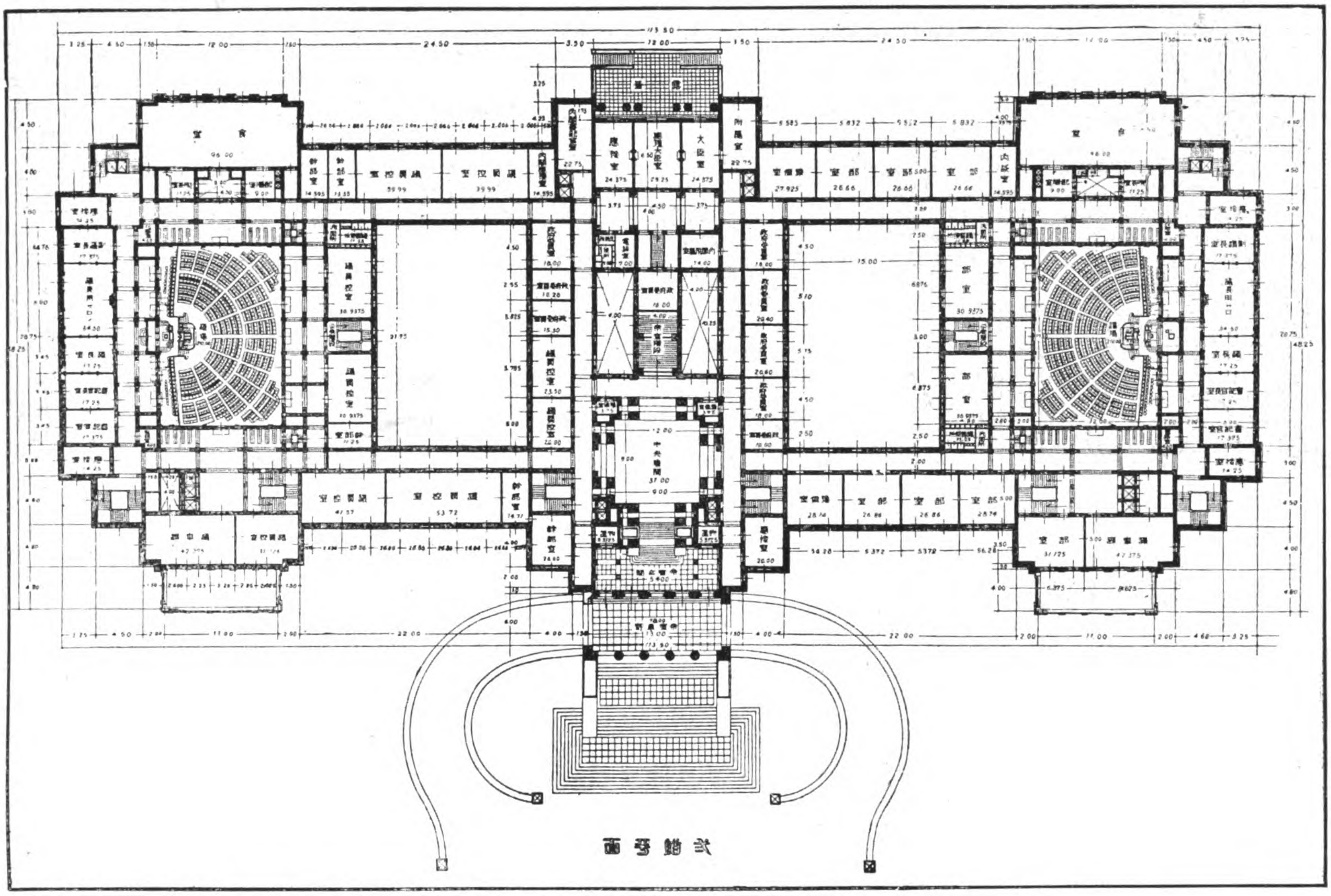
It seems a great pity that the artistically beautiful lines of Japanese architecture are so difficult to incorporate in twentieth century building design; yet, on the other hand, it is a relief to know that the new city will be an improvement on past attempts superficially to imitate foreign styles in houses. In building design and construction practice, as in many other things, the Japanese have learned their lesson by sad experience. Their architects have passed through the purely imitative stage which filled the cities of Japan with reproductions of all that was hideous in foreign building design and successfully mastered western architectural principles and the art of building to the point where many of their latest efforts stand on a par with the highest and best examples of modern American or European practice.

With greater contact with the world there has come a revolt against the shocking so-called European architecture which defiled the land. Due to the necessity of adopting methods at once economical and proof against earthquake shocks, this sentiment unfortunately has not found expression in a revival of the exquisite

architecture evolved by the Japanese from the Sino-Korean *motif*. Only at a considerable extra cost can the beautiful lines of their own buildings be reproduced in stone and concrete, so the Japanese are compelled through sheer necessity to adopt designs free from ornamentation, over-hanging eaves, cornices and ginger-bread work.

As a matter of fact, it would be difficult to adopt the ancient style of Japanese architecture to modern needs. After all, it is a type of architecture closely related with Buddhist rites and ceremonies, completely out of place when applied to other than temple or purely domestic purposes. The modern architect therefore has been compelled to adopt in their entirety the models

This type of dwelling is becoming more and more standardized, especially since the earthquake and fire, when a large number of American " knock-down" houses and bungalows were imported in order to provide economical and quick shelter. Some of these bungalows were very elaborate and are setting the style in the new suburban residential districts. The experience of the Japanese in Korea and Manchuria, where they have applied the best exterior design of foreign houses and adapted the interiors to their own ideas of comfort, is having its effect upon new dwelling-houses for the home country. In Manchuria, especially in Dairen and Fushun, the new residential sections are outwardly a replica of the Southern California type of bungalow, but designed for severe cold weather.



First Floor Plan of Japan's New Diet Building.

and types of business buildings as developed in other countries. Japanese architecture is the apotheosis of wood as building material, and the demands of the present day call for something more durable and safe. These and other reasons have compelled the abandonment of the old style of architecture for modern buildings erected to Western designs.

In the home or family life of the people the architectural changes have been less complete than in the official and business buildings. Many foreign-style residences have been erected, but for the most part these have been additions to dwellings built in the Japanese style. While the former have been used principally for social functions and entertainment, the latter have been devoted to private family life. Different attempts have been made to combine the advantages of the two styles in one structure. There exist some European-style residential buildings which, in addition to rooms fitted up and furnished as in the West, contain chambers constructed in Japanese fashion, with matted floors, sliding divisions, alcoves, and all the features of dwellings of the old style. The contrary method of erecting a residence having all the external characteristics of the old Japanese style and fitting up a part of the interior with rooms in European style with solid walls, fireplaces, folding doors, and parquet floors, is also being followed.

The tendency towards this type of residence is seen in many of the new suburban districts of Tokyo, where real estate companies are adopting the American methods of improving a section of land with streets, sewers, water, light, etc., and erecting thereon standardized bungalow residences for sale or to rent. The boom in suburban real estate has resulted in the erection of more than 150,000 houses since the earthquake and fire. The purchase of land and the erection of tenement houses were undertaken by these real estate companies on a large scale, but the attempt to hold these properties at high prices has since resulted in a decided slump, with consequent financial loss to the promoters.

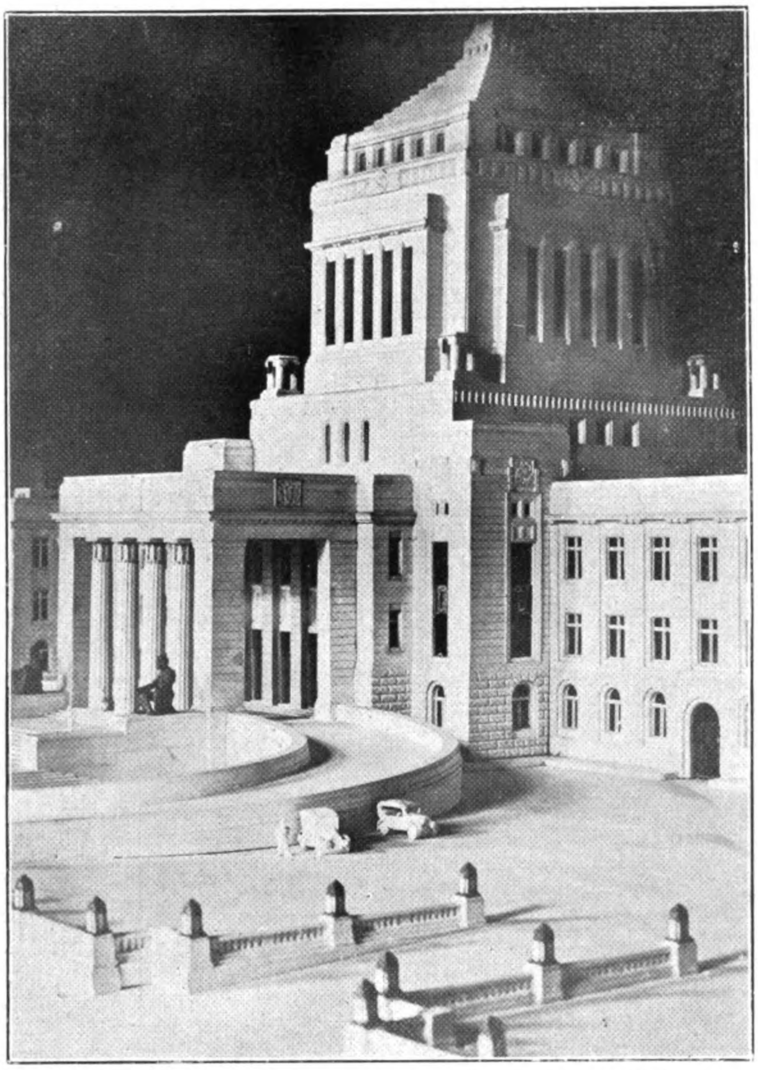
The introduction of foreign-style buildings of solid construction in Tokyo and some of the principal cities dates back several decades. Among the earliest buildings of this kind were the College of Engineering at Toranomon, the Government Printing Office destroyed by the fire, the Russian and British Legation buildings, the old Shinagawa railway station, two foreign-style palaces for the Imperial Princes, the Military Staff Office, the Foreign Office building, and the National Museum at Uyeno. Following these were erected the first blocks of the Tokyo University buildings at Hongo known as the Law and Literature Department. Other blocks have since been carried out in varied styles of architecture, rather to the loss of unity in design. At a later date the fine Government buildings

at Hibiya Park, comprising the Navy Department, the Ministry of Justice, and the Palace of Justice were erected; and in other quarters of the city the Department of Communications and the Department of Agriculture and Commerce, both destroyed by the fire.

One of the best modern buildings in Tokyo is the Bank of Japan, designed by Dr. K. Tatsuno. It is constructed in solid granite and of striking proportions and design, having a distinctly monumental character and unmistakably expressing its purpose as a national treasury. The Mitsui building at Suruga-cho, destroyed by fire, was a handsome building in brick, stone, and terra-cotta designed by the same architect.

Among the private banks, the Murai Bank at Nihonbashi merits notice for its successful architectural treatment.

The Mitsubishi Company gave a great impetus to the construction of modern mercantile buildings by erecting large blocks within the open space called the Marunouchi, outside the moat of the Imperial Palace. This large area of open ground was made over by the Government some forty years ago to the Mitsubishi Company, who laid it out in a manner worthy of its fine position. The first large building block erected was that to contain the bank and offices of the Mitsubishi Company itself. This was quickly followed by other balancing blocks, some of which were taken by the leading shipping and insurance companies, and part forming rented offices for business firms. These buildings were designed by Dr. Tatsuzo Sone. The Tokyo Municipal building, or City Hall, occupies a fine site opposite to the Mitsu Bishi buildings. This is a brick and stone building with a large central hall and *flèche* after the style of the European town halls. It also was damaged during the quake, and is now undergoing extensive repairs. A new reinforced concrete structure of seven stories has been designed to take its place. Near to these buildings are the Chamber of Commerce, the Imperial Theatre, and the Metropolitan Police Offices—all fine buildings of their kind. The Imperial Theater was extensively damaged during the quake, while the Police Headquarters was so gutted by the fire and damaged by the quake that its walls had to be demolished by blasting.

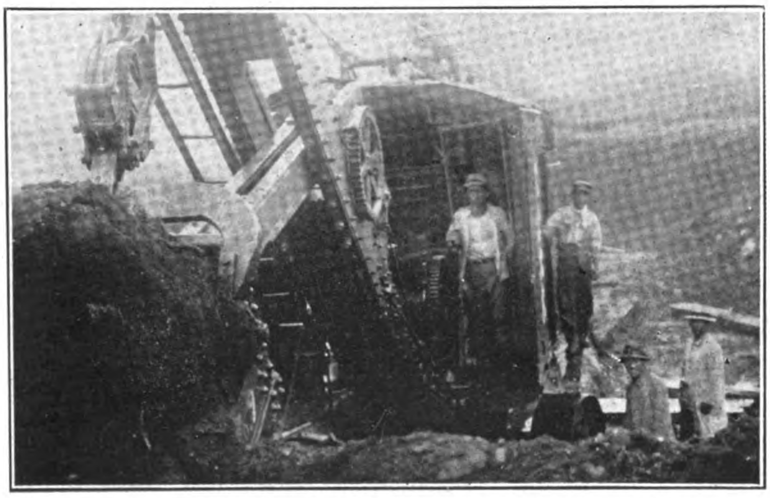


Japan's New Diet Building: The Central Tower and Main Entrance.

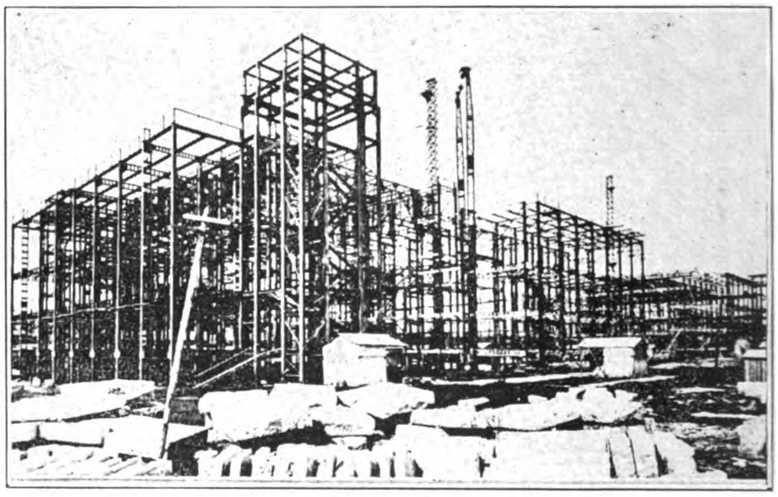
The prevalence of earthquake necessitated considerable caution in the execution of solid buildings. The architects hesitated to attempt buildings of excessive height, and additional precautions, such as would hardly be deemed necessary elsewhere, have been taken against the possibility of the structures being subject to violent shock and vibration. The steel skeleton frame, bedded in the solid walls to tie the building together, has been used in many of the important buildings, such as the Bank of Japan, the buildings of the Imperial Household and the Mitsui Head Office. The Imperial Theater and the Mitsubishi building have heavy steel frames.

The result of this progress in utilitarian architecture is to produce a medley of buildings in different styles, all foreign to the country and hardly consistent with a national type of architecture. The same, however, may be said of the modern cities of European countries, where all the Western styles of design are promiscuously used side by side.

Various attempts have been made in Japan to impart somewhat of a national character to modern buildings by introducing forms and details of design copied from the ancient wooden buildings. Most of such ornamental features are unsuited to a solid material like stone or brick. But besides this, these decorative forms are too intimately associated in the minds of the people with ecclesiastical art to appear anything but inappropriate when applied to secular buildings.



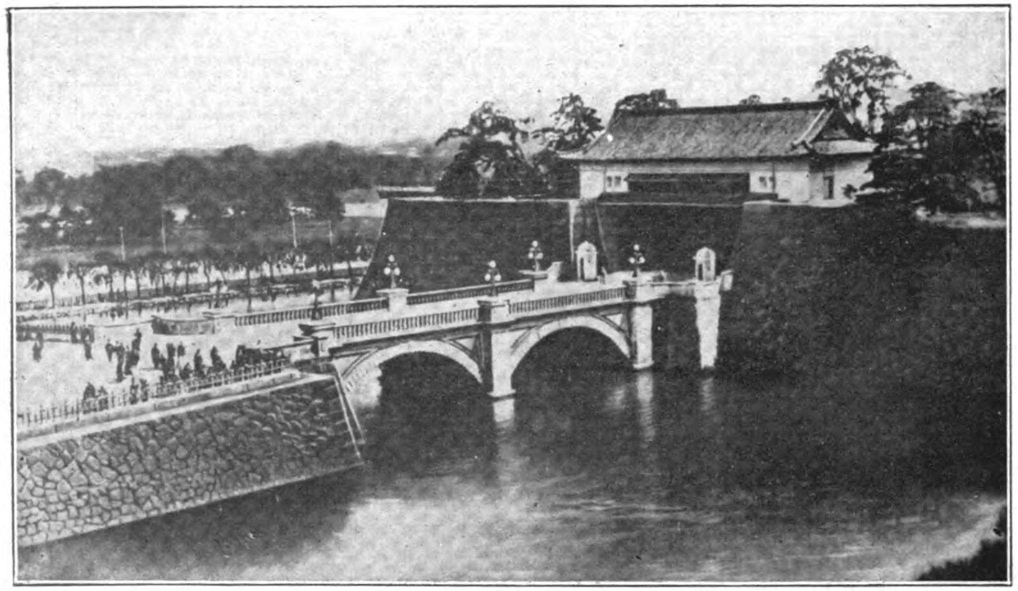
Excavating for the Foundations of the New Parliament House.

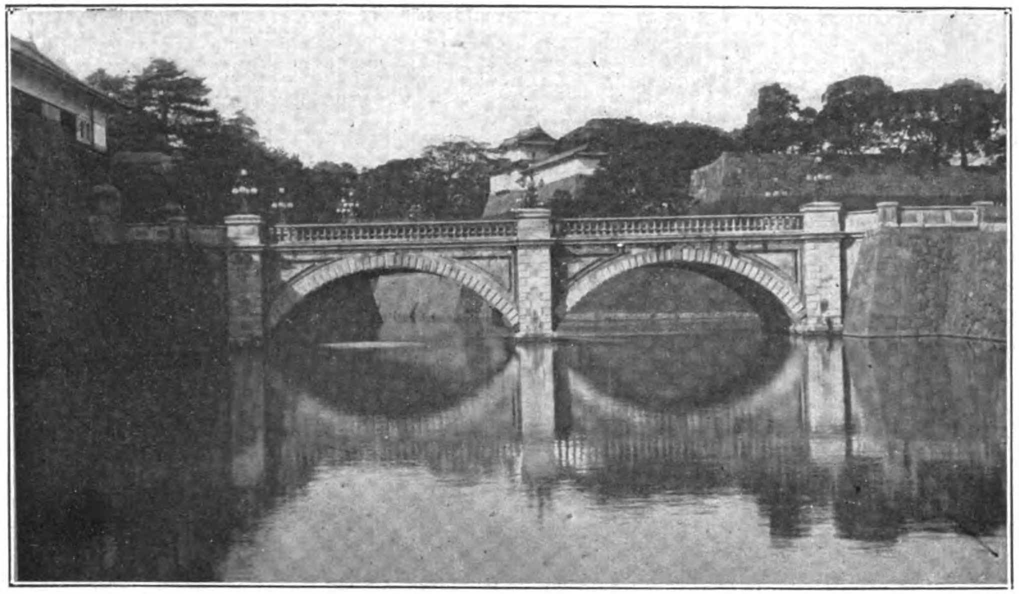


Present State of Steel Work.

The Japanese architects have made gradual but steady progress in mastering the principles of western architecture, displaying splendid skill and originality in design, which in many instances achieves perfection. The Akasaka Palace, home of the Crown Prince and Regent, is one of the best examples of foreign architecture designed by Japanese architects and erected under their supervision.

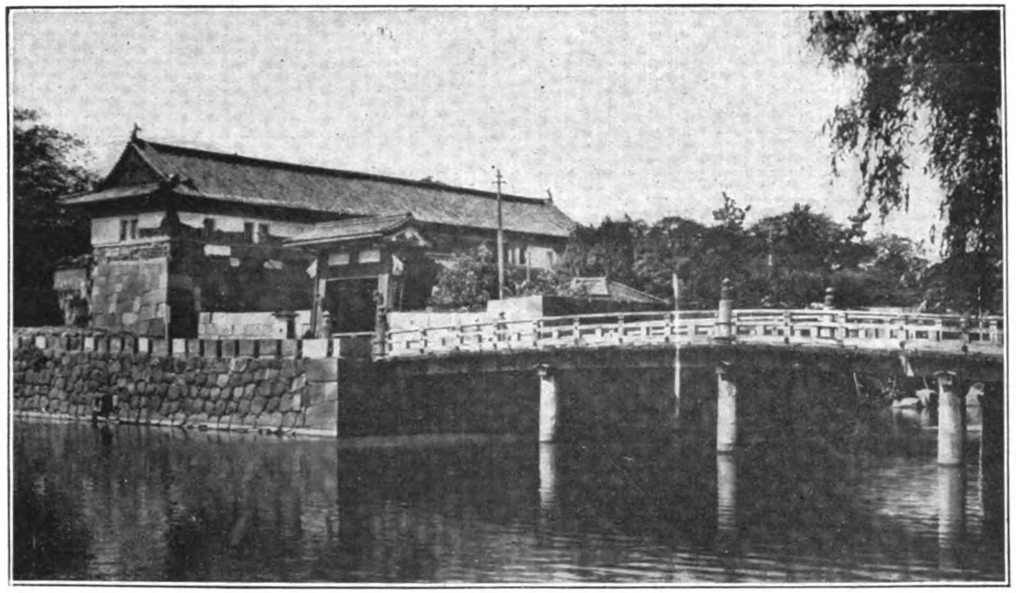
GATES TO IMPERIAL PALACE, TOKYO



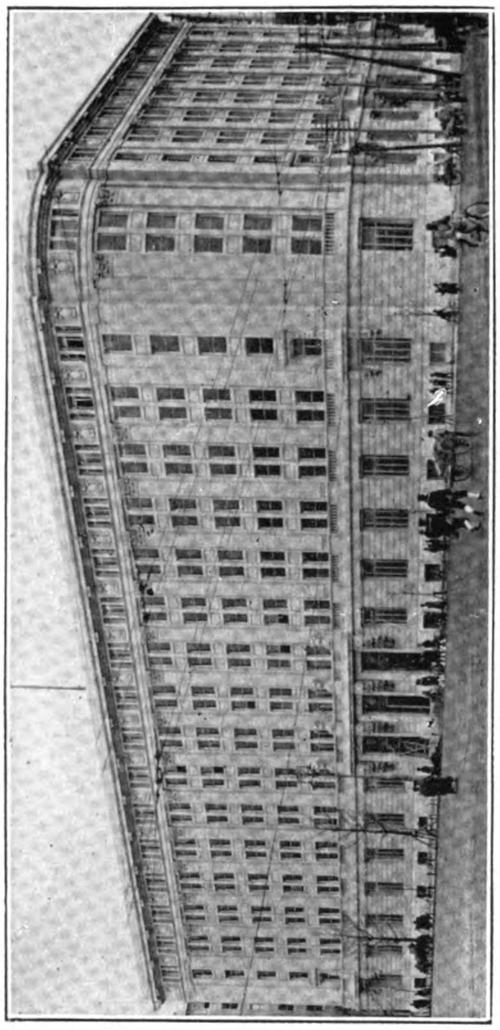


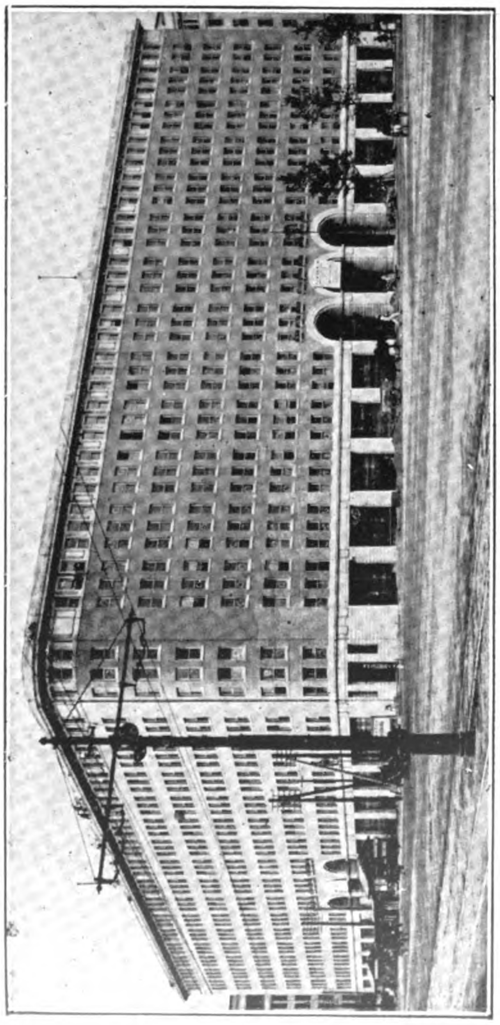
Main Entrance Gate and Bridges to the Imperial Palace at Tokyo

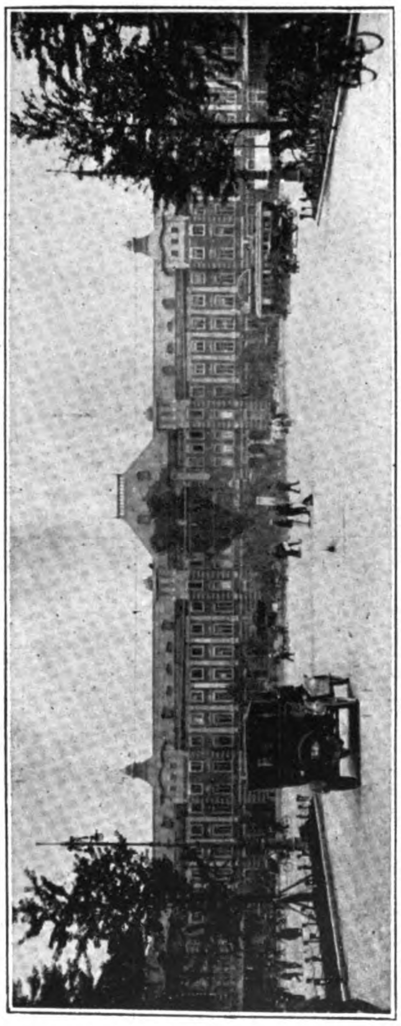
The "Kikyomon" (Side Gate) of Imperial Palace

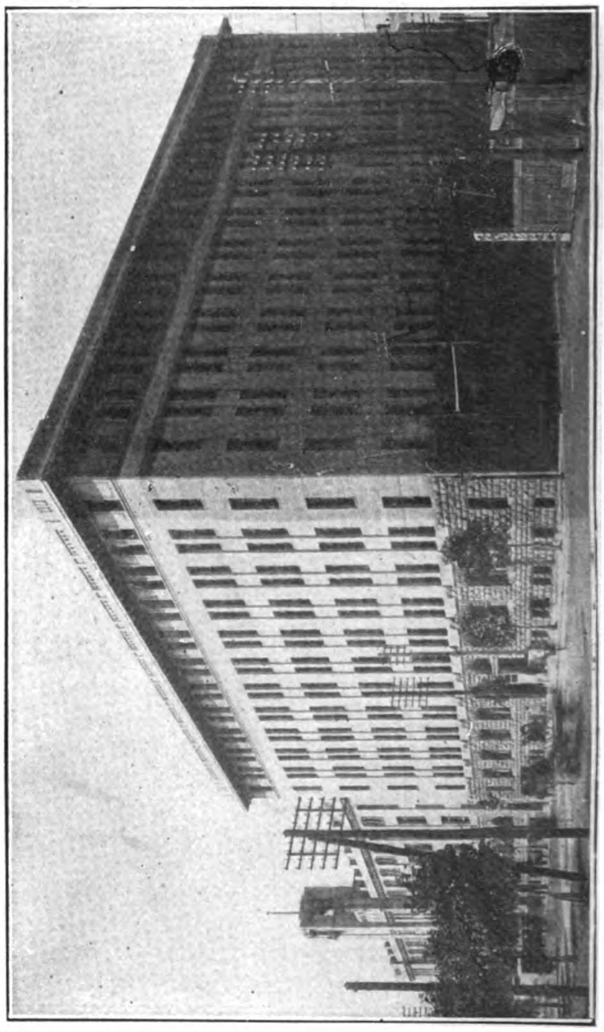


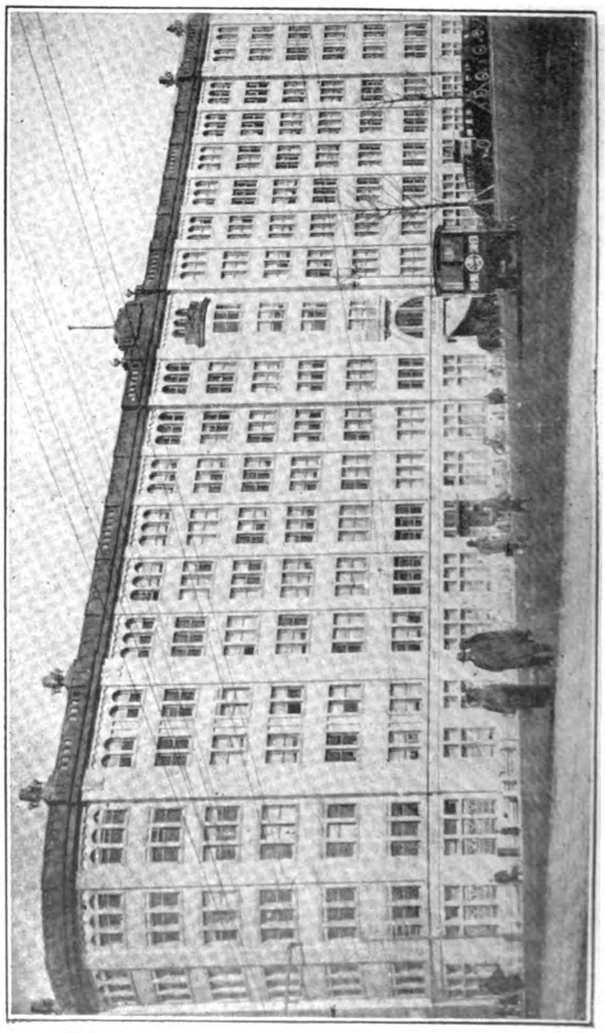
The "Otemon" (Side Gate) of Imperial Palace

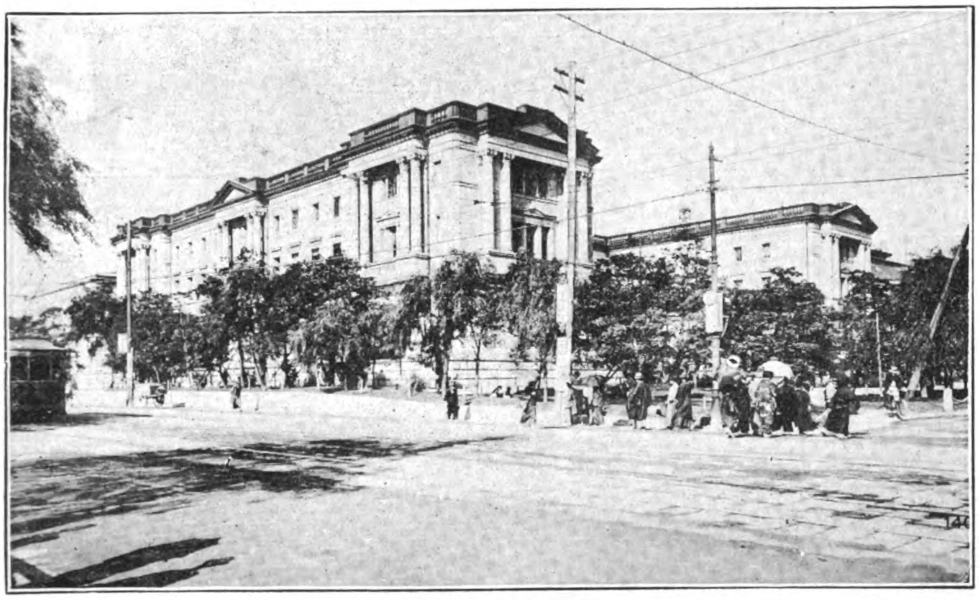

The Nippon Yusen Kaisha Head Office


The Manunouchi (Mitsubishi) Office Building

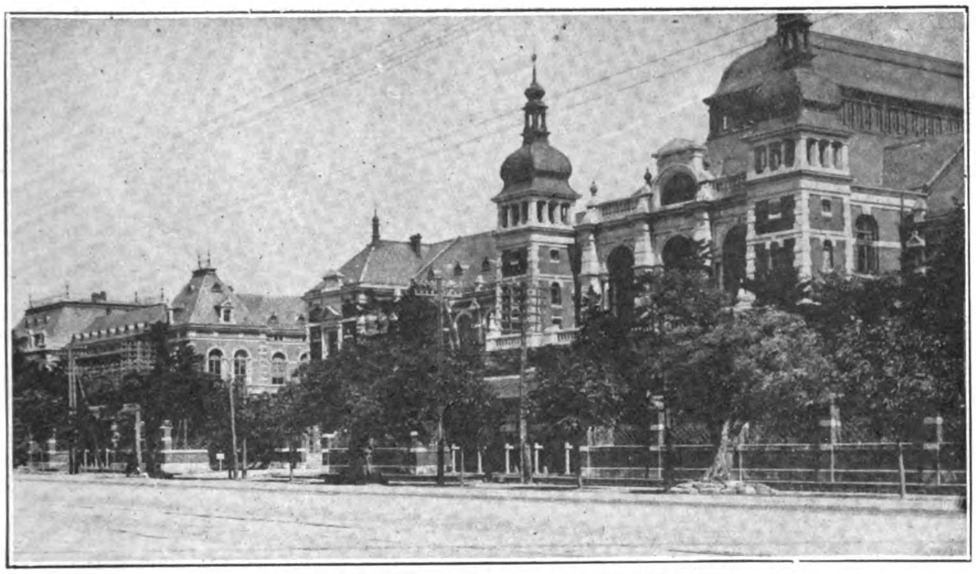

The Tokyo Central Railway Station


The Mitsubishi Head Offices

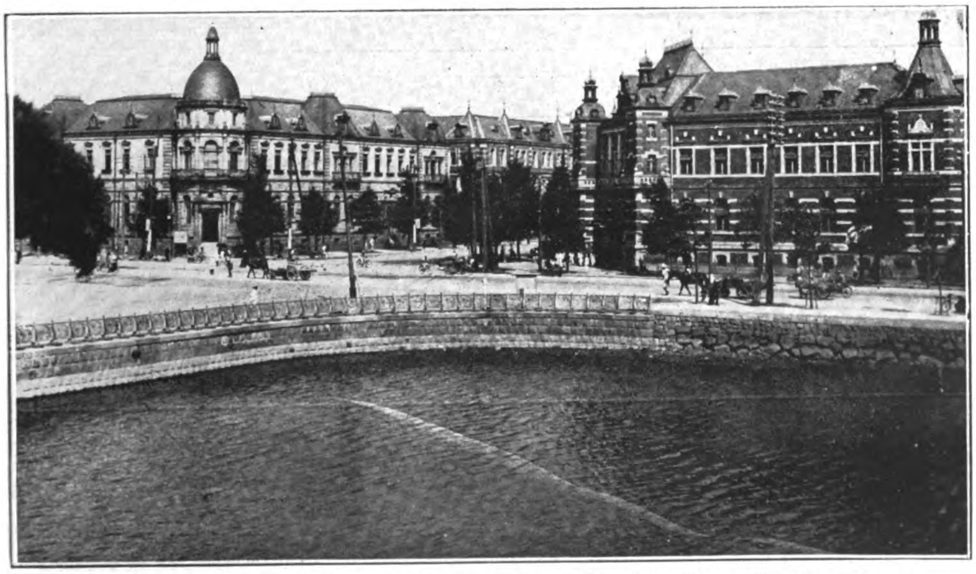

The Tokyo Kaijo Building



The Bank of Japan.



Court of Cassation and Department of Justice.



Babasaki Street, the Heart of the Marunouchi District. These Buildings were all Erected by the Mitsubishi Company and withstood the Quake without damage. Right-hand Building is the Tokyo Chamber of Commerce.

This palace is a magnificent structure of gray granite after the style of European palaces of the 17th century, but with all interior decorations true to Japanese art and ideals. Another striking building is the Tokyo Central Station, designed by K. Tatsuno and erected by the Obayashi Gumi. This is a steel and brick structure erected in 1910, which came through the quake without a crack. It may not measure up to the best architectural design, but it stood the test where other buildings failed.

From 1910 onward there was a marked improvement in the style of buildings erected in Tokyo, but no striking progress was made until the Great War ushered in an era of unprecedented prosperity and activity in all lines of business. The need for more room, and up-to-date and commodious offices to handle the increasing volume of business, forced a revolution in building methods, and with the influence of Europe cut off the Japanese turned to America and adopted our designs and construction methods to such an extent that the future capital of the empire will be for all practical purposes and outward appearances an American city. New steel and concrete office buildings, five, six and seven stories high, began to loom above the black-tiled roofs of the old city. Department stores, banks, shops and factories, all built to standard American practice, followed in rapid succession, and the bulk of the architectural and construction work was done by the leading Japanese architects and contractors.

The Ginza, or main shopping thoroughfare of Tokyo, began to assume more and more a Western appearance. The old-style Japanese shops were rapidly displaced either by entirely new buildings or by remodelling their fronts and putting in plate-glass show windows. At the time of the earthquake and fire the entire Ginza had been transformed into a Western shopping street, though in many instances the old Japanese buildings had simply been camouflaged by imitation foreign fronts of stucco, tile or brick. At the same time, large and imposing office buildings began to make their appearance along this thoroughfare and the side streets of the Nihonbashi district. Several department stores followed the lead of the Mitsukoshi, and many banks, flushed with war-time profits, gave a further impetus to new building along the Ginza. These department stores, with their imposing plate-glass show windows dressed with the artistic genius of the Japanese, are every bit as attractive as those along Fifth Avenue in New York. One of the most up-to-date structures along the Ginza is the new building of the Chiyoda Life Insurance Company, containing the offices of many prominent firms, with the two lower floors given over to the temporary use of Iida & Company's great Takashimaya Department Store. This building was somewhat damaged by the fire, but a new facing has been chipped on the blistered stone, restoring its perfect appearance.

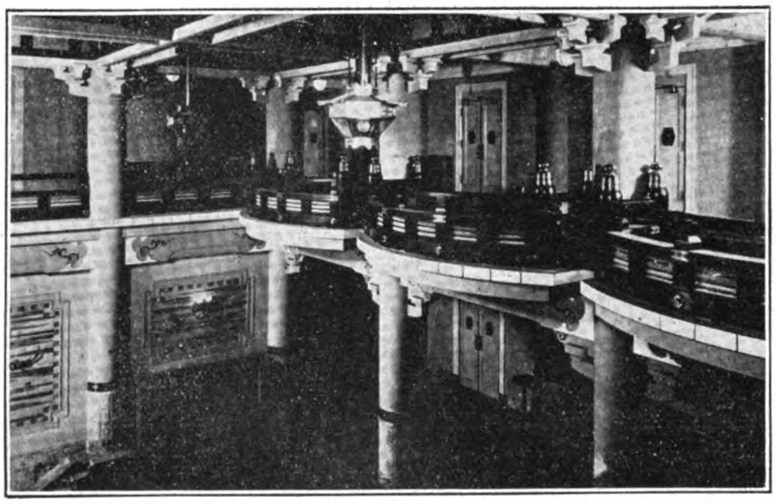
Another building which attracts considerable attention on the Ginza above the Mitsukoshi Department Store is the new Tokyo main branch of the Yamaguchi Bank, a handsome structure erected by the Takanaga Komuten.

As a result of the great earthquake and destruction of property along the main business street of Tokyo, an association of merchants has prepared a building program for the reconstruction of the business edifices along the

THE KABUKI THEATER, TOKYO'S MOST BEAUTIFUL BUILDING

A Dream of Old Japan in Modern Steel and Concrete

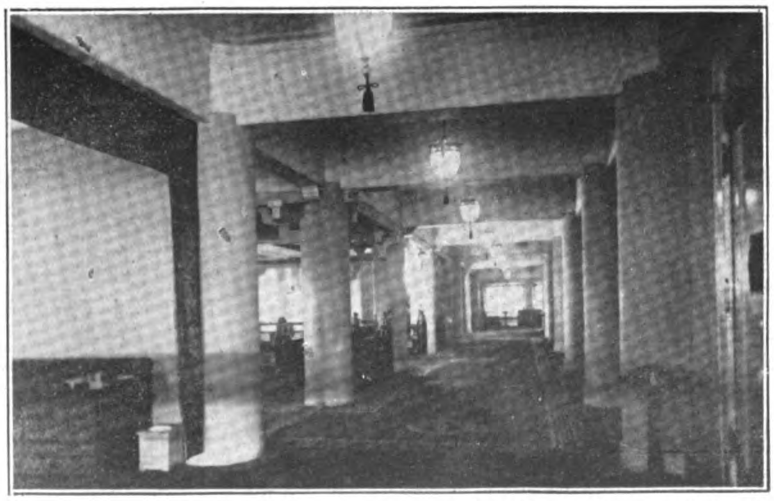
Erected by the Obayashi Gumi, Building Contractors

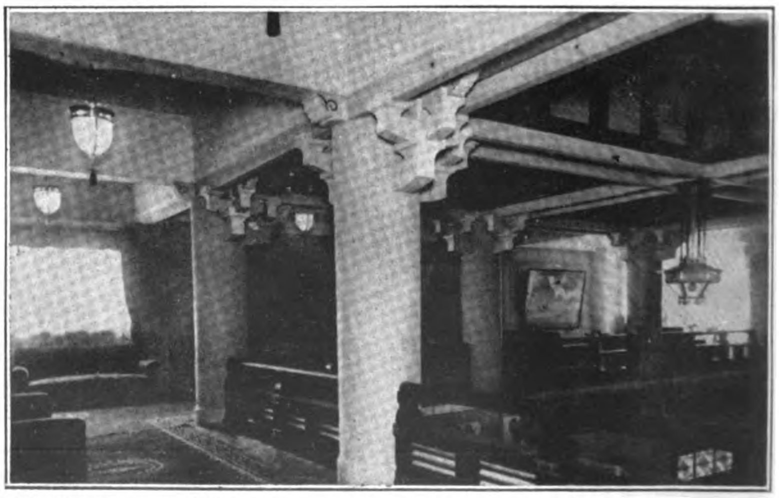


The Boxes

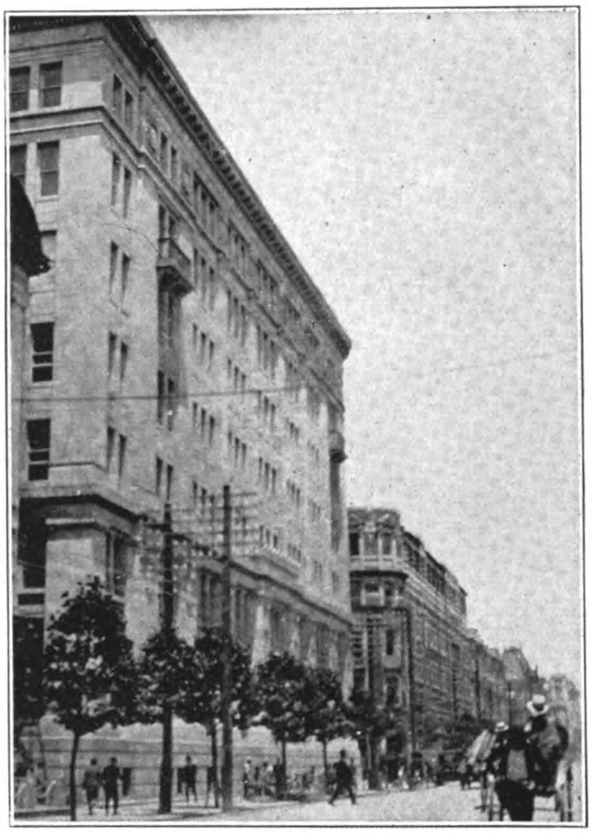
Orchestra Stalls and Galleries

Reminiscent of Old Japan: The Beautiful Exterior of the Kabukiza

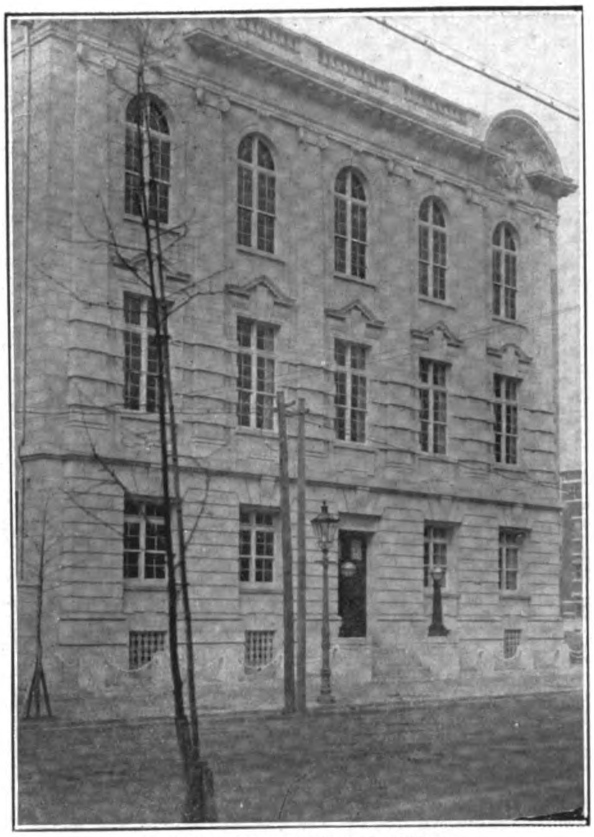




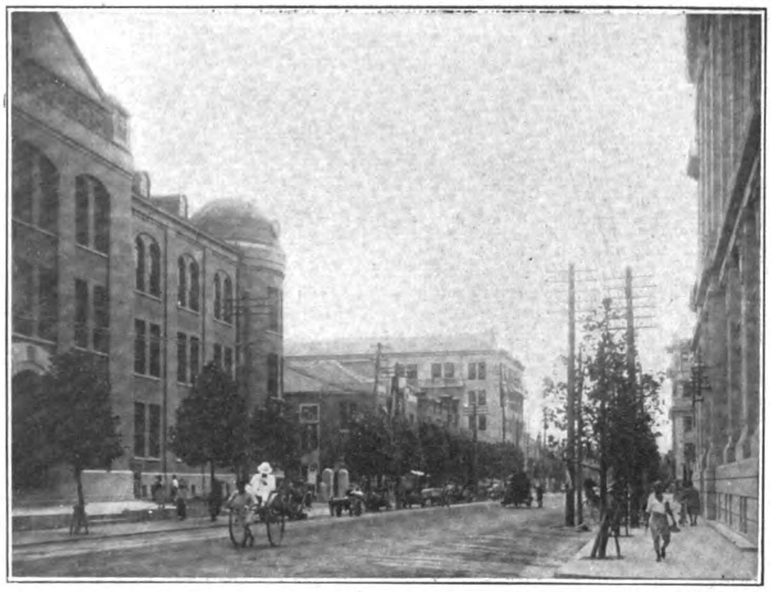
The Commodious and Comfortable Corridors and Lounge

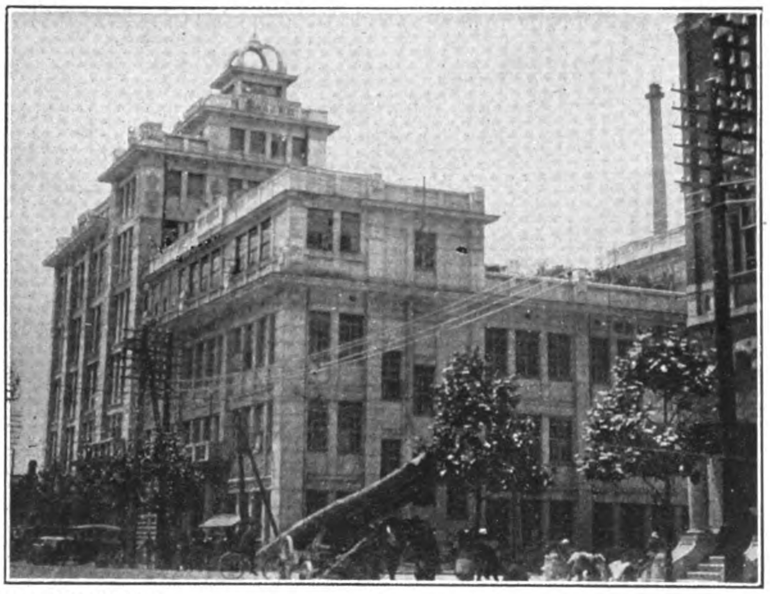


Nippon Oil Building



Railway Association Building



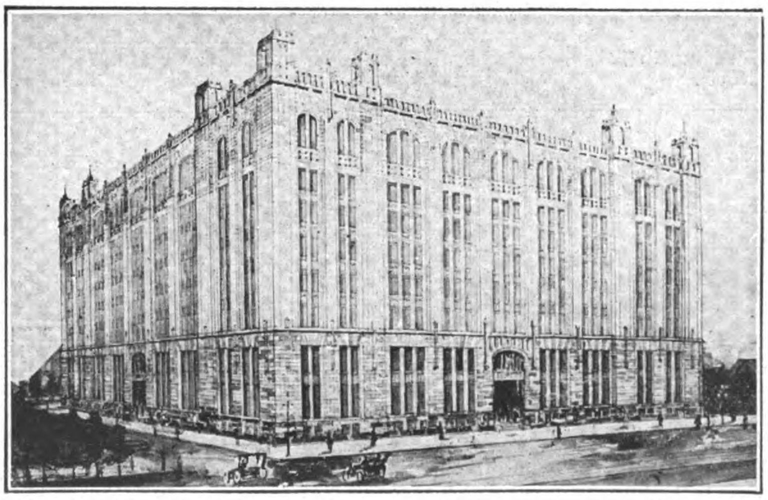


THE MARUNOUCHI DISTRICT

Left: Tokyo Prefectural Government Building; Background, "Hochi Shimbun." "Tokyo Nichi Nichi" Building

Ginza between Shimbashi and Kyobashi. The plan is necessitated by the fact that the present temporary buildings have to be replaced by steel and concrete structures not later than August 31, 1928, in accordance with the regulations issued by the Government for the reconstruction of the capital.

The officers of the Merchants' Association are said to be seeking foreign capital for their project. To this end they have submitted their plan to Ambassador Matsudaira at Washington through Mr. Junnosuke Inouye, former Minister of Finance, in an effort to get in touch with American financiers who might be interested in the scheme.



The Nagai Office Building: A Handsome Reinforced Concrete Structure which collapsed during the Earthquake, when only half-finished

According to the Government building regulations, about 50 acres of land along the Ginza, on both sides, will be affected by the reconstruction program. The Merchants' Association proposes to erect about 25 buildings, each on a lot 120 by 60 feet. These buildings, as mentioned, will be steel and concrete, 5 stories, each to cost about Y.2,400,000. The total amount of Y.60,000,000 is to be obtained abroad. The financial plan calls for the issue to mature in 20 years.

The New Parliament Building

The dominating figure of Tokyo will be the Parliament

House, a magnificent site for a group of Government buildings that will be erected later on in its immediate vicinity. This imposing pile of steel, concrete and cut granite will arise from the highest ground (90 feet above sea-level) in the center of the capital near the Sakurada Gate of the Imperial Palace. The designing and construction carried out by the Government architects under the Department of Finance is evidence of an architectural awakening and a determination to be freed from the monstrosities which foreign architects imposed upon the Japanese during their earlier contacts with European art. The structure calls for an expenditure of Y.20,000,000, spread over a period of twelve years, the beginning of a program that includes the erection of buildings for the Departments of Home Affairs, Foreign Affairs, Finance, Navy, Education and Commerce and Agriculture, the whole forming an Imperial Government center which will do credit to the position of Japan as a great nation.

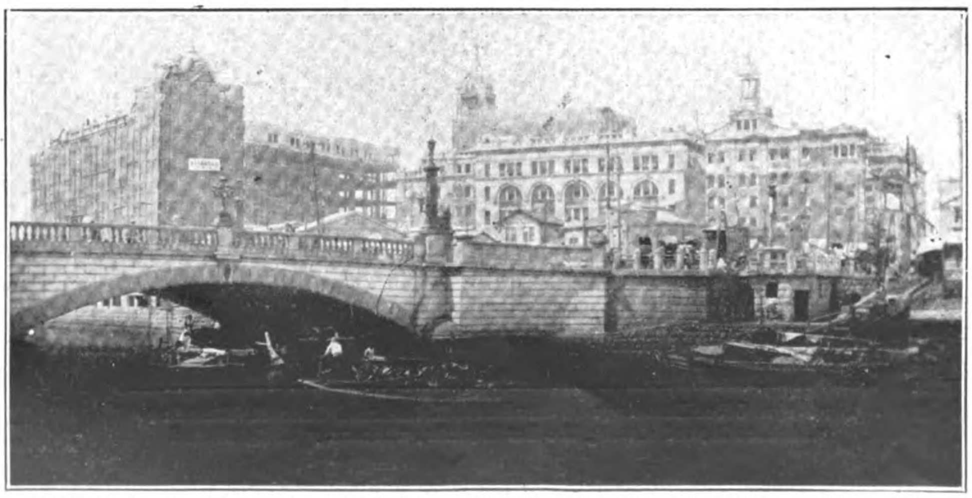
The Kuhara Head Office Building: Type of Monolithic Reinforced Concrete Structure, Free from Excess Ornamentation, which withstood the Earthquake without the Slightest Damage

The Finance Department, having supervision over the construction of new Government buildings, has prepared a budget of Y.200,000,000 with which to build nine new department edifices over a period of ten years. The share for the fiscal year 1926, to be included in the next budget, is estimated at between Y.10,000,000 and Y.15,000,000.

Three buildings are most urgently needed, and the Government plans to complete this group in the first three years, the construction of the second group to start immediately afterwards with the same time allotted, and the third group to be completed before 1926.

Katakura Silk Spinning Company's Building in Tokyo, erected by the Shimizu Gumi.

Toyama Industrial Library in Shiba, Tokyo, erected by the Shimizu Gumi.



Nihonbashi, The Heart of Tokyo, Showing the Mitsukoshi Department Store to the Right

The Construction Section has been negotiating with the other Departments of the Government with a view to obtaining their ideas on the plan of the buildings. The drafting of the buildings is to be completed in July, and if the budget is approved at the next regular session of the Diet, the work will be started immediately thereafter. The entire building program is to be financed

The Tokyo Branch of the Bank of Chosen, erected by the Shimizu Gumi; Architect, Dr. M. Kuzunishi

by the sale of Government properties. It is planned to dispose of real estate to the value of Y.15,000,000,000 for this purpose during the course of 1925 and 1926.

The new Parliament house, set in the middle of a park site covering 87,000 square yards, will have an area of 14,984 square yards, with some 60,000 square yards of floor area. Exclusive of the basement there will be three stories, with a frontal of 678 feet and a width of 294 feet. The height from the ground to the roof will be 69 feet, and 216 feet to the top of the central tower. There will be 361 rooms, to be used by the members of the House of Peers and the House of Representatives. The House of Peers, covering 840 square yards, will seat 500 members, with provision for 580 and a gallery capacity of 968 seats. The House of Representatives will cover the same area and will also seat 500, with provision for 630 and a gallery seating for 1,137 persons. Great attention was paid to the foundations, the contract for which was awarded to the Oriental Compressol Company. Mechanical excavators were employed in excavating for the foundations and pile clusters driven to make the bed for the concrete pedestals. The steel frame will be finished with brick walls and faced with cut granite. All

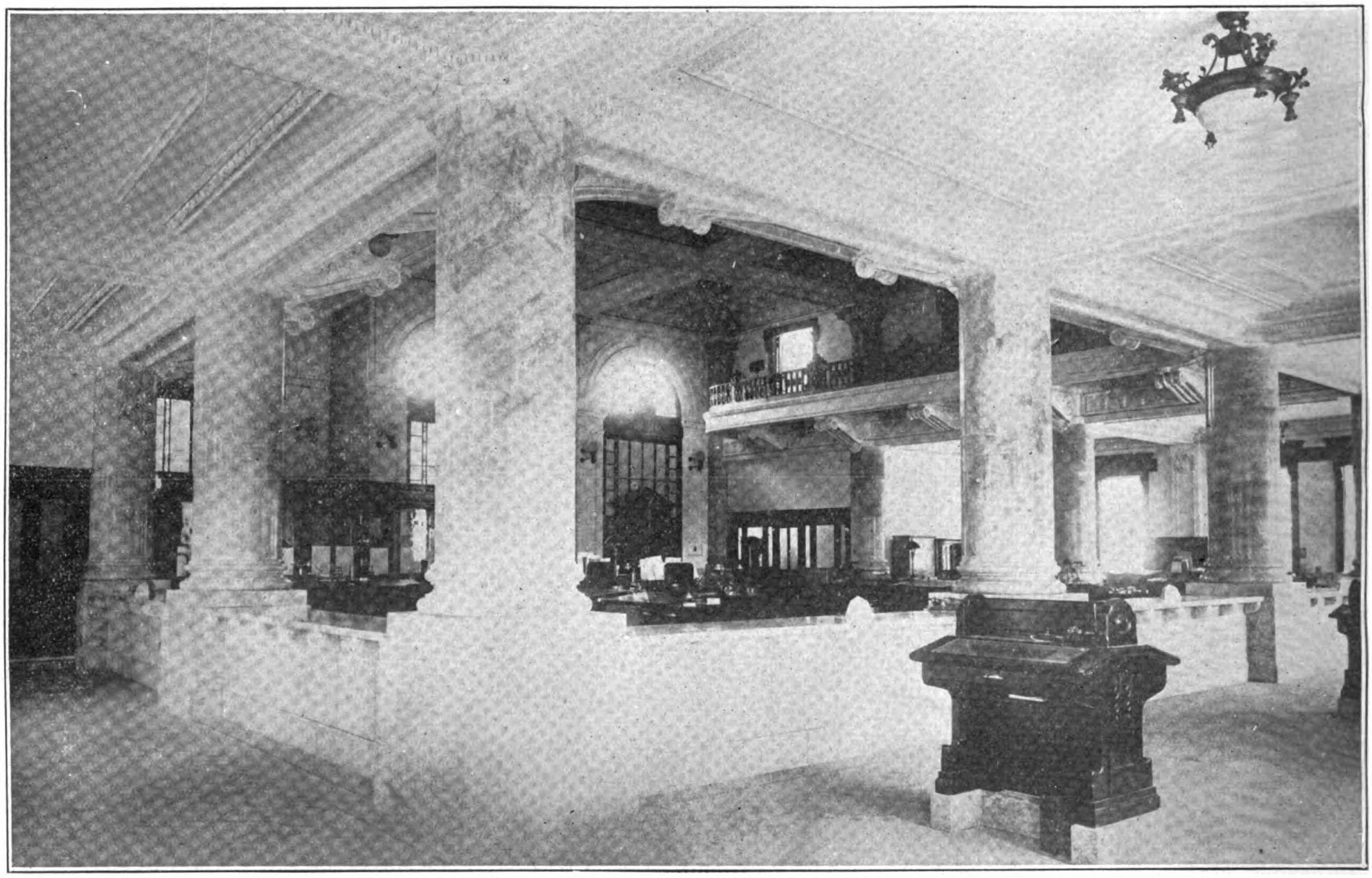
Entrance to the Okawa-Tanaka Building, another Monolithic Reinforced Concrete Structure that successfully withstood the Quake; A Shimizu Gumi Building

floors, roof and partitions will be of reinforced concrete.

Like so many other important public undertakings started some years ago, the original construction estimates have undergone considerable expansion, due to the increased costs of materials and labor. The building as originally designed called for an outlay of only Y.7,500,000, spread over the ten-year period 1918-1927. In 1923 the site was greatly increased and the estimates brought up to Y.20,000,000, and the date for completion set for 1930. The earthquake and the attendant calls on the treasury for more urgent construction compelled a still further pruning down in the annual allotments for the Diet building, and its completion is now postponed until 1934. By March of this year the foundation work had been practically completed and about six per cent. of the steel work erected.

The Mitsubishi Bank

After the Parliament building comes the classic Greek structure which houses the Mitsubishi Bank. This is undoubtedly the most beautiful modern business structure in Japan and one of the finest of its kind in the world. It stands in the



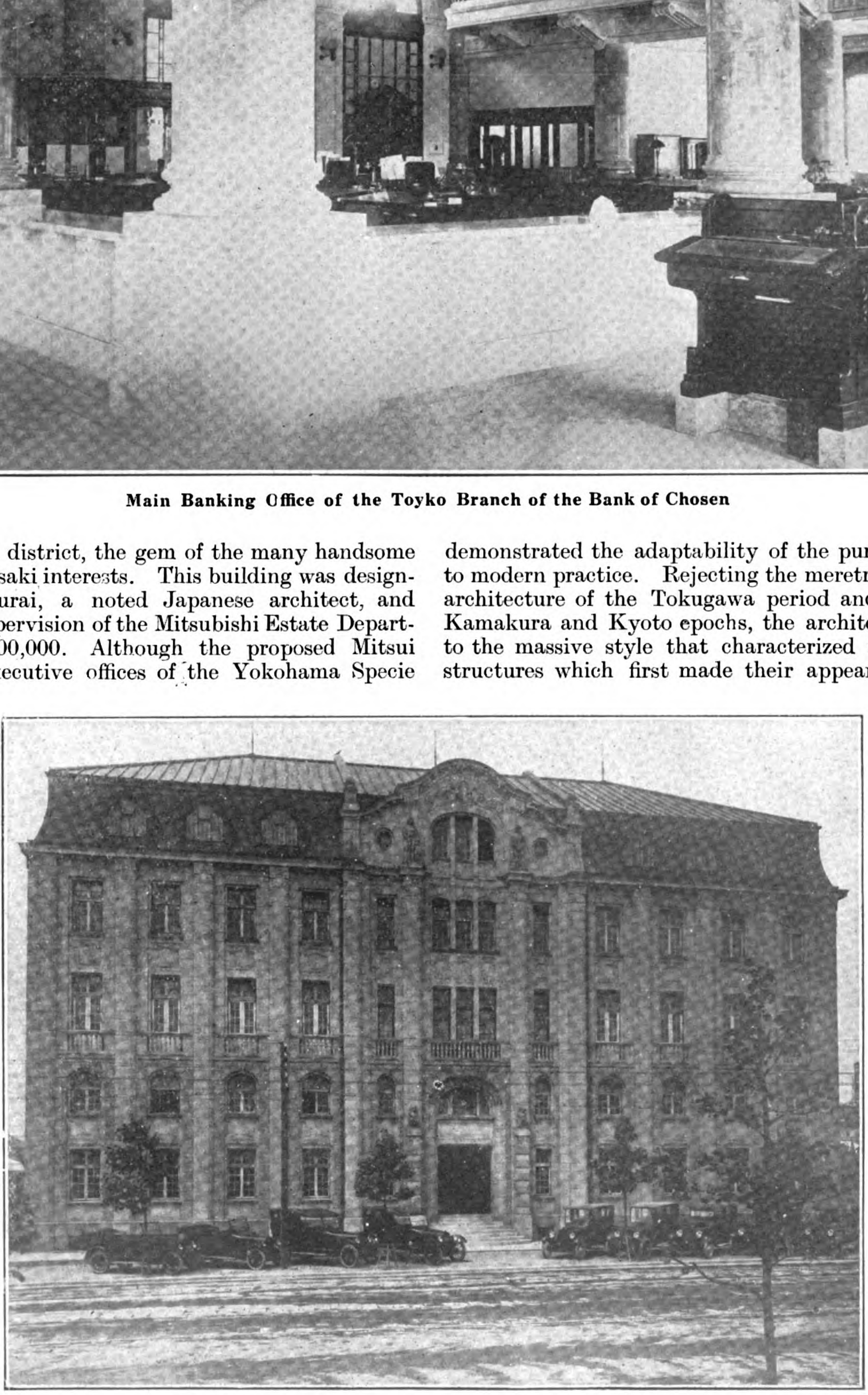
Main Banking Office of the Toyko Branch of the Bank of Chosen

center of the Marunouchi district, the gem of the many handsome edifices erected by the Iwasaki interests. This building was designed by Dr. Kotaro Sakurai, a noted Japanese architect, and erected under the direct supervision of the Mitsubishi Estate Department at a cost of Y.3,000,000. Although the proposed Mitsui Building and the new executive offices of the Yokohama Specie Bank will be larger, costlier and more imposing, it will be difficult for even these magnificent structures to surpass in impressive dignity the lines of this example of classic Greek architecture. This building is described and illustrated elsewhere in this number of THE FAR EASTERN REVIEW.

The Kabukiza Theater

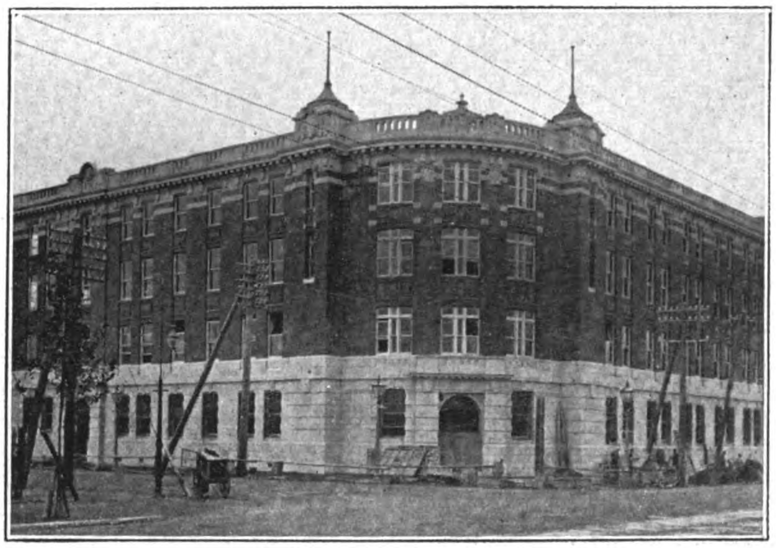
By far the most beautiful building in Tokyo is the new Kabukiza Theater, which embodies the finest traditions of Japanese architecture carried out in steel and concrete. In this temple of art, famous in the history of Japanese drama, the architects have fully and ably demonstrated the adaptability of the pure Japanese building lines to modern practice. Rejecting the meretricious and over-decorated architecture of the Tokugawa period and the finer types of the Kamakura and Kyoto epochs, the architects have carried us back to the massive style that characterized the original Sino-Korean structures which first made their appearance in Japan at Nara. Several of these structures still stand as monuments to the art and technique of a bygone age when China and Japan were the most highly civilized countries of the globe.

In the majestic lines of the sweeping roof, the ordered symmetry of its curves and solemn harmony of exterior composition, combined with the wonderful power and splendor of interior decorative art, the architects have succeeded in reproducing in steel and concrete a fire-proof and earthquake-proof temple that will stand as a permanent monument to the genius of the Japanese people, in strict keeping with their best traditions and ideals. The building is unique in

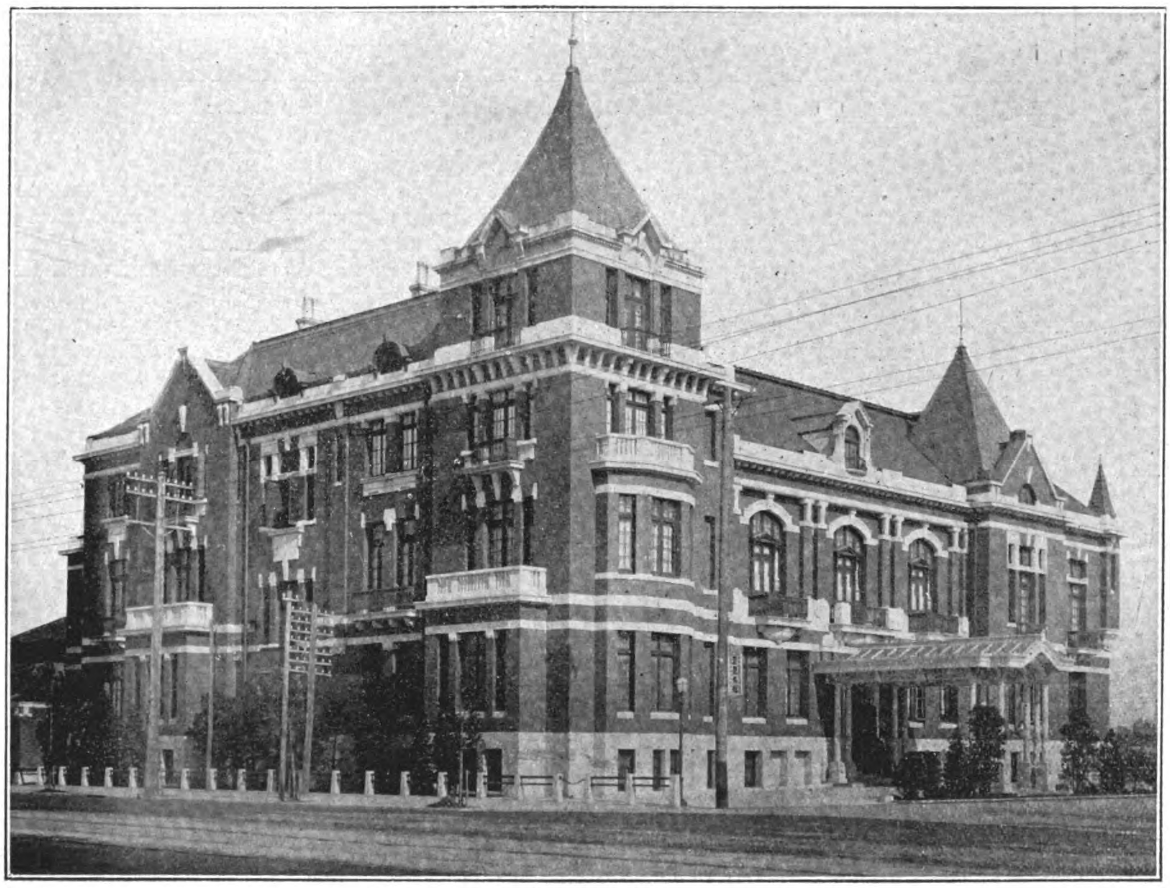


Magnificent New Office Building of Takata & Company, Tokyo

Life Insurance Association Building



Bank of Taiwan, Ltd.



The Bankers' Club

The Chiyoda Building

The Yamaguchi Bank at Nihonbashi

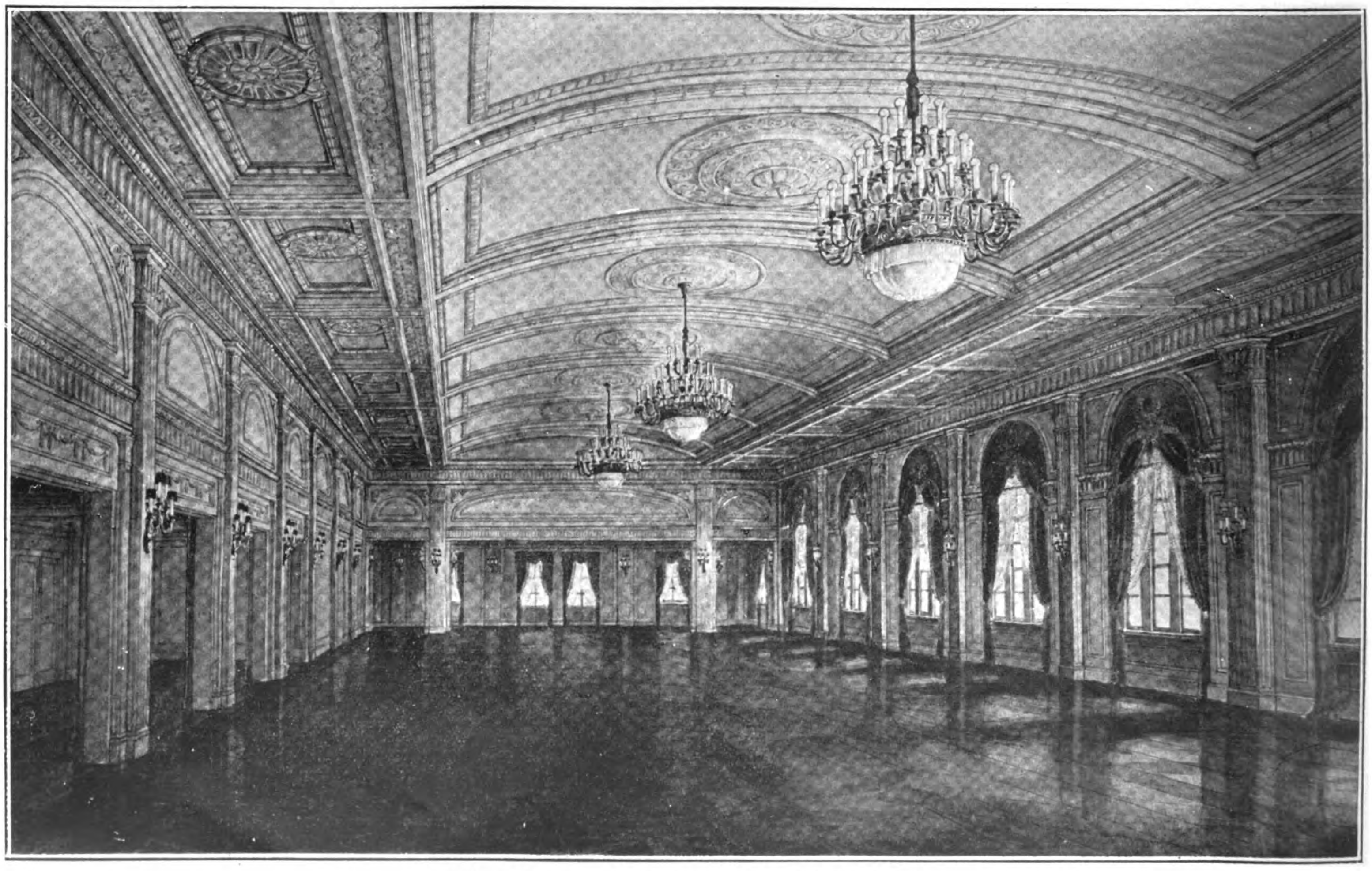
Japan, where the craze for imitation foreign-style houses closed the eyes of the people to the beauty of their own dignified architecture. The museum in the Meiji Memorial Park was the first modern building erected in Japan along these lines, but its one-storey architecture and lines are more reminiscent of the palace buildings of Peking than of the historical structures at Nara and Kyoto.

Work on the new theater was commenced in June 1922 and was nearing completion when the earthquake and fire devastated the city. The building withstood the earthquake shocks, but the conflagration which laid the surrounding district in ashes swept through the open windows and completely gutted the interior, leaving only the empty shell of steel and concrete. Patiently setting to work again, the building was once more finished and furnished, and in December 1924 thrown open to the public.

The Beautiful Tokyo "Kaikan," or Palace Hotel, now being repaired by the Shimizu Gumi

The building is 100-feet high, covering a site of 81,000 square feet, with a main floor area (orchestra and boxes) of 32,760 square feet. The dress circle has an area of 16,398 sq. feet, the family circle 15,422, and the gallery 7,084 square feet. The seating capacity of the theater is 2,296. The main stage, one of the largest in the world, is 144-feet wide and 72-feet deep, the back stage and wings covering 3,600 square feet. An outer revolving stage, 60 feet in diameter, operated by electricity, carrying a smaller hand-operated revolving 40-feet stage, forms part of the main stage equipment. The main stage can be elevated or lowered by means of electric motors. The dressing-rooms, covering 10,304 square feet on two floors, are perhaps the most comfortable and best fitted in the world. As Japanese performances last for eight to ten hours, a dining-room on each floor is provided for the actors.

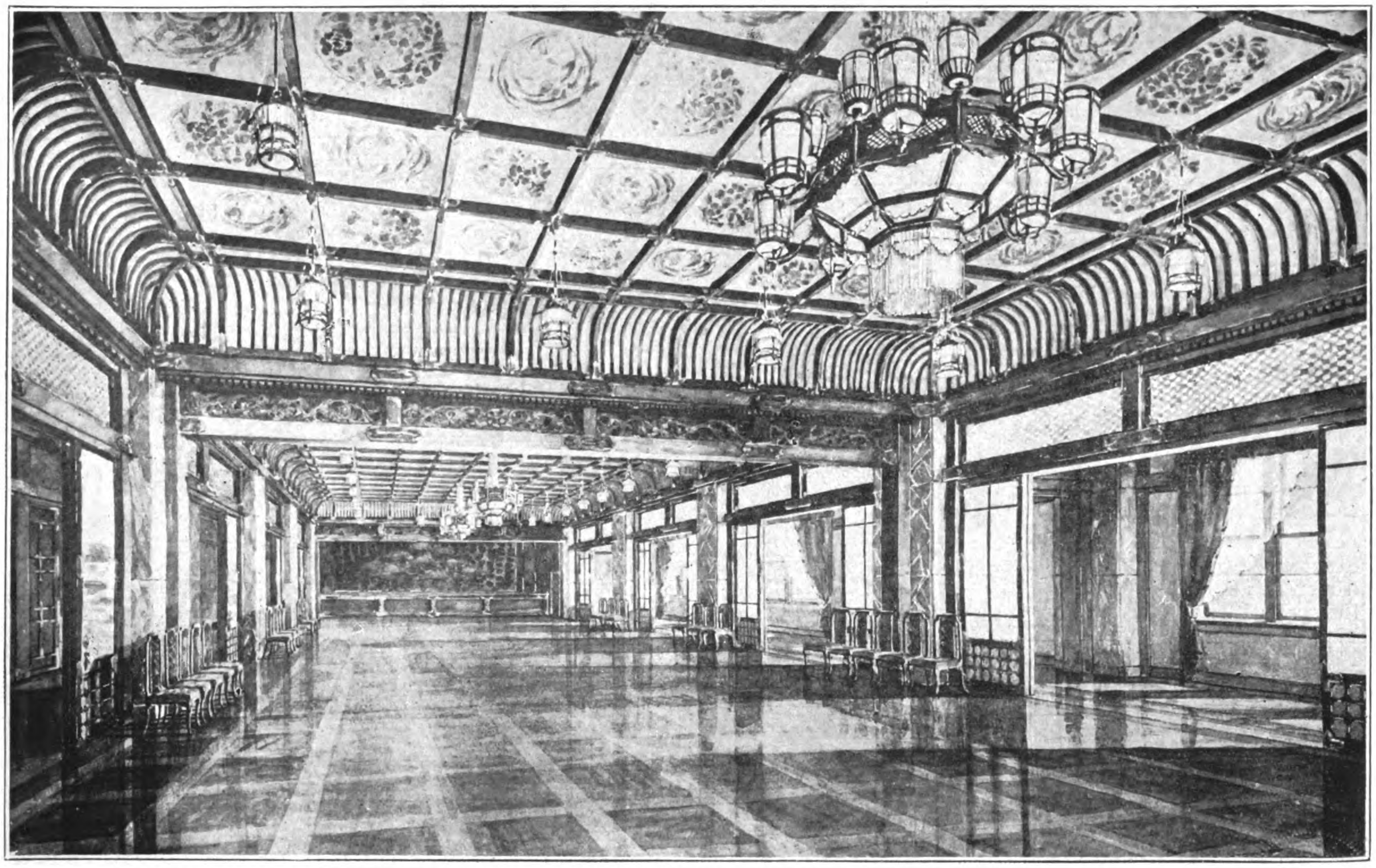
The interior decorations, while sumptuous, are in strict keeping with the severe simplicity of Japanese architecture. Color effects have been worked out after the best style of temple decoration, and the effect is heightened by plain cypress wood paneling and trim. The lobbies are wide and the ceilings high, giving the appearance of great space. The lounge rooms are also commodious and comfortable, with a special room where children can be safely kept and amused while the parents enjoy the play. Ventilating apparatus



Ball and Banquet Room of the Tokyo Palace Hotel

cools or heats the air as needed, and a steam-heating plant maintains an even temperature in winter. The construction of this building was carried out by the well-known building contractors, the Obayashi Gumi, to the design of Mr. Shin-ichiro Okada, Professor of Engineering at the Waseda University. The cost of the

The Tokyo City Hall, opposite the Mitsubishi Bank, in the Marunouchi District



The Japanese-style Banquet Hall and Concert Room of the Tokyo Palace Hotel, copied from the Nijo Imperial Palace at Kyoto

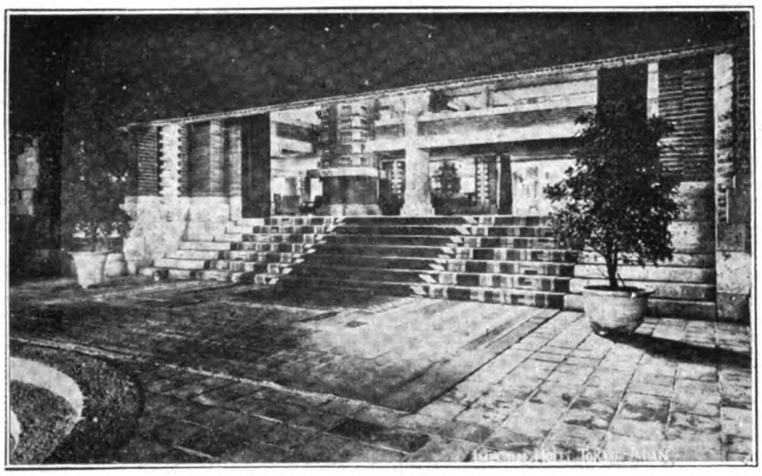
building is stated to be Y.2,700,000, of which Y.1,700,000 is in the building itself, Y.300,000 in its electrical equipment, and Y.700,000 in furnishing and decoration.

The influence of this building on the reconstruction of Tokyo may be very great if other builders and architects take heed of the possibilities and practicability of building permanent structures in pure Japanese style. Such buildings are not always practicable for offices and business purposes, but there is nothing to prevent the *motif* being carried out in official and public buildings. A return to the pure Japanese style for such exteriors would enhance the beauty of Tokyo a thousandfold and make the new capital unique amongst the cities of the world.

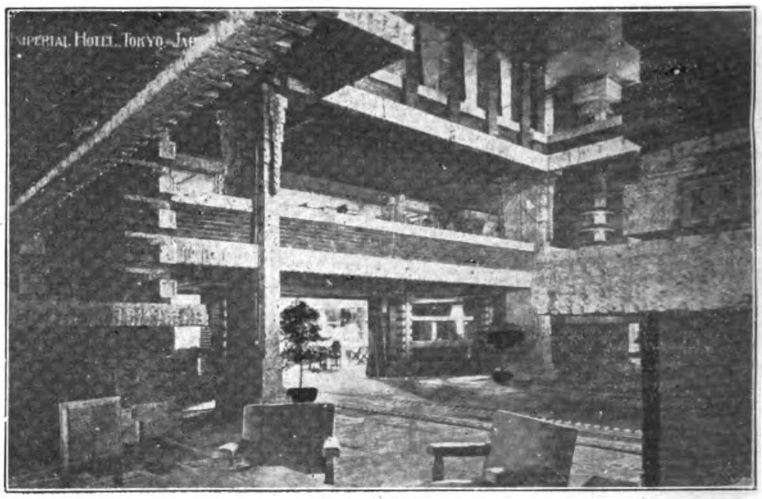
The Imperial Theater and Palace Hotel, now combined under One Ownership

The Marunouchi Group

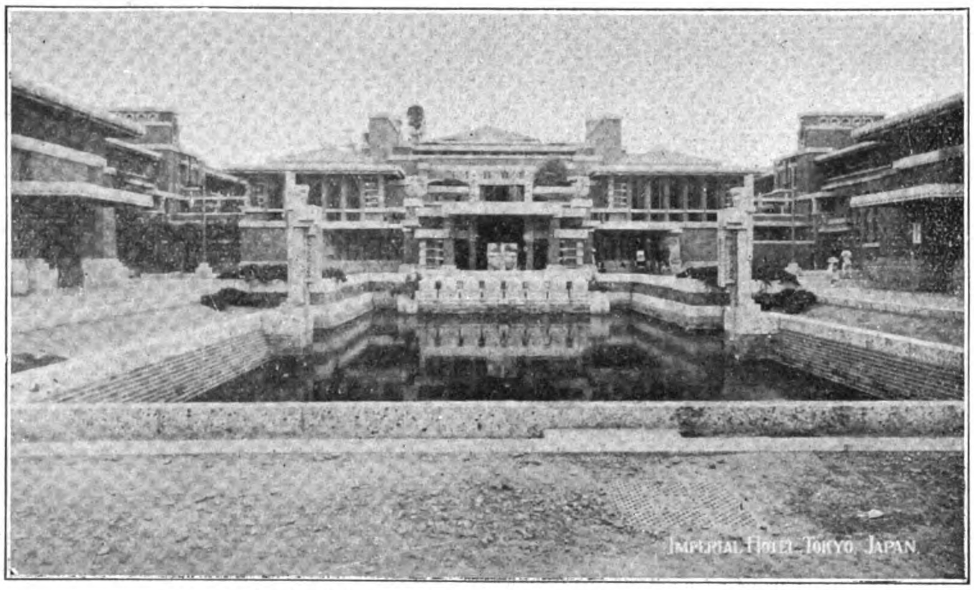
Marunouchi, the business heart of the capital and the financial center of Japan, has been reserved in the Reconstruction and Town Planning Programs as an exclusive fire-proof district. Within its limits only stone, steel and concrete materials may be employed in construction, and as a consequence many fine office buildings have already been erected and as many others projected. Much of this valuable property is owned by the Mitsubishi estate, and it is largely due to their initiative and steady program of improvements that this section has been transformed into the most modern part of Tokyo. The Iwasakis, like the Astors in New York, have specialized in



Entrance Hall

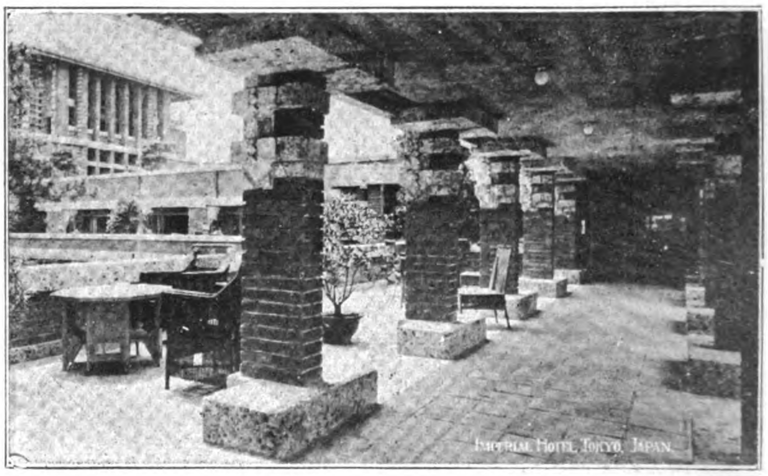


Main Lobby



Main Entrance from Hibiya Park Side

"Peacock Alley"



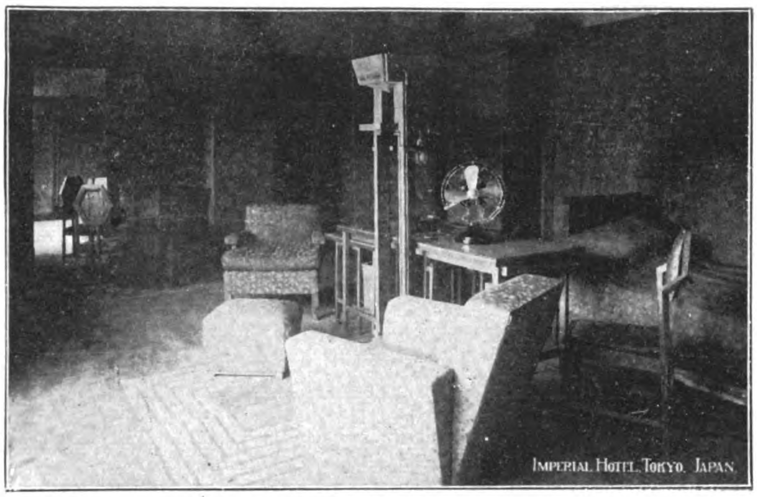
One of the many Verandahs

THE IMPERIAL HOTEL AT TOKYO.

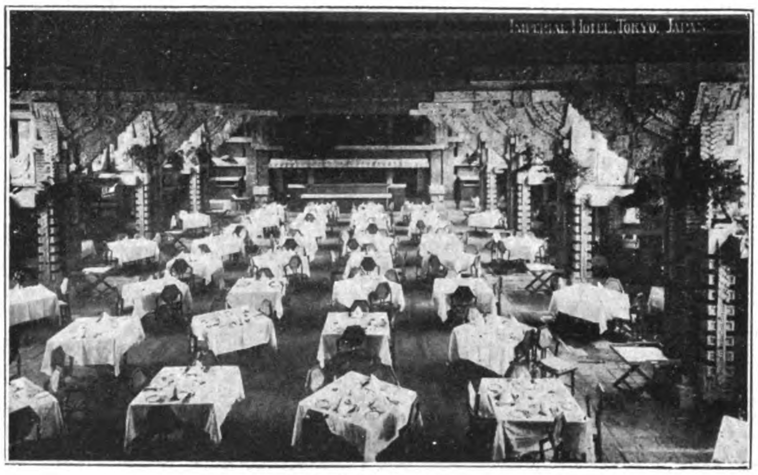
Tokyo real estate, until at the present time they own 4,308,431 square feet of urban property, of which 2,490,919 square feet is located in the Marunouchi district, immediately in front of the Tokyo Central Railway Station and extending along the east side of the Imperial Palace grounds facing the moat and park. Here are over forty modern buildings containing the offices of more than eight hundred commercial firms and other organizations, with special buildings erected by such influential concerns as the Nippon Yusen Kaisha, Tokyo Marine Insurance Company, Nippon Oil Company, Furukawa and Kuhara Companies, Yokohama Specie Bank, Taiwan Bank, Chosen Bank, Tokyo Chamber of Commerce, Imperial Theater, Bankers' Club. Industrial Club, Sale & Frazar, Industrial Bank of Japan and the various Mitsubishi offices.

Mitsubishi Head Office

The center of this group is the headquarters building of the Mitsubishi companies, devoted exclusively to the business of this immense organization. Here are the executive offices of the Mitsubishi Goshi Kaisha, the central holding company, which, in addition to exercising direction over the several individual companies belonging to the consortium, supervises the general, personnel, intelligence, economic research, accounts and estate departments. Under this one roof are grouped the executive offices of the combination of companies known as the Mitsubishi Consortium, which, with the holding company, are capitalized at Y.395,000,000. Here is the office of the Mitsubishi Shipbuilding and Engineering Company, Ltd., capitalized at Y.50,000,000, operating the great shipyards at Kobe and Nagasaki; the Mitsubishi Iron and Steel Company, Ltd., with Y.25,000,000 capital, operating steel and iron works at Kenjiho, and various mines in Korea: the Mitsubishi Warehouse Co., Ltd, a Y.10,000,000 enterprise owning huge bonded warehouses at Tokyo, Yokohama, Kobe, Osaka and other points in Japan; the Mitsubishi Trading Company, Ltd., with branches in all the principal cities of the world, which not only handles the great import and export business of the consortium, but engages



A Guest Room

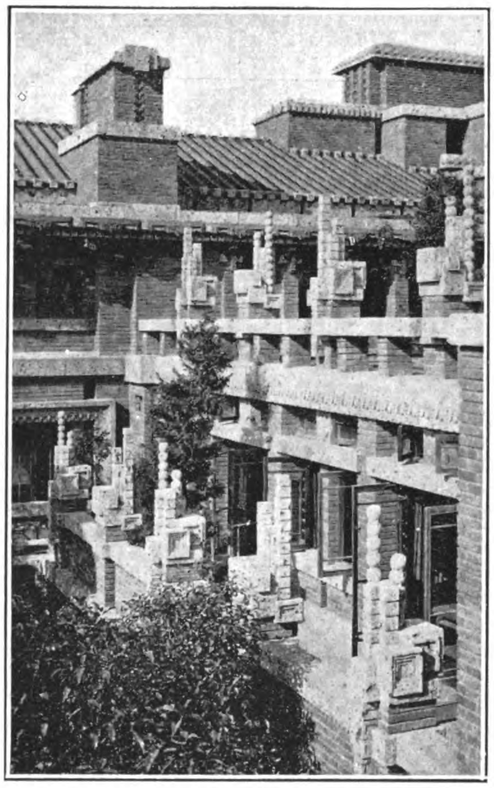


Main Dining Room

in manufacturing and in operating steamship lines. This concern alone purchases over $50,000,000 of American products yearly. Then there is the Mitsubishi Mining Company, Ltd., capitalized at Y.100,000,000, operating 15 metal mines, 12 coal mines, smelters, a refinery, a coke works and a laboratory. The Mitsubishi Internal Combustion Engine Company, a Y.55,000,000 enterprize, specializes in the manufacture of aircraft, aero-engines, Diesel engines and automobiles, and the Mitsubishi Electrical Engineering Company, with Y.15,000,000 capital, manufactures generators, motors and other high-class electric machinery. The Mitsubishi Marine and Fire Insurance Company, with a capital of Y.5,000,000, is kept busy looking after the business of the consortium.

Marunouchi Building

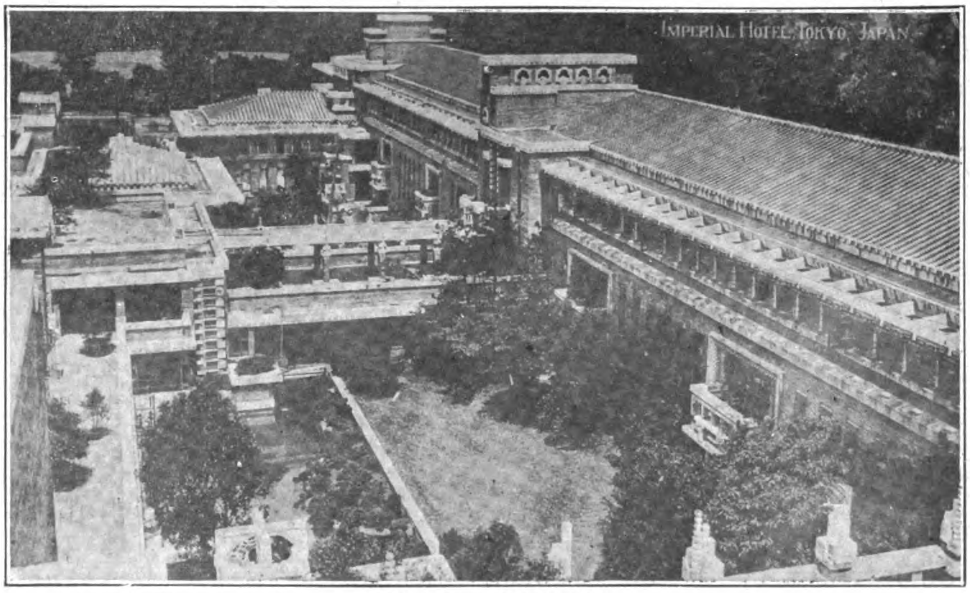
The Mitsubishi Head Office building is overshadowed by its immediate neighbor, the eight-storey Marunouchi building filling the entire block directly in front of the Tokyo Central Station. This building was also erected by the Mitsubishi Estate Department to the design of Dr. Kotaro Sakurai, the architect of the Mitsubishi Bank. It enjoys the distinction of being the largest and most up-to-date office building in Asia, having 643,000 square feet of floor area divided into 350 offices. The main halls forming an arcade on the ground floor are lined on both sides with some forty high-class shops, and on the street sides there are twenty or more stores with ample show window space, making the building one of the most popular shopping centers of the city. From the many and varied interests encompassed within its walls the building is now the most favored one in Tokyo. More than 50,000 people cross its thresholds every day.



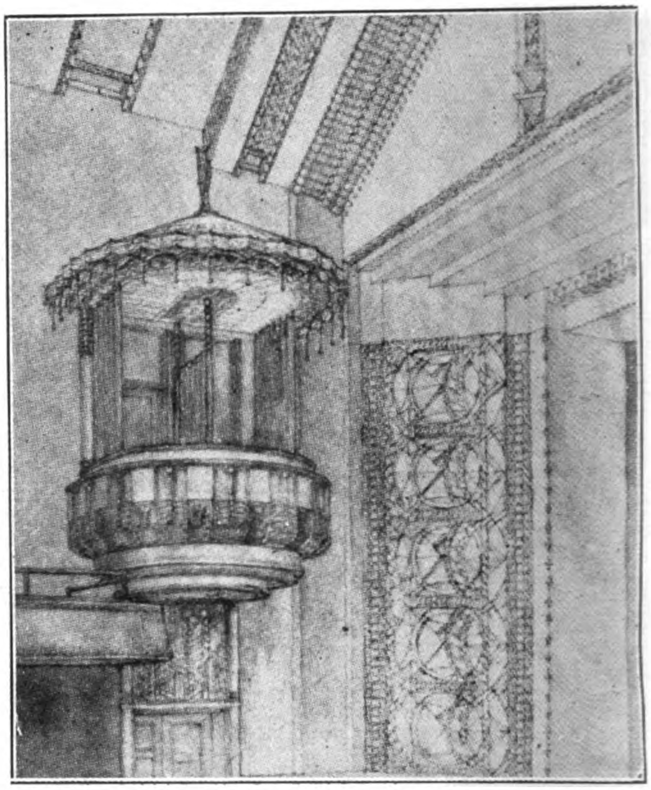
Detail of Balcony Construction

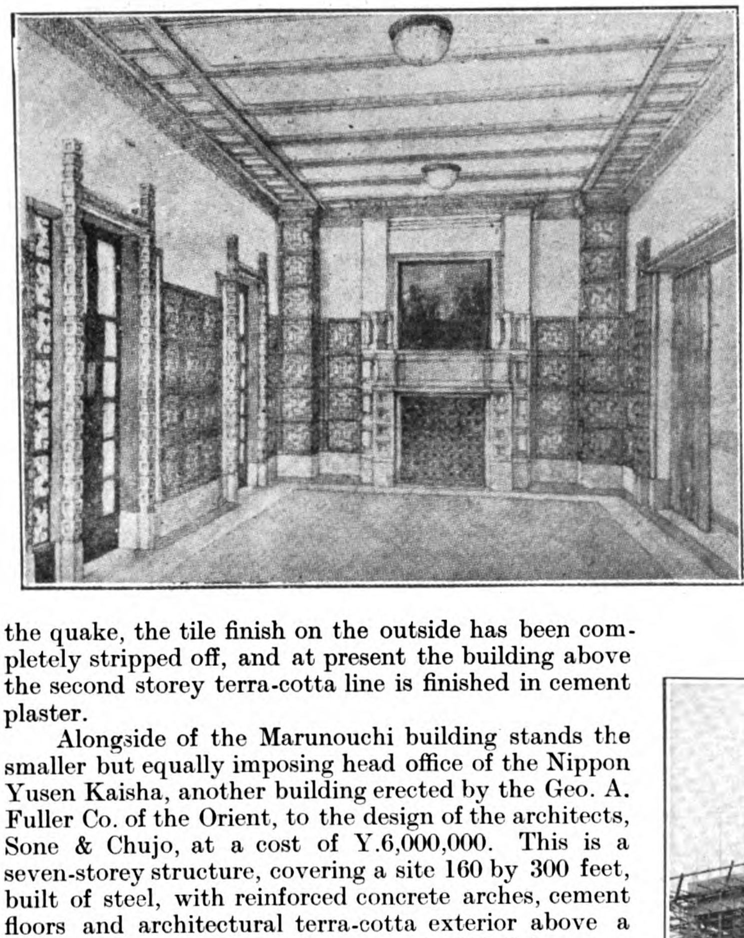
This building is one of four large office structures erected by the Geo. A. Fuller organization of New York working in conjunction with the Japanese. Due largely to the initiative of the late Baron Kondo, president of the Nippon Yusen Kaisha, this great firm of American builders was induced to come to Japan and form an American-Japanese concern called the Geo. A. Fuller Company of the Orient, Ltd., for the express purpose of erecting the Marunouchi, Yusen and Japan Oil buildings, at the same time teaching the Japanese the most advanced methods of construction in order that they might carry on alone the campaign of modernizing their cities with efficiency. A complete American organization was taken to Tokyo, and amongst the personnel were several Japanese architects and builders who had been studying American building methods, and a large number of Japanese engineers and construction experts subsequently joined the organization on the ground. These men quickly assimilated American ideas, displaying no desire to cling to tradition in architectural *motif* or engineering methods, and as a result acquired an experience that is enabling them to carry on the modern steel structural work now in evidence on all sides.

The Marunouchi Building, 300 by 350 feet, is eight stories high, of structural steel, with reinforced concrete arches and cement floors. The exterior consists of a granite base, succeeded by a storey of architectural terra-cotta, and above that by six stories of brickwork faced with Japanese finishing tile. The upper storey is of cement stucco work. The cost of the building was approximately Y.10,000,000. The earthquake developed several weaknesses in design and caused considerable superficial damage to the palstering, walls and outside tile finish. As a consequence of the lessons learned as the result of



View from the Roof





THE NEW SHIMBASHI MUSIC HALL IN TOKYO

Top: Exterior View and Corner of Stage. Left: Detail of One of the Several Lounge Rooms

the quake, the tile finish on the outside has been completely stripped off, and at present the building above the second storey terra-cotta line is finished in cement plaster.

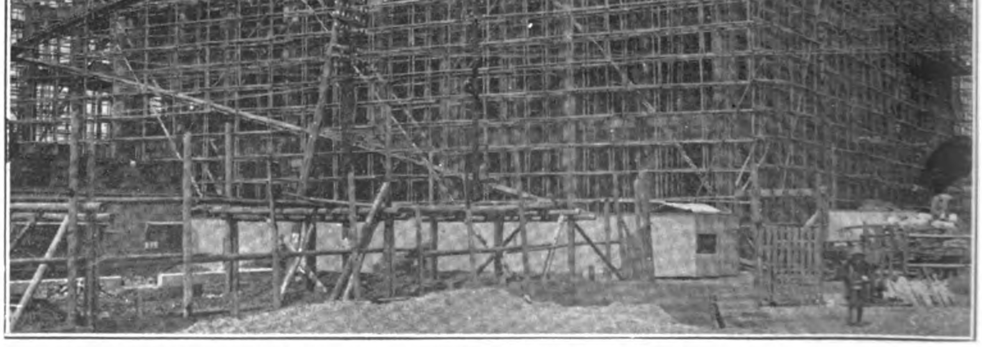
Alongside of the Marunouchi building stands the smaller but equally imposing head office of the Nippon Yusen Kaisha, another building erected by the Geo. A. Fuller Co. of the Orient, to the design of the architects, Sone & Chujo, at a cost of Y.6,000,000. This is a seven-storey structure, covering a site 160 by 300 feet, built of steel, with reinforced concrete arches, cement floors and architectural terra-cotta exterior above a granite base. The total floor area is 312,578 square feet. The other building erected by the Fuller combination is a seven-storey office structure of skeleton steel construction, with reinforced floor arches and cement floors, for the Japan Oil Company to the design of Sone & Chujo, architects. The cost was Y.3,000,000.

Across the broad avenue from the Nippon Yusen Kaisha office is the Tokyo Marine Insurance (Tokyo Kaijo) Building, another handsome office structure which came through the quake with only superficial damages. Many other modern buildings have been erected in this district along lines that will make of it in the future a replica of the financial centers in any large western metropolis.

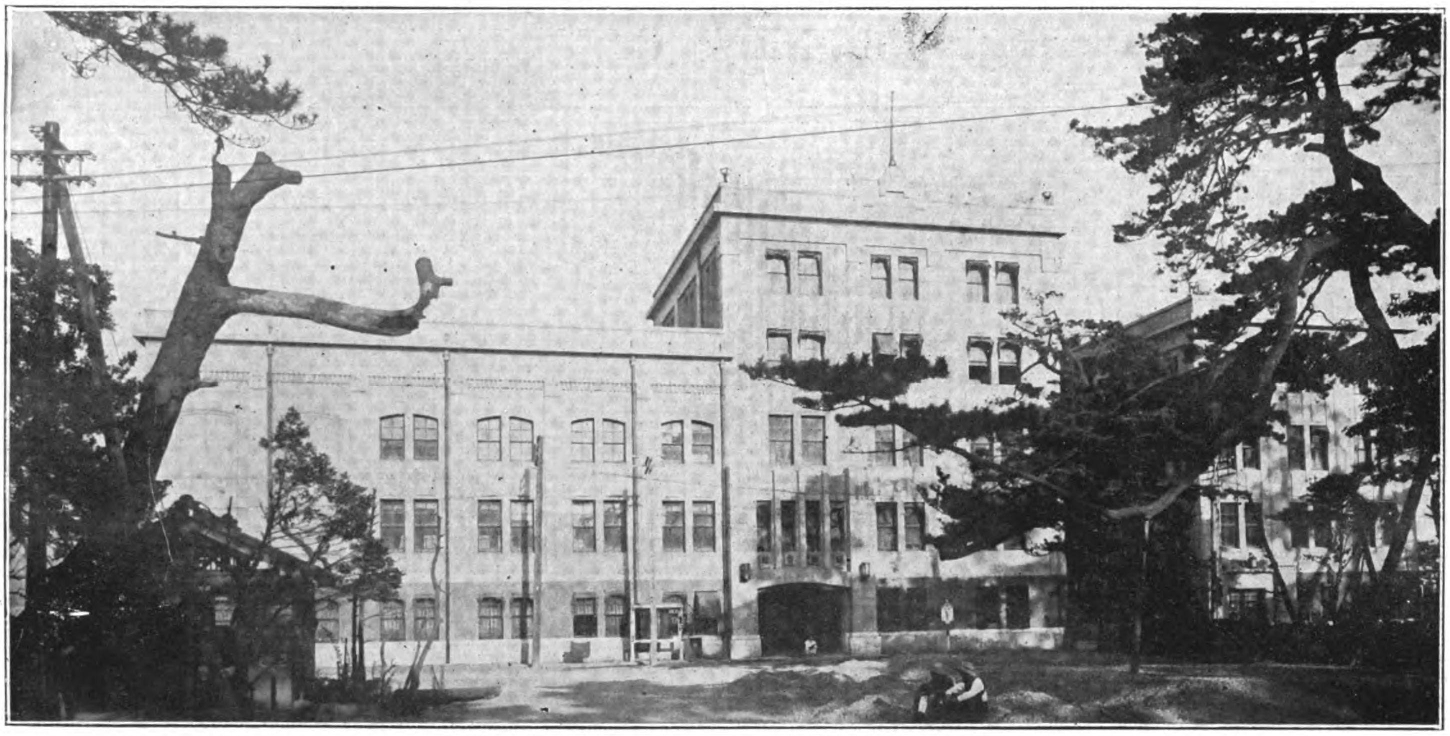
Mitsubishi Building No. 28

Among the new additions to the handsome group of financial structures in the Marunouchi district represented by the Yokohama Specie, Taiwan, Chosen, Yasuda, Industrial and Mistsubishi bank buildings, is the new six-storey and basement reinforced concrete Mitsubishi Building No. 28, which will be ready for occupancy in the spring of 1926. This building will have a floor area of 47,000 square feet, and the construction throughout will be earthquake and fire-proof. The first storey will be faced with granite, with pressed brick and stucco. Two passenger elevators will be installed, and each floor will be fitted with mail chutes, toilets and fire-extinguishing nozzles.

Amongst these handsome financial structures are those housing the Industrial Bank of Japan (described elsewhere in this number), the Yasuda Bank, the Tokyo Branch of the Bank of Chosen, and the temporary executive offices of the Yokohama Specie Bank. The six-storey Bank of Chosen, erected by the Shimizu Gumi, is a steel skeleton reinforced concrete building faced with granite and white stone, with 5,276



New Head Office Building for the Oriental Development Company in course of erection by the Okura Building Company, Ltd.

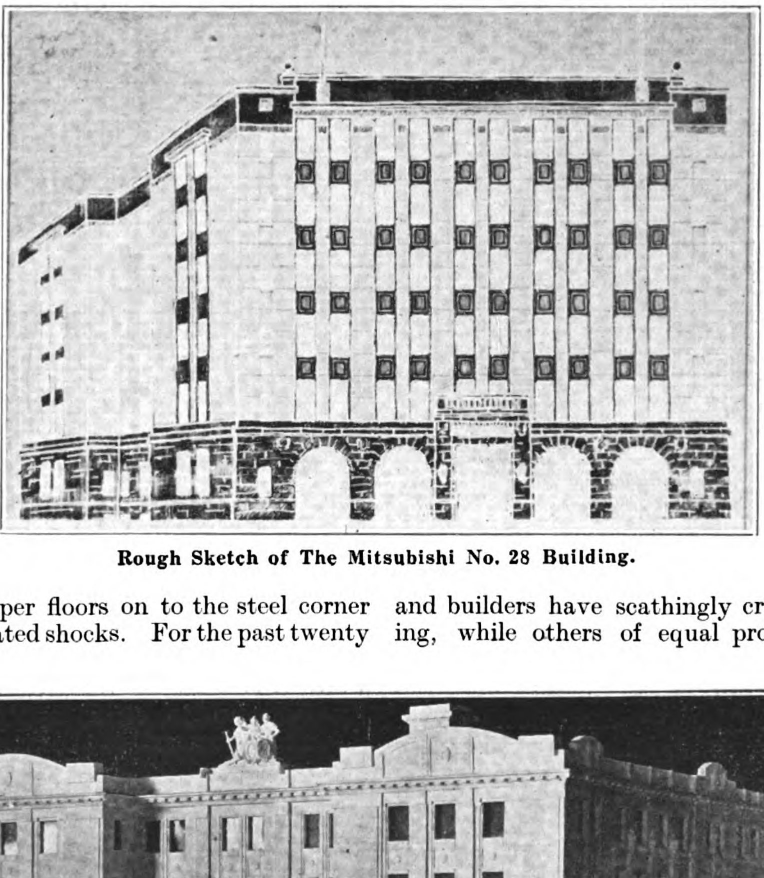


The Kyocho Assembly Building: A Massive Reinforced Concrete Structure erected by the Okura Building Co., Ltd.

square yards of floor space. This is a splendid example of a modern building designed by a Japanese architect (Mr. M. Kuzunishi, Doctor of Engineering) which stood the quake without developing a crack or structural defect of any kind.

Palace Hotel

One of the really handsome buildings which failed was the newly-completed Palace Hotel, known as the "Tokyo Kaikan," a palatial structure of five floors designed as a high-class social and entertainment center, and erected at a cost of over Y.3,000,000. During the quake the brick walls of the entire second storey were shaken out, throwing the full strain of the heavy upper floors on to the steel corner columns, which bent under the repeated shocks. For the past twenty months the building has been considered as dangerous, but engineers have reported that it can be repaired and strengthened in such a way as to make it absolutely safe in the future. Based on these recommendations, the Imperial Theater Company recently acquired the property and entrusted to the Shimizu Gumi (who built the original structure) the work of carrying out the repairs, which will take the form of bolting heavy steel beams to the corner columns and embedding them in a thick pillar of concrete.



Rough Sketch of The Mitsubishi No. 28 Building.

The interior decorations of this building follow the best traditions in Japanese art, with numerous Japanese-styled dining-rooms and a banquet hall in lacquer and gold to a design copied from the Nijo Palace at Kyoto. On the fourth floor there is also a foreign banquet hall in the French style, accommodating 1,500 persons.

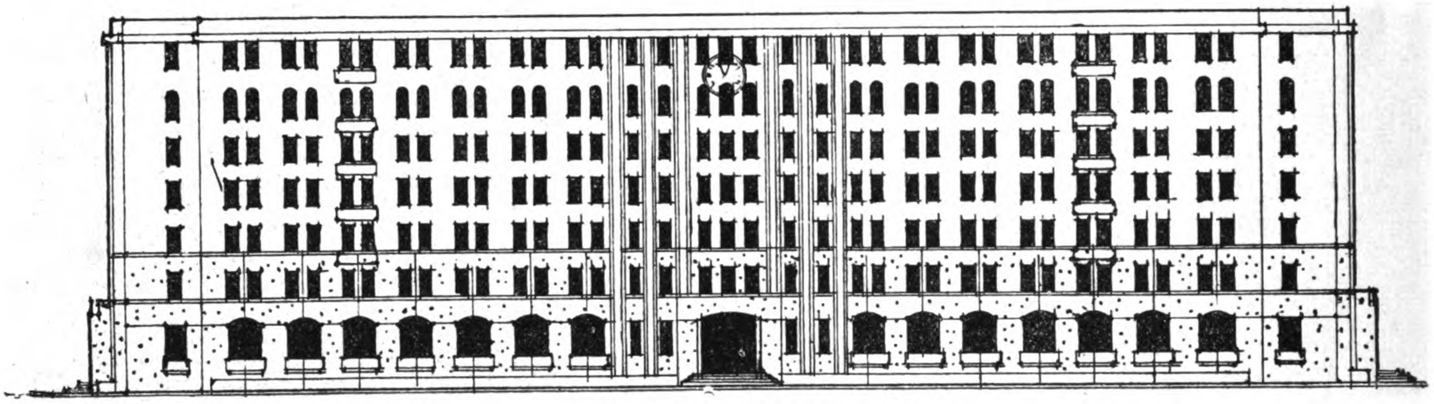
The Imperial Hotel

Probably no structure erected anywhere in the world in recent years has been the subject of as much controversy as the new Imperial Hotel, facing Hibiya Park, designed and erected by Frank Lloyd Wright of Chicago. Other architects and builders have scathingly criticized and condemned the building, while others of equal prominence have as enthusiastically praised its design and construction. The architect contends that the structure is "a clear, consistent statement of a more coherent idea, a stronger note in our modern life where unity and character come out of the nature of the thing done—in fitness to purpose; . . . its simplicity and sincerity cannot fail to teach Japan a new lesson regarding Western civilization in aspects that are vital to that civilization itself."

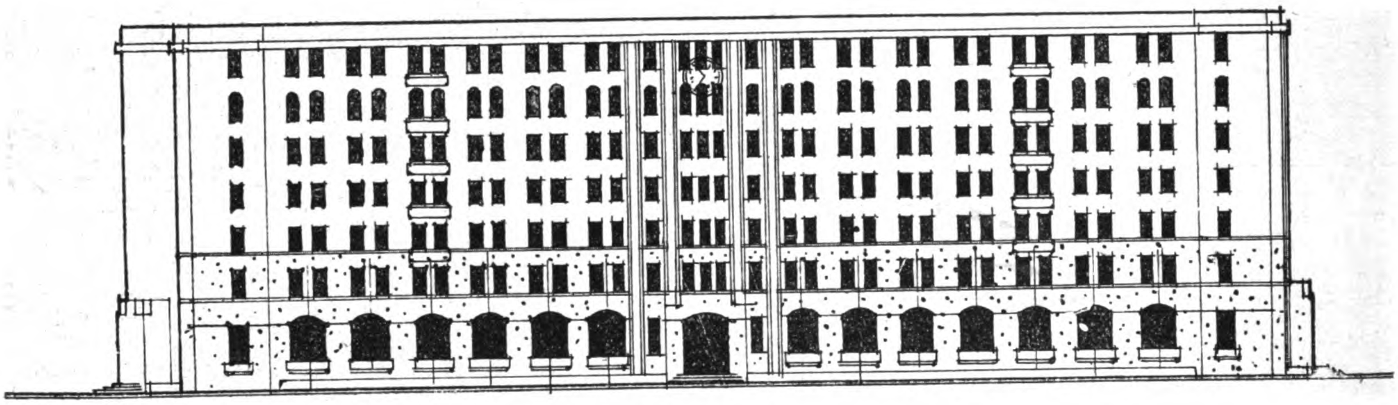
This may be all true, but it is difficult for the layman to under-

Model of The New Industrial Club, opposite the Tokyo Central Station

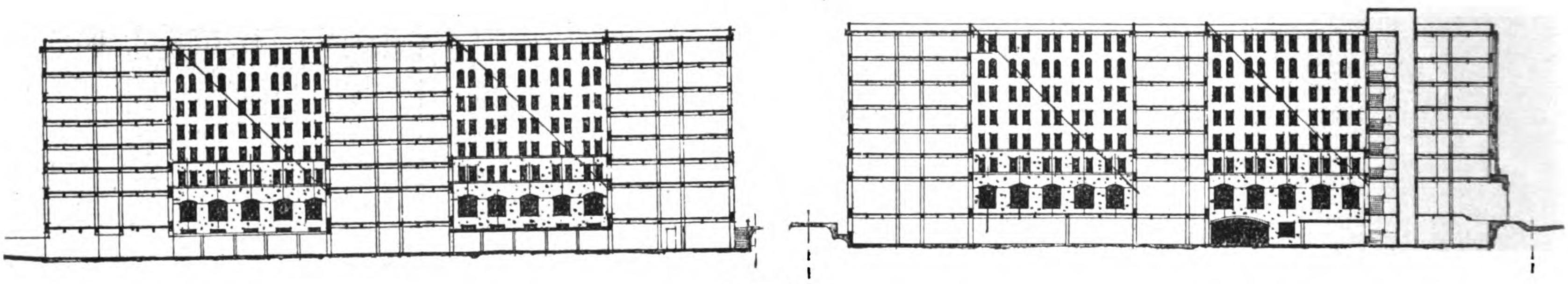
TOKYO'S NEW CITY HALL



FRONT ELEVATION



REAR ELEVATION



SECTIONS

stand what bearing the resurrection of the ancient Aztec, Toltec or Inca *motif* has on the vital aspects of our modern civilization, especially when it eliminates the furnishings our civilization exacts in a modern hotel. Undoubtedly the Imperial Hotel is one of the world's finest structures in point of character, which is all its own. It is not difficult to recognize the genius which conceived such a poem in stone and brick, and due praise must be spontaneously offered to the brilliant engineering talent which adhered to strictly straight lines and flat arches throughout the entire building. The only fair comment that can be advanced is that the building is probably a hundred years ahead of the age in its architectural features and fifty years behind in many things which make for the comfort of its patrons. The architect sacrificed everything to his art, raising a monument to his genius and bequeathing to the Japanese the difficult task of making it a financial success.

The building, however, nobly stood the test, and whatever its drawbacks, both Japanese and foreigners have reason to render profound thanks that it was completed before the earthquake. Its splendid theoretical structural design worked out practically when the terrific shocks violently jolted the building. It trembled, swayed and rocked in the upheaval, and at its ending quietly steadied to position free of distortion, rents, cracks or damage of any kind. Through all the subsequent tremors it remained a haven of refuge to those who enjoyed its hospitality.

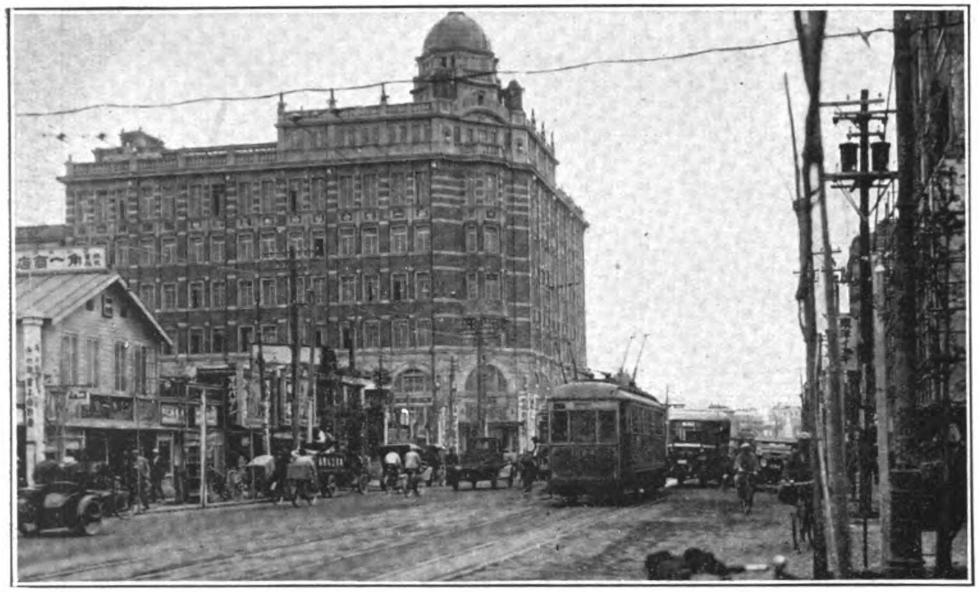
New American Embassy

Since the earthquake the American Embassy has been located in the front rooms of the north wing of the Imperial Hotel, and it is gratifying to Americans and Japanese alike to know that the American Government will erect a new Embassy and Consulate in Tokyo to take the place of the old wooden building destroyed in the conflagration. The project is a gesture of America's sincere friendship for Japan, and the buildings are to be on a scale commensurate with the finest premises maintained by any other Government in a foreign capital. The buildings will be earthquake and fire-proof, and the plans provide for an Embassy office and staff quarters as well as a suitable private residence for the Ambassador. A separate plot of land is to be acquired for the erection of a Consulate-General building.

The Imperial Household Department has ceded the Prince Ito property to the United States as long as that country desires to use it for Embassy purposes. The property adjoins the present American Embassy grounds in Reinanzaka, and the grant increases nearly 50 per cent the area of the old Embassy grounds.

The grant is similar to that under which the present American Embassy grounds are now held, except that the new order is from the Imperial Household Department instead of the Japanese Government. Congress recently appropriated $1,250,000 for new Embassy buildings and a new Consulate in Tokyo. Of this, it is

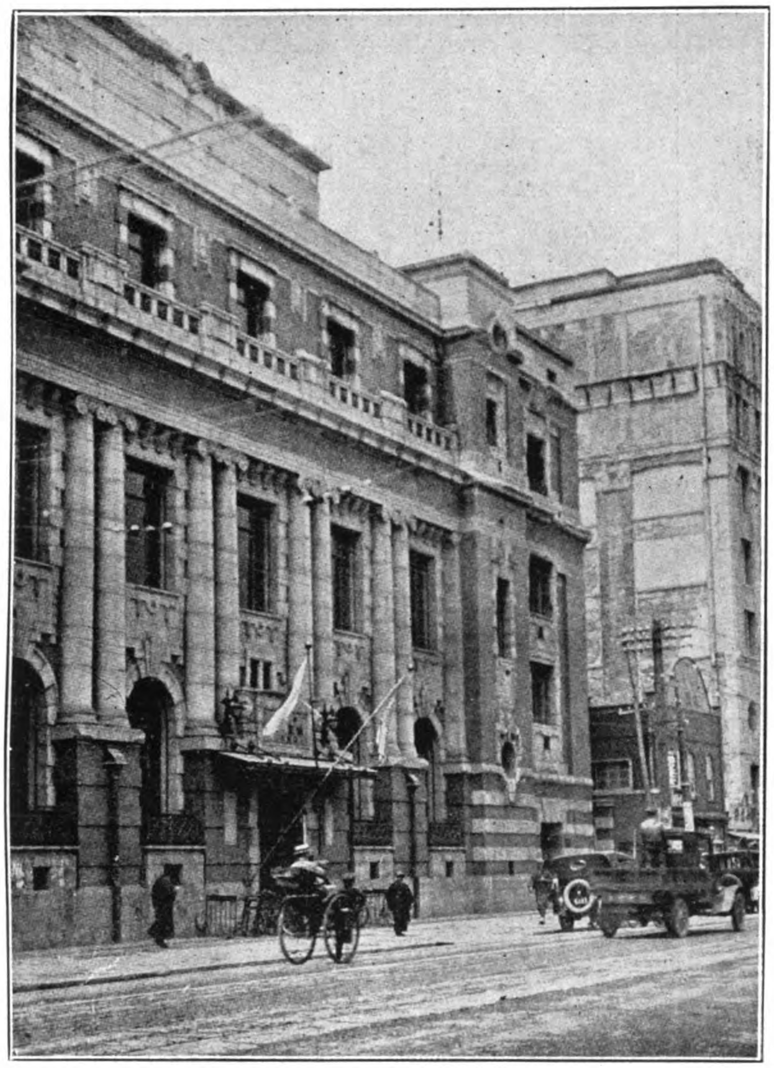
THE GINZA, TOKYO'S MAIN THOROUGHFARE



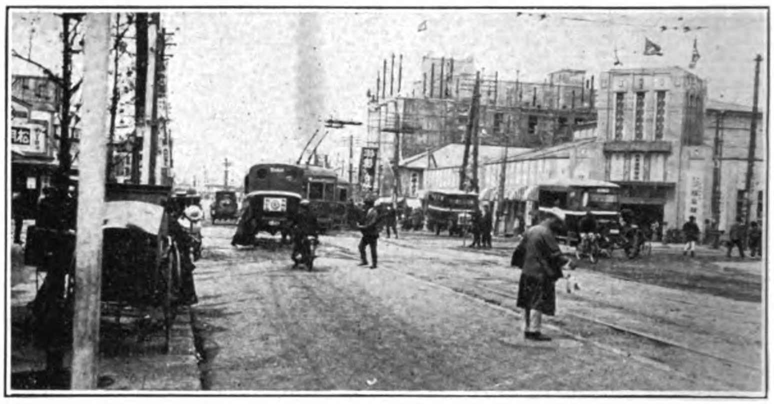
Looking North and South from the First Mutual Life Insurance Building.

Looking North from Nippon Bridge.

The Matsuzaka-ya Department Store.



The Tokyo Branch of the Sumitomo Bank, near the Ginza, was saved through the heroism of five faithful employees who, at the risk of their lives, stayed inside the structure to close the fire shutters with which the windows were equipped. As the flames had surrounded the building they were compelled to remain inside three days



The Temporary Quarters of the Shirokiya Departmeut Store in Nihonbashi, Tokyo

understood, approximately $1,000,000 is for the Embassy and the other quarter of a million dollars is for the Consulate.

The letting of contracts and all other details concerning these buildings will be handled by the State Department in Washington.

There is to be one central Embassy building and several other buildings which will be the homes of all persons connected with the American Embassy in Japan.

New British Embassy Group

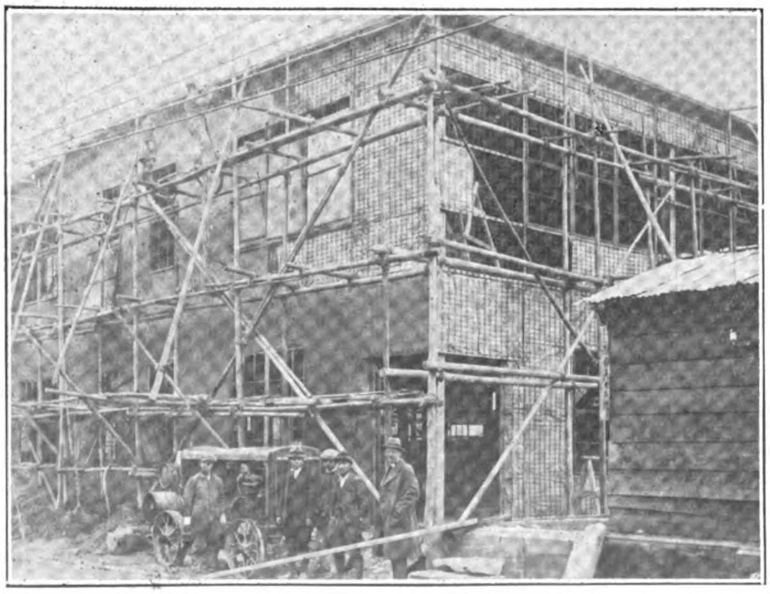
The British Government has also prepared a provisional estimate of £300,000 for the erection of a new group of Embassy buildings in Tokyo. The old buildings are to be replaced by eleven separate residences, besides an office block and several quarters for the staff.

The buildings will be designed to resist a seismic co-efficient of one-quarter gravity, or a horizontal acceleration of eight feet per second, which factor is considered adequate in the structural design of the buildings to make reasonably safe provision against the effects of severe earthquakes.

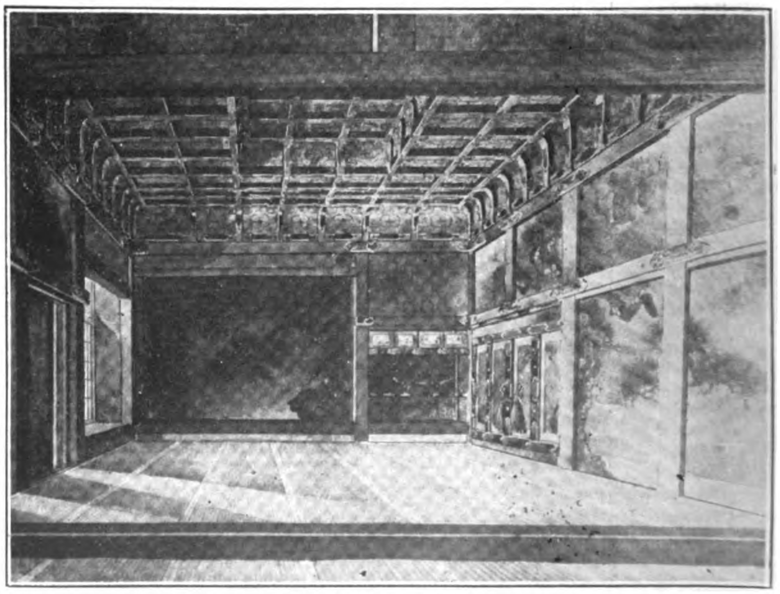
The system of construction for the buildings will be that of monolithic reinforced concrete throughout, not only as regards the structural frame of the building, but as regards wall panels, partitions, floors and roofs. The reinforcement will be continuous throughout; the lay-out of the buildings will be designed to give the maximum rigidity by the provision of the most effective sway-bracing through the whole of the blocks.

The limitations imposed on the design of the building by the nature of the structural problem will inevitably demand a design of some unusual features. It will, for instance, be essential to aim at a minimum of external projections, and detachable external surfaces will also be eliminated. The constructions will probably be treated as moulded buildings, formed of plastic material such as concrete, with decoration in the form of stamped patternings, panels, recesses or other methods of design adapted to the proper functioning of the material. Roofs will probably be flat, and it is proposed that no part of the buildings shall be of a greater height than two storeys, nor will they exceed 110 feet in length.

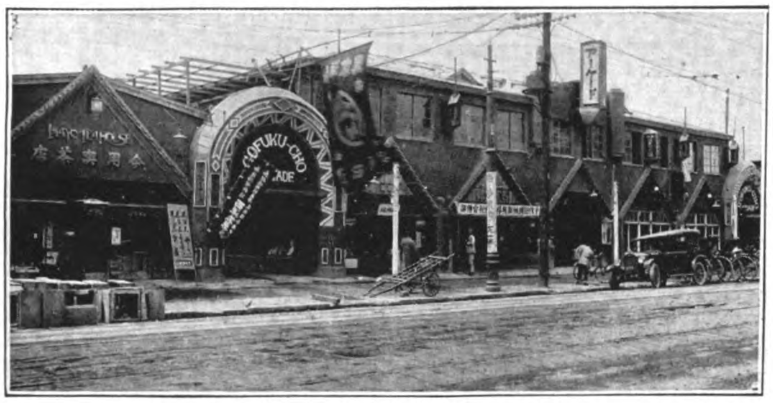
Special provision will be made as regards foundations, which will consist of a skeleton reinforced concrete raft of as heavy a



International Cement Gun, operated by an Ingersoll-Rand Air Compressor, Surfacing the Laffin Building at Yokohama



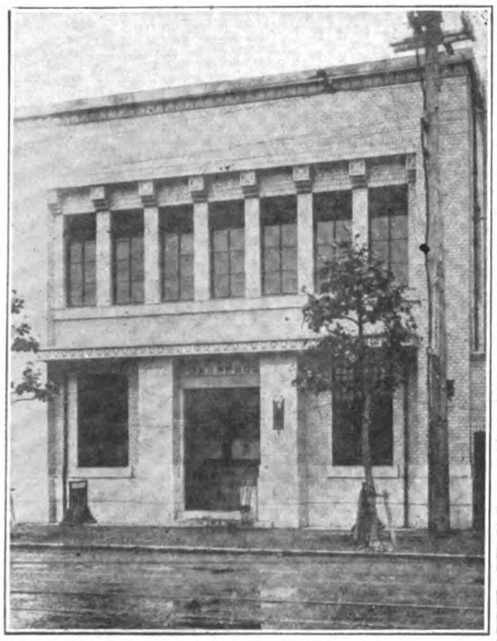
Japanese Room in the Private Residence of the Iwasakis at Tamagawa



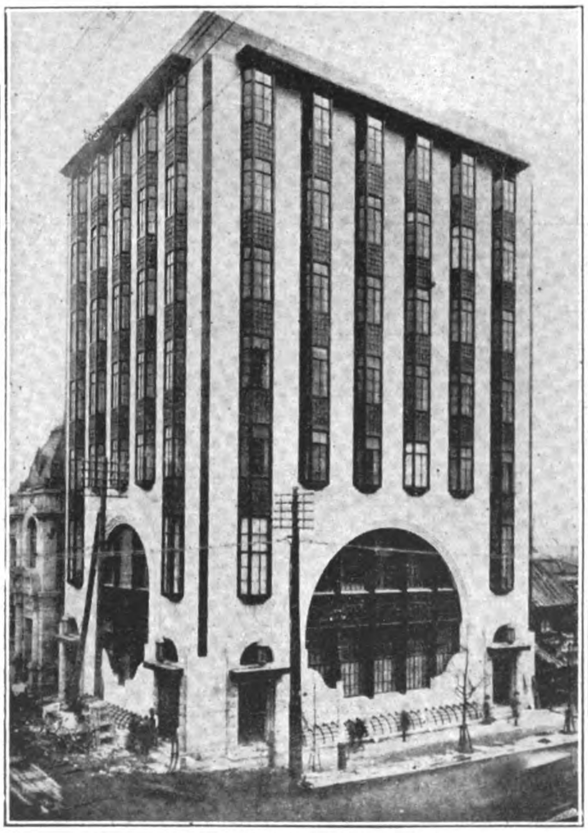
Gofuku-cho Arcade in Nihonbashi

Mansei Arcade, Manseibashi

Mitsui Bank, Nihonbashi Branch



Yamaguchi Bank .Branch Office



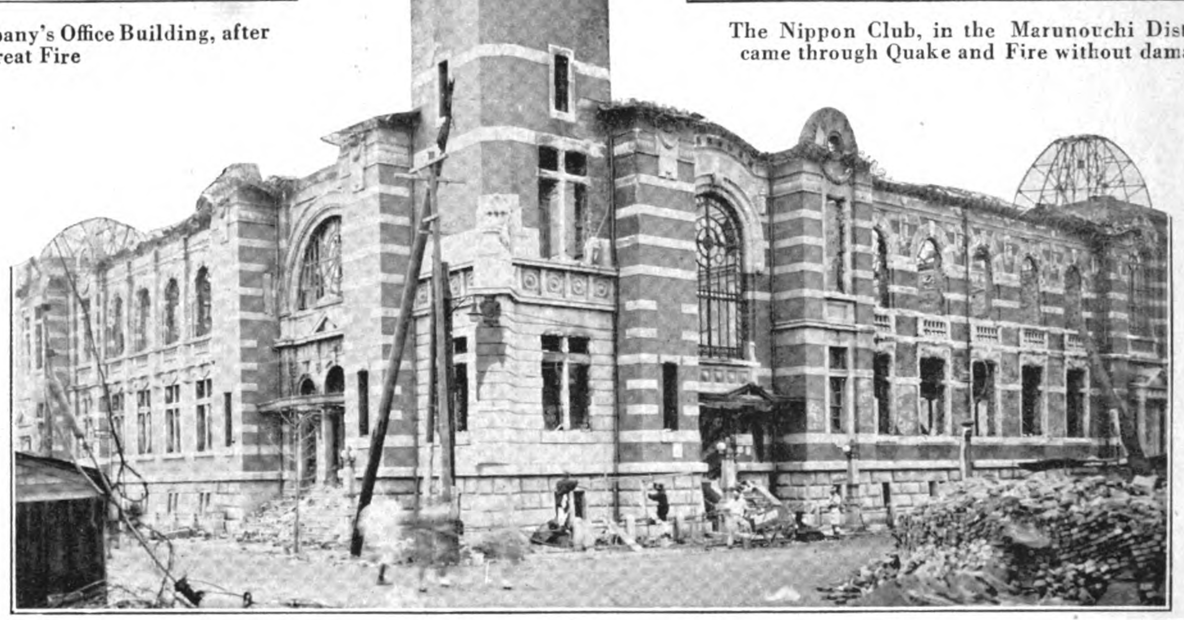
Yamaguchi Bank, Head Office, Tokyo

Yamaguchi Bank, Ginza Branch

TOKYO BUILDINGS ERECTED BY TAKENAKA-KOMUTEN

Sankyo Pharmacy Company's Office Building, after the Great Fire

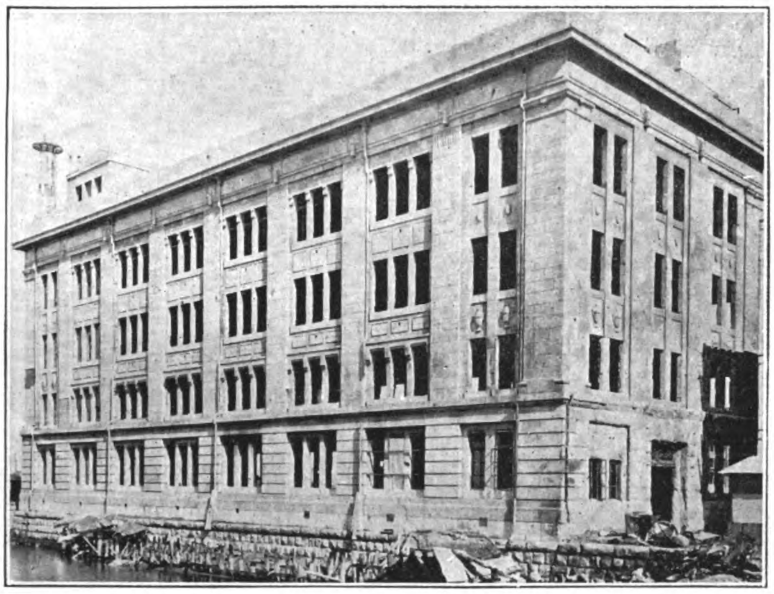
The Nippon Club, in the Marunouchi District, came through Quake and Fire without damage



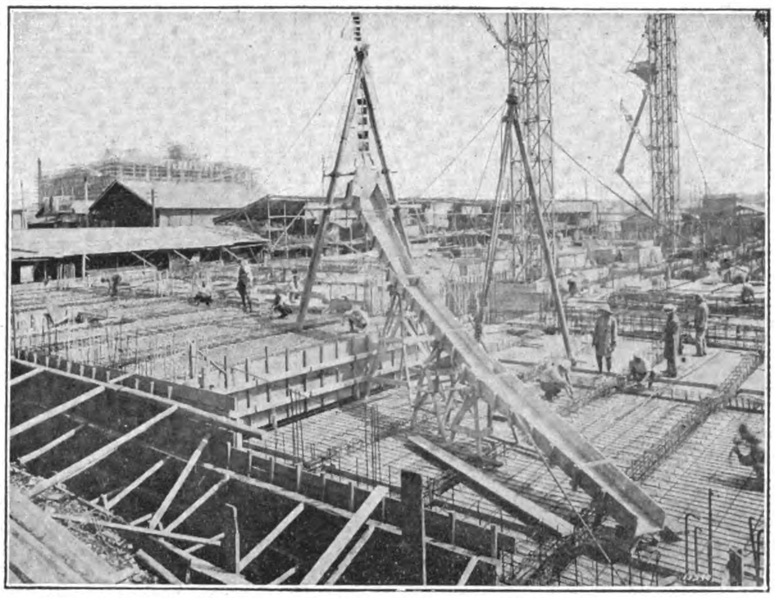
The Memorial Hall in Yokohama, erected by Japanese and Foreign Residents to Commemorate the Opening of the Port, a steel frame and brick building which withstood the violence of the earthquake, only to be gutted by the conflagration which followed

The Hoshi Memorial School, Reinforced Concrete Construction

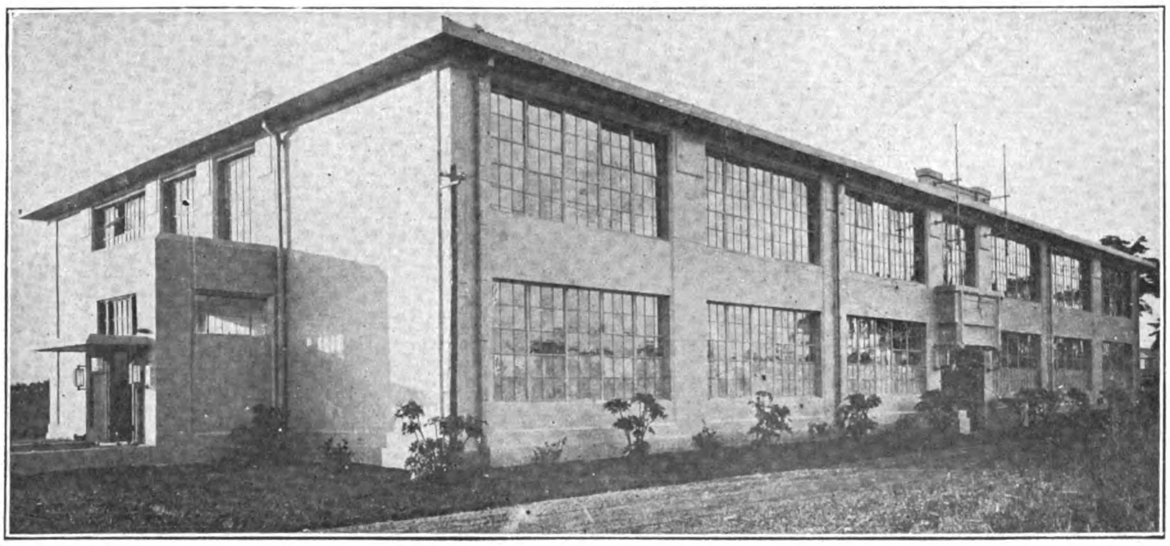
BUILDINGS IN THE TOKYO AND YOKOHAMA



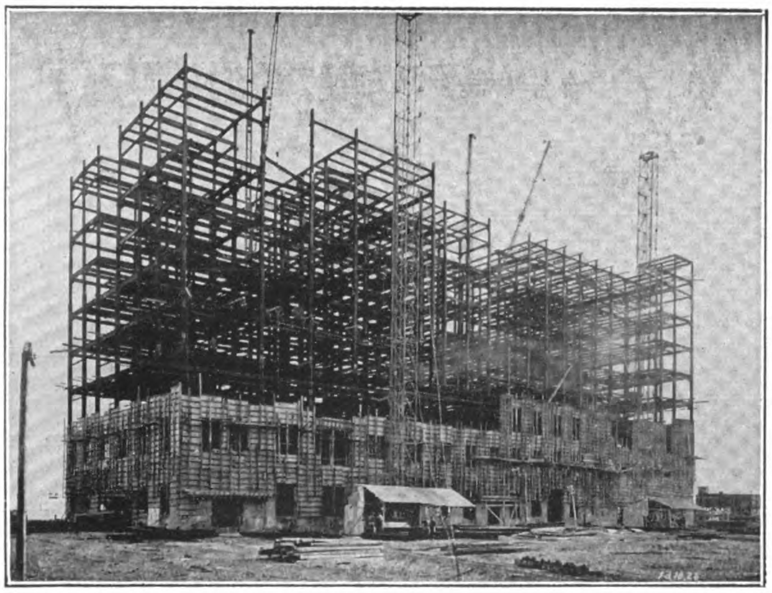
New Office Building of the Dai Ichi Ginko, newly erected in the heart of Tokyo, which was devastated by the fire. The building sustained only one small crack in the outside curtain wall as a result of the quake



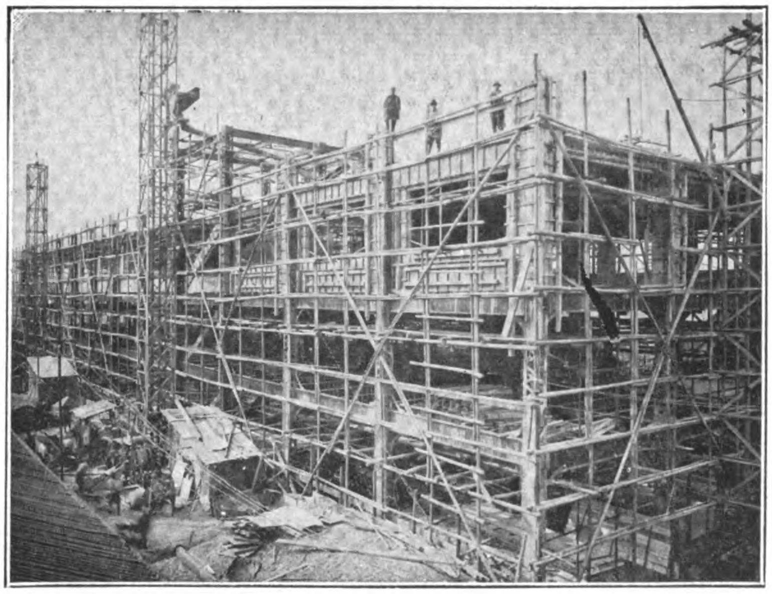
New Office Building for the Tokyo Electric Light Company, a steel frame, reinforced concrete building now in course of erection



Tokyo Women's Christian College Academy Building, Two-storied Reinforced Concrete Construction



The Steel Frame and Reinforced Concrete Mill Building of the Nisshin Flour Company, erected on the Reclaimed Land at Tsurumi



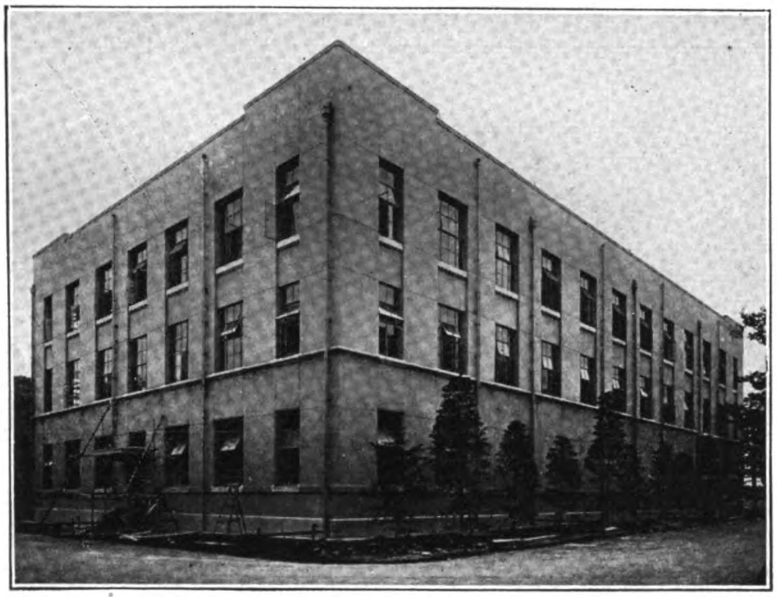
New Three-storied Steel Frame and Reinforced Concrete Factory Building for the Nippon Electric Company

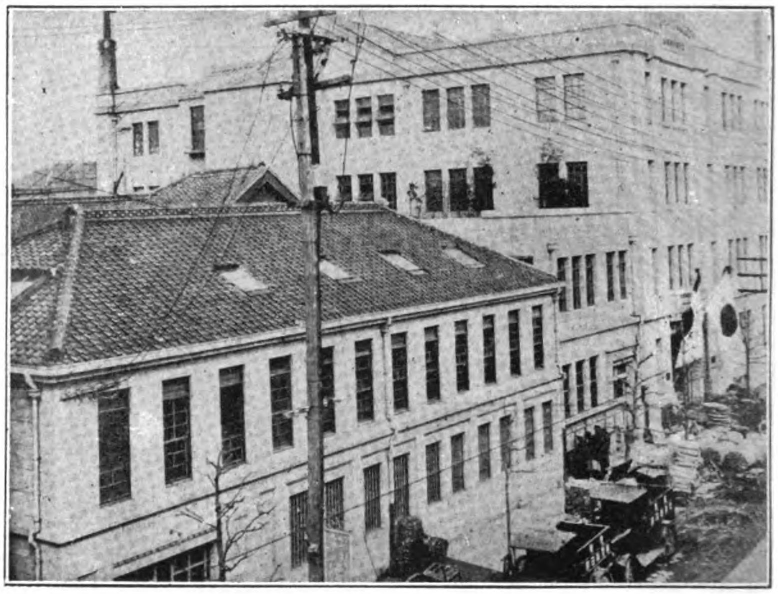
DISTRICTS ERECTED BY THE SHIMIZU GUMI

The Chugai Building, after the Fire

Okaya Company Building

Tokyo Branch of the Kajima Bank


Government Chemical Laboratory at Hongo


The "Asahi Shimbun" Building

Ensuiko Sugar Company's Building

Nozawaya Store at Yokohama

The "Hochi Shimbun" Building

TOKYO BUILDINGS ERECTED BY THE TAKENAKA KOMUTEN

Two Views of the Ginza

nature as is reasonable, with reinforced girders of ribbings under all main and cross walls in both directions. The foundations will be made as heavy as possible, and the skeleton raft will bear upon piles sunk into the strata beneath the building.

The buildings designed on these principles will introduce many new problems, and when the work is completed the result should present a dignified group of buildings worthy to be the residence of His Majesty's representative at the Court of the Emperor of Japan. They should be ample for the requirements of a staff which, owing to the increased importance of Far Eastern affairs, has increased largely since the Embassy was first built in 1873.

Construction work on a new Central Post-office, to be erected at a cost of about Y.6,000,000, will be undertaken before the end of the present year, according to plans of the Department of Communications. The building will be four stories high and built of ferro-concrete or reinforced steel, located in Marunouchi, the business center of the city, on the site now occupied by the temporary post-office in use since the earthquake.

Hoshi Commercial School

One of the handsome additions to the architecture of Tokyo is the Hoshi Commercial School, located in the suburb of Osaki. This building was erected by Mr. H. Hoshi, president of the Hoshi Pharmaceutical Company, operating a chemical and drug factory and a chain of drug stores throughout the empire. The main store on the Ginza before it was gutted by the great fire was a replica of the big department drug stores in the United States, fitted with ice-cream and soda-water fountains and light lunch rooms. It was one of the most popular resorts in the shopping center of the city. Nearly three years ago Mr. Hoshi called an architect, and said he wanted a school building erected capable of accommodating 3,000 students which would not only be the most up-to-date and finest in the Orient, but have an auditorium large enough to seat all the students at once.

Kokko Life Insurance Building on the Ginza, the lower part rented to the Matzuzaka Department Store. Erected by the Obayashi Gumi Co., Ltd.

The architect drew rough sketches that same night and showed them the next morning to Mr. Hoshi, who accepted them and ordered the building erected without delay. The contract for its erection was awarded to the Shimizu Gumi.

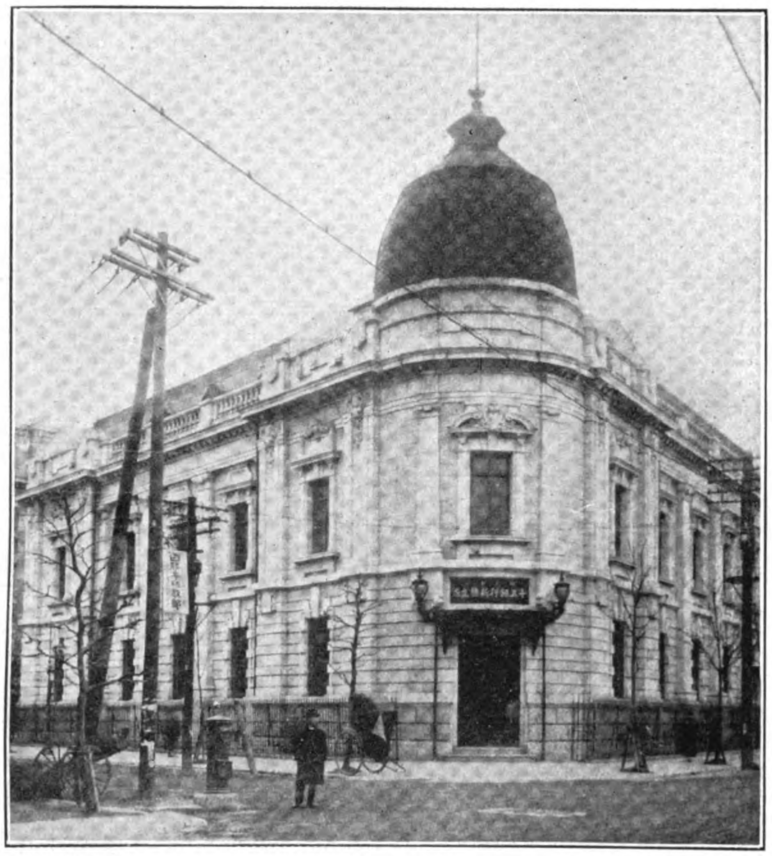
Not a single change has been made from the original rough sketches, although the finished building represents an investment of Y.2,000,000.

Impressively massive in design, the building stands like a solid rock on level ground near the Hoshi factories. Of concrete and steel construction throughout, it is not only absolutely fire-proof, but also earthquake-proof, as was shown in September of 1923, when the big earthquake did not make as much as a single crack in the walls.

The feature of the structure is the auditorium seating 3,000 persons. There is but one balcony of great depth, and the stage has an opening of 40 feet. The stage is to be equipped with machinery and fixtures to make it the equal of that of any Western theater, and will be large enough to accommodate any play or opera that may be desired to be given.

The Shimbashi Music Hall

Another handsome theater building, called the Shimbashi Embujo, has been erected since the earthquake only a few blocks distant from and in the same district as the Kabukiza. This was recently opened for performances and dances given by the geisha of the Shimbashi district in order to bring to Tokyo the celebrated cherry-blossom and other seasonal dances which have made their sisters famous in Kyoto and Osaka. Although the exterior of this theater is plain and uninteresting from an architectural standpoint, the interior is a splendid example of the adaptability of Japanese art to western structural methods. The building, of steel and concrete with brick and terra-cotta facings, is 120-ft. wide, 189-ft. long and 75-ft. high. Unfortunately no particulars concerning the building were obtainable, but its stage, almost as large as that of the Kabukiza is a revolving one fitted with all



Shimbashi Branch of the Jugo Ginko, Tokyo, a Takenaka Edifice

up-to-date theatrical mechanical innovations. The halls and lounge rooms are large and commodious, elegantly furnished and elaborately decorated.

New Yokohama Hotel

Mr. Ariyoshi, Mayor of Yokohama, is the leading spirit in a movement for the erection of a new hotel that will accommodate the many visitors to that port and serve as a social center for its permanent residents. Under his direction plans have been drawn for the erection of a million yen hotel to be erected on the Bund, and the city authorities have agreeed to furnish the funds required for construction. It is proposed to turn the completed building over to a private company, specially organized for its management, who will furnish and operate it. The city of Yokohama has Y.840,000 available in the treasury for this purpose and will lend the balance of Y.160,000 to the operating company at 6½ per cent. interest, and when the enterprise is paying eight per cent. dividends to the shareholders the company will then pay interest to the city on the whole million yen. Although plans for the building have not yet been drawn, it is proposed that it shall be of earthquake and fire-proof construction, four stories high, with one hundred guest rooms in addition to those required for social activities.

Japanese Construction Firms

The wide publicity given to the work of the Geo. A. Fuller Company and other American building constructors has created the impression that foreign technical supervision is absolutely essential in carrying out any large structural steel or engineering contract in Japan. That this idea has been permitted to take root is due entirely to the natural modesty and reticence of the Japanese, combined with a complete indifference to modern publicity and advertising methods. It is the same in building construction as in electrical and other industrial installations, where the big things done by foreign engineers receive a full measure of publicity devised by advertising experts, while the equally important engineering undertakings carried out by the Japanese are not heard of outside a very small circle of interested people in their own country. There exist in Japan several engineering and construction companies whose work stands on a par with the best American or European practice, and although in this, as in many other lines of modern engineering, the Japanese have received their instruction from the West, their progress has been so rapid that in many instances they have outdistanced their teachers, tackling undertakings on their own initiative that compel the unstinted praise and admiration of all fair-minded foreign engineers.

The names of the Okura Engineering and Contracting Company, Ltd., the Shimizu Gumi, the Obayashi Gumi and the Takenaka Kumuten are unknown outside of Japan; yet these four engineering and building contractors have done and are doing work that in any other country would fill the pages of the technical press as examples of the highest engineering skill. Everywhere throughout Japan, Korea, Formosa and Manchuria one sees engineering undertakings being carried forward under Japanese direction, which is rapidly developing the resources and industries of the empire, and at least fifty per cent. of these contracts are being executed by one or other of the above enterprising concerns.

The Okura Building Co., Ltd.

In the Okura Building Company we find a subsidiary of the Okura Gumi, one of the Big Four of Japan, ranking in the business world after the Mitsui, Mitsubishi and Yasuda interests.

At its head stands an American-trained and educated engineer, Mr. C. Kadono, who by sheer ability and worth has forged to the top and is now the vice-president and practical executive of the great Okura interests. The engineering and contracting department of the Okura Gumi is comparatively new in the field, but it has many large and important engineering works to its credit, not only in Japan, Korea and Manchuria, but in China. It is taking a most active part in the reconstruction of Tokyo, being awarded the contract for the erection of several of the bridges throughout the city as well as the greater work of taking the lead in subway construction. Many of the handsome new structures which will grace the new metropolis have been erected by this concern, the new Hall of Virtues in the Meiji Memorial Park being an architectural gem that would do credit to any capital in the world. Amongst the other structures erected by this enterprising firm in Tokyo since the earthquake is the large steel frame office building for the Oriental Development Company, now in course of construction near the Imperial Hotel, a new building for the Imperial University, the building for the Japan Beer Brewing Company, and the immense barracks or temporary wooden structures which house the activities of the Departments of Finance, Home Affairs and Communications. In Yokohama the Okura Building Company has erected a generating station for the Tokyo Electric Light Company and the factory buildings for the Kirin Beer Company, the Nisshin Flour Milling Company and the Nisshin Seiyu Company.

The Shimizu Gumi

Another eminently successful engineering and building construction concern is the Shimizu Gumi, a purely Japanese organization that came into existence about 130 years ago and has maintained its position as the leading building contractors of Japan by keeping step with modern developments and adapting them to the needs of the empire.

It would be difficult to find a city in Japan which this concern has not helped to beautify, as during its long existence it has built many important Government offices, banks, factories and private residences. Although the average foreigner looks upon the Shimizu Gumi as merely another Japanese concern that has taken up modern steel and concrete construction, its name is equally well known throughout the empire in connection with the highest examples of pure Japanese art in building design, as typified in the great banquet room of the Nijo Detached Palace at Kyoto and the Imperial mortuary shrines at Aoyama and Yoyogi.

At the time of the Meiji Restoration this company constructed the Mitsui Exchange Bank, the first modern bank building in Japan, and then the Dai-Ichi, or First Bank. The firm was reorganized in October 1915 as a limited partnership (Goshi Kaisha) with a capital of Y.3,000,000, and under the management of Mr. Kugokichi Shimizu, and afterward under that of Mr. Teikichi Shimizu, has undertaken some of the most important building contracts in Tokyo and other important cities of the empire.

The Bank of Chosen, the Katakura Raw Silk Company's building, the Okawa-Tanaka office building, the magnificent Palace Hotel (Tokyo Kaikan), together with many others which are rapidly changing the sky-line of Tokyo, have been erected by this efficient organization.

Its activities cover every branch of the building trade. Under the Tokyo Head Office the firm operates its own iron works at Shibaura, where structural steel frames for all its buildings are made; it has its own woodworking and interior trim plant at Fukagawa, a gravel pit in Kanagawa, and a quarry in Korea.

The Shimizu Gumi has branch offices at Osaka, Nagoya, Kyoto, Hakata, Keijo (Seoul) and Dairen, each equipped with its own plant and workshops. It also is represented in Yokohama, Hokkaido, Kanagawa, Hiroshima, Beppu and Harbin. Many of the handsome new buildings in Korea and Manchuria have been erected under its supervision.

At least 500 buildings are always under construction by the Shimizu firm, with 1,000 regular employees and an army of workmen on the pay-roll. The regular staff includes some of the best engineering and architectural talent in Japan. A special feature of its business is the high standard of its work, and to preserve this enviable reputation it bears absolute responsibility by never letting any of its work to sub-contractors.

The Obayashi Gumi Company, Ltd.

Another very old and successful contracting firm is the Obayashi Gumi Company, Ltd., which was organized into a limited company in 1892 with a capital of Y.2,000,000 under the presidency of Mr. Y. Obayashi. The activities of this company cover every branch of engineering and building construction. Not only do they undertake general building construction, but contract for railway and hydro-electric work, harbor and river improvements, dockyards, bridges and tunnels, and are amongst the largest labor contractors in the empire. Like the Shimizu Gumi, the Obayashi organization is self-contained, taking full responsibility for all work entrusted to them without sub-letting to other contractors. Their organization is so well equipped that their work has always been completed within contract time, being enabled to maintain this reputation by operating its own interior trim and working factories and structural steel plants. One of these is located at Chishima-machi, under the head office at Osaka, and the other at Fukagawa in Tokyo.

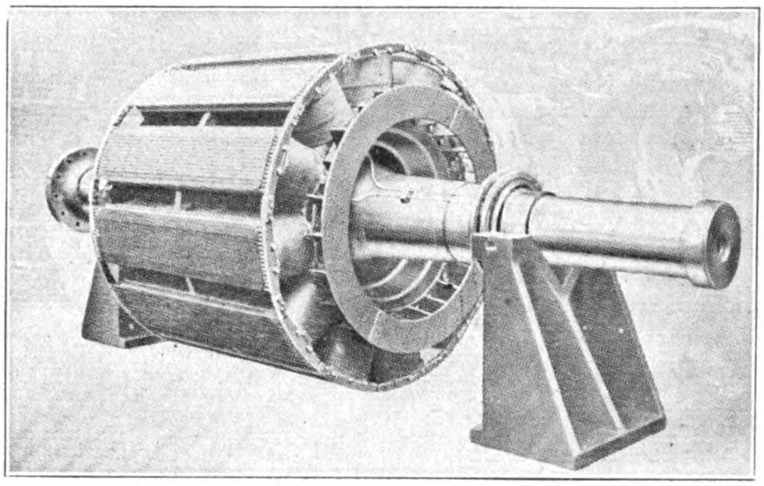
Since its organization into a limited company in 1892 the Obayashi Gumi has completed work aggregating over seven hundred million yen, in which are included more than thirty per cent. of all Government buildings. The high honor was conferred on this firm to construct the Meiji Imperial Funeral Mausoleum and that of the late Shoken Empress Dowager, as well as the main contract for the permanent Eastern Imperial Mausoleum at Momoyama. Many of the most important buildings and engineering works in Western Japan were constructed under the direction of the Osaka office of the company, while in Tokyo stands the Central Railway Station, the Industrial Bank of Japan and the Kabuki Theater as monuments to their engineering ability. These three buildings stood the upheaval without a crack or damage of any kind when many other modern structures either failed completely or developed structural weaknesses of varying degrees. A brilliant and enviable record.

Takenaka Komuten

One of the most active and successful Japanese construction firms is the enterprise conducted under the name of the Takenaka Komuten. Like many other prominent Japanese companies, the present organization is the outgrowth of a business originated centuries ago when Japanese architecture reached its highest point. The founder of the House of Takenaka was chief constructor for the great Daimyo, Nobunaga Oda, and when his chief was defeated, removed to Nagoya and originated what is known as the Osumi style of architecture. Many of the most beautiful temples and shrines of the period are the work of the forefather of the present head of the firm.

His descendant, Mr. Toemon Takenaka, was quick to see the great opportunities created by the development of his country along Western lines, and in 1899, at the commencement of the modern era, he established the Takenaka Architectural Office. Scrapping the old Japanese conventionalities in design, structure and working methods, he boldly undertook the most modern types of construction. It is difficult to say much about this very modest and enterprising concern. Mr. Takenaka believes that his work speaks for itself, and in a handsome booklet of 120 pages presents the illustrations of the many modern buildings erected by the firm in various parts of Japan. The list of these buildings would fill a page of the magazine. They cover a wide range, embracing banks, Government buildings office buildings, cotton mills, stock exchanges, department stores, schools, college buildings, Y.M.C.A. edifices, observatories, hospitals, temples shrines, palaces, private residences, warehouses, newspaper offices, hotels, etc.

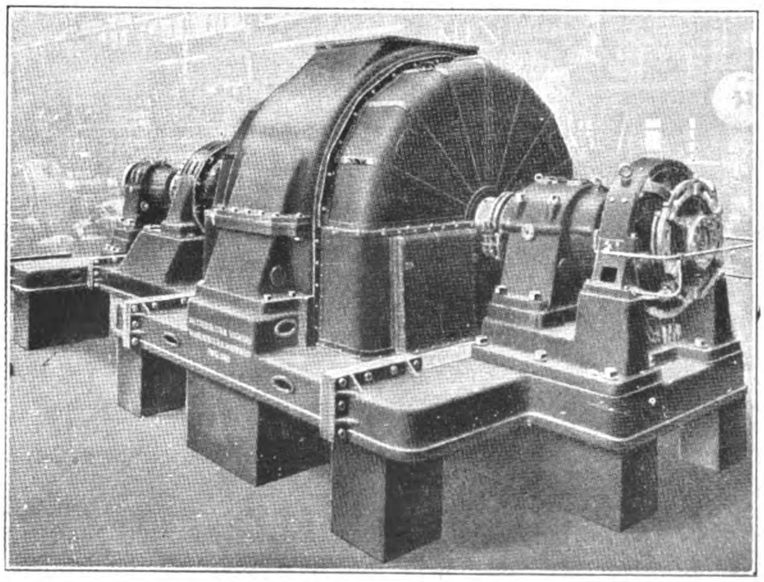
With this article we present two pages of illustrations of new buildings erected in Tokyo by the Takenaka Komuten, which show that it is keeping abreast of the times with the most modern and approved construction methods. The head office of the firm is in Osaka, where they have erected most of the important modern buildings which grace this city.



Finished Rotor of "Metro-Vick" Frequency Changer.

Large Frequency Changer for Japan

THE very large hydro-electric development which is taking place in Central Japan, chiefly as the result of the activities of the Daido Electric Power Co., Ltd., has resulted in the linking together of many hitherto isolated systems. The Momoyama Power Station is one of a series of Hydro-Electric Stations which are built or building along the course of the Kiso river. It is almost mid-way between two large centers of distribution, *i.e.*, Tokyo, where the periodicity is 50, and Osaka, where the American standard of 60 periods has been adopted. It is here that the Frequency Changer, built by the Metropolitan-Vickers Electrical



View of the Exciter End of One of the "Metro-Vick" Frequency Changers for the Momoyama Power Plant.

Co., Ltd., is to be installed. This machine weighs 208 tons, and its overall length is 50-ft. 6-in. The set consists of two machines coupled together with a starting motor between them and an exciter for each machine on the outer end of each shaft. The individual machines are designed so that they will operate when uncoupled as synchronous condensers, so that at any time in the future if it is not desired to transfer load from the 50-period to the 60-period side of the system, or *vice versa*, and will be connected up for 11,000 volts star connection.

The output as a frequency changer is at 6,600-6,600 delta connected, 50-60 periods, 600 r.p.m., and is equal to 16,000 kva. at 0.94 power factor, that is 15,000 kw., with 25 per cent. overload for two hours without injury. As a separate machine running as a synchronous condenser, the ten-pole machine gives 15,000 kva. leading and lagging at 50 periods, 600 r.p.m. and 15,000 kva. leading and 12,500 kva. lagging at 60 periods, 720 r.p.m. Under the same conditions the 12-pole machine gives 15,000 kva. leading and lagging at 60 periods, 600 r.p.m.

When used as a frequency changer the starting motor is used for running the set up to synchronous speed and the resistance steps operated by contactor gear, but when the unit is split into two machines for use as synchronous condensers, each machine will be tap-started by means of an auto-transformer. Damper windings are provided on the machines for this purpose.

In order to facilitate starting both as a frequency changer and when the set is split, a special high-pressure oiling system is provided, and it was found that by this means the starting torque could be reduced to approximately 1½ per cent. of full load for each machine, the starting kva. being about 12 per cent. respectively.

It will therefore be possible to guarantee in future a starting kva. of approximately 15 per cent. of full kva. if this point is of sufficient importance.

In addition to the high-pressure lubricating system for starting, an ordinary lubrication system for running is provided.

The machines passed all tests successfully, and equivalent heat runs were made to ensure that temperature guarantees, etc., were met.

The Brains Behind the "Daido"

Momosuke Fukuzawa

THE recent successful issue on the New York market of a further $13,500,000 gold loan through Dillon, Read & Company for the Great Consolidated Electric Power Company, Ltd. ("Daido"), of Japan, has attracted considerable attention to the personality of the man whose enterprise has created one of the largest super-power companies in the world. The issue was a 6½ per cent. offered at 86 and interest to yield over 7¾ per cent.

Mr. Momosuke Fukuzawa, the Electrical Wizard of Japan

Sinking fund provision calls for retirement of $300,000 per annum for the first ten years and $700,000 per annum thereafter at a price not exceeding 100 and interest either by purchase or by call by lot.

The bonds are a direct obligation of the company and are secured by a closed first mortgage lien under the laws of Japan on properties representing a cost, less depreciation as of February 28, of $33,234,000.

The bonds are further secured by closed mortgage lien on additional properties representing a cost of $37,063,000, subject only to the lien of the mortgage securing the $14,500,000 series "A" bonds.

Net income before interest and depreciation for the twelve months ended May 31 amounted to $5,241,398, or about two and three-quarter times annual interest requirements on total mortgage bonds and about twice the annual interest charges on both mortgage and debenture bonds to be outstanding on completion of the new financing.

This loan brings the dream of Momosuke Fukuzawa, of a great super-power system covering the entire main island of Japan, one step nearer fulfilment. This great Japanese industrialist, who has made his own way in the world, has now borrowed something like $30,000,000 from American investors in one year.

Momosuke Fukuzawa is the son of Yukichi Fukuzawa, educator and philosopher, who seventy-five years ago was one of the first Japanese to visit the United States to learn the language and study American customs. He thought that in individuality he had discovered the secret of American success in business. "Strike out for yourselves," he advised his children. "Do not wait for somebody to push you along and do not depend on other people. In individuality lies success."

Momosuke Fukuzawa heeded his father's advice. Upon graduation from Keio University, founded by Yukichi Fukuzawa, he sailed for the United States and entered a private school near Boston. He was graduated from that school a young man in his twenties, and found employment in the freight offices of the Pennsylvania Railroad, always fending for himself. His father held rigidly to his policy of making the boys stand on their own feet.

When the young Japanese student believed he had a grasp of American railroading he returned to Japan to work out some of his ideas for giving the island proper transportation. When the Japanese Government took over the Japanese railroads Momosuke Fukuzawa entered the electrical field. He believed in the American system of unification.

A great opportunity, he thought, existed to form a large generating and transmission company to supply power to the various companies owning distributing systems in the principal power-consuming districts of Japan. The "Daido," or Great Consolidated Electric Power Company, Ltd., was organized as the first step in an ambitious plan to merge many other properties. Then Momosuke Fukuzawa started to build power plants, and he still is building. He retained American consulting engineers, and he saw to it that his plants were equipped with the most modern machinery from the United States.

At present the Company owns nine hydro-electric power plants, having a total capacity of 169,540 kilowatts, and four steam generating plants of a combined capacity of 100,500. It is primarily a wholesaler of power, and as such is the second largest manufacturer in Japan. The total power output is exceeded only by the Tokyo-Electric Light Company and its subsidiaries.

In less than three years the Daido has trebled its generating capacity, and present plans call for a similar increase in the next three years. Momosuke Fukuzawa is in his late fifties, but he still is planning far into the future. He is working on plans in connection with the electrification of Japanese railroads.

Momosuke Fukuzawa's interests are widespread, and he is a powerful figure in all of the important industries in Japan. He is a director of thirty-eight corporations. He is an engineer of recognized distinction and an author of many books on science and finance. He wrote a financial history of the United States. At one time he was a member of the Japanese parliament.

Continuing the educational work of his father, he has written a book of advice for boys under the title, "Let Me Tell You Frankly." He is well known in railroad and electrical circles in America. At Union College, Schenectady, on June 9, 1924, Momosuke Fukuzawa received the honorary degree of doctor of science. He is progressive in his ideas on sport and is one of the leaders of the movement in Japan to encourage women to play tennis.

MITSUI
Where Business is Humanity

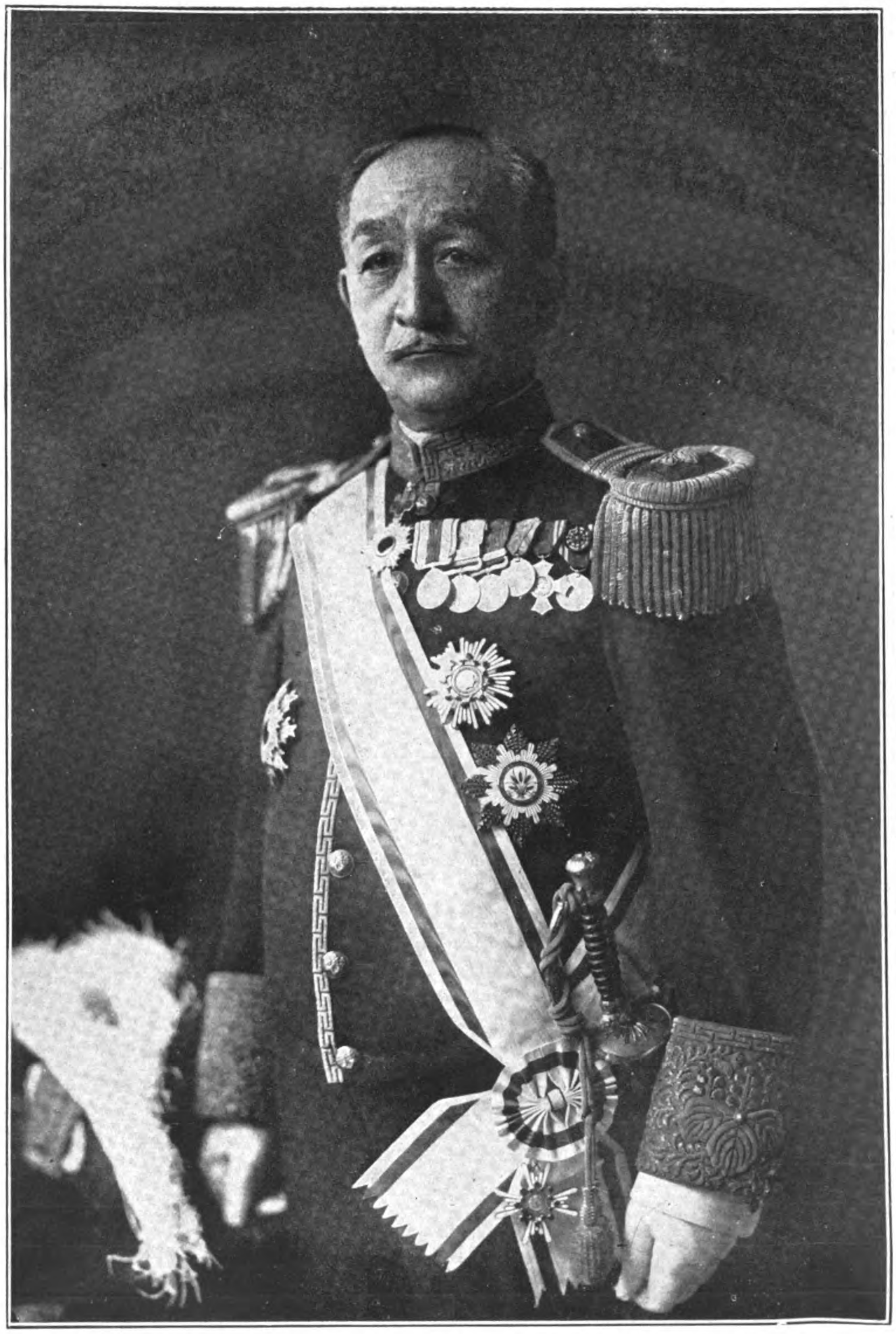
A Family Corporation Which Personifies the Traditions and Spirit of Japan, Enduring through the Centuries While Other World-wide Trading Companies have been born, lived their lives, and faded into oblivion.

By George Bronson Rea

TO single out any particular group, firm or individual as deserving of special praise or merit for their financial contributions to the fund for relieving the earthquake sufferers would be eminently unfair. When the call for help came, the response was immediate from rich and poor alike, all giving generously according to their means. It is unsatisfactory to draw conclusions from dry statistics, yet the *Japan Year Book* states that the Emperor donated Y.10,000,000 to the Emergency Relief Fund, while another Y.30,760,000 was disbursed from the national treasury. Excluding the Imperial donation, the total relief funds from all sources was Y.59,013,395, of which Y.21,614,301 came from abroad.

It is not surprising that the great Mitsui family out of their abundant wealth should contribute Y.5,000,000 to the fund, or that the amount, together with the donations of other wealthy individuals and corporations, should be given due publicity. Such contributions were measured largely by the munificence of the Imperial family, which no private individual, no matter how great his wealth, would attempt to exceed. That contribution was spontaneous, the logical and proper thing to do. From the Emperor down they gave according to their wealth, and then proceeded in their own quiet ways to supplement this by further contributions for special charities and relief work carried out under their own supervision.

How much more was spent by the Mitsuis in the cause of humanity for erecting barracks, distributing food, clothing and bedding, in maintaining hospitals, facilitating transport of food supplies on their steamers and lighters, extending free storage in their warhouses and using their organization for the common welfare, is a totally different matter, one that will never be made public. This secret is preserved in the private archives of the Mitsui family, a memorial to the past and a reminder to future Mitsuis that the present generation has faithfully lived up to the cardinal precept of the family, "BUSINESS IS HUMANITY."



Baron Hachiroemon Mitsui, Head of the Eleven Mitsui Families whose Centuries-old Code of Business Honor has carried them to the highest pinnacle of commercial prosperity

The Mitsuis, more than any other present-day organization in Japan, are typical of the nation. For the Mitsuis *are* Japan, the personification of its traditions, its virtues, its institutions, its chivalry and its commerce. It is the greatest family corporation the world has ever known. There are families in Japan, descendants of shoguns, daimyos and samurai, who have blazed their name across the pages of history as statesmen and fighting men, but there are few who combine all that is best in the national character with all that is best in trade and finance, an occupation for many centuries looked down upon as unworthy of the fighting man. The Rothschilds are perhaps the most striking example of family unity in high finance that the western world is familiar with, but the family is international, broken up for business purposes, typical of its race and its traditions. The Astors, the Vanderbilts, and the Goulds conform to the normal type of American millionaire families, where the original fortune has been divided and scattered through international marriages. We have to come to Japan to find a family corporation that stretches back in an un-

broken line to the medieval ages with a definite program and fixed policy directing its activities for the past three hundred years.

The Mitsui pedigree goes back to the sixth century with a well-established line from that period to the 12th century, when Takahisa, the daimyo of the Sasaki clan and overlord of Omi, was adopted into the family, bringing with him the coat of arms represented by four black squares with white centers, since then the recognized escutcheon of the Mitsui family. From this point the history of the Mitsuis is carried forward to the present time through existant archives without a break. The successor of Takahisa was Takayasu-Mitsui, the lord of Echigo, whose son, Sokubei Mitsui, initiated the business which has since grown to such vast proportions. His son, Takatoshi Mitsui, started business in Kyoto and then established a drapery shop in Yedo, one of the pioneer merchants to open business in the new capital of the shogun.

In Yedo was laid the foundation of the great Mitsui fortune by one of the younger brothers of Takatoshi, named Hachirobei Mitsui.

This young man introduced the system of double entry book-keeping and cash retailing, since accepted in all parts of the world as the safest method in merchandizing, antedating the bargain sales of the modern American department stores by three centuries. The business methods which have elevated the Woolworths, the Wannamakers, the Marshall Fields and the Selfridges to the proud position of merchant princes was introduced in Japan by a sixteenth century Mitsui. Hachirobei Mitsui also worked out and applied the principles upon which modern world banking is conducted, organizing the collection and remittance of money throughout the country by bills of exchange at a time when these paper transactions were unheard of in Japan. This was the beginning of the Mitsui banking business, resulting in Hachirobei's appointment to the position of purchasing agent to the shogun in 1687, later on in 1691 to be entrusted with all the remittances of the Government, equivalent to the duties of a modern state treasurer and paymaster-general. From this time forward the business of the Mitsuis has been closely identified with the fortunes of the Government of Japan.

The drapery store in Yedo prospered beyond measure, overflowing the capacity of the original shop and necessitating a larger and more central location. The historic site at Suruga-cho was then acquired, and from that date has remained the business headquarters of the family. An illustration of the original Mitsui department store in old Yedo, painted by Hiroshige, the greatest Japanese artist of his time, is reproduced with this article, together with the headquarters building destroyed during the fire and the magnificent new structure that will replace it. The buildings alone typify the growth of the Mitsui influence in Japan. The banking business initiated by Hachirobei Mitsui way back in the sixteenth century has developed into the present Mitsui Bank, one of the strongest financial institutions in Japan and rapidly extending its sphere of influence in foreign countries. After the death of Hachirobei, other Mitsuis were called upon by succeeding shoguns to supervise their finances, and when the great issue came before the nation for the restoration of the Mikado it was the Mitsuis who principally financed the imperial armies in putting down rebellion and restoring power to the actual sovereign.

Dr. Takuma Dan, Director-General of the Combined World-wide Mitsui Interests. An engineer-executive and creator of wealth who has risen from the ranks to the head of the greatest organization in Japan. One of the world's foremost captains of industry

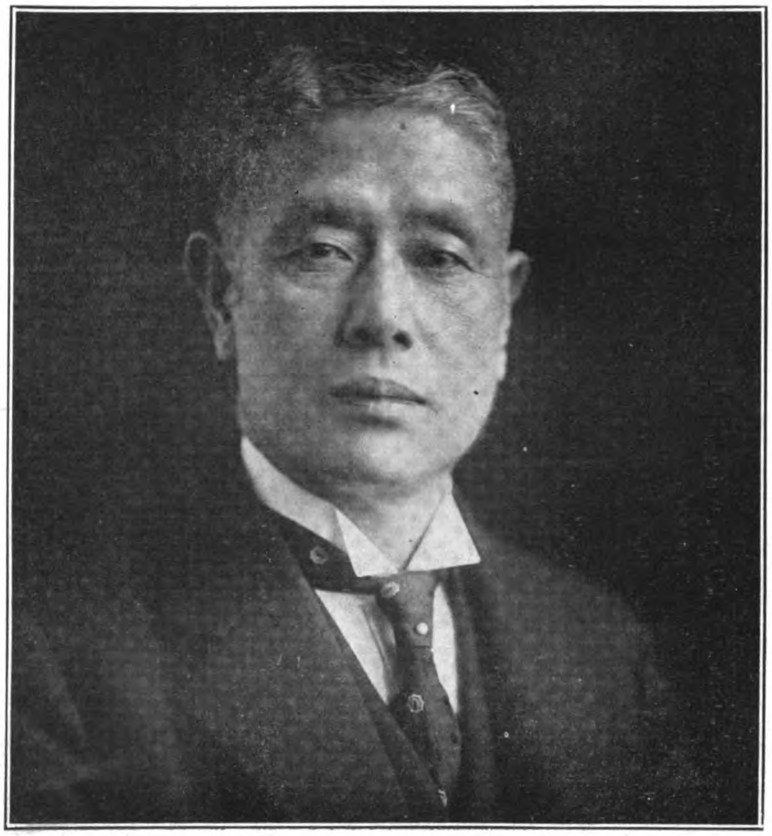
After the Meiji Restoration, the Mitsuis acted as treasurers for the Imperial Government and materially assisted in the financial and political solidification of the new régime, a fact that will help in part to explain the present prominent position of the family in the councils of the nation. The history of the Mitsuis since the Restoration is the economic history of Japan. As far back as 1707 they became interested in foreign commerce by appointing a resident representative at Nagasaki to conduct business with the Dutch traders. When the country was opened up to foreign trade as a result of the visit of Commodore Perry in 1853, the Mitsuis were one of the first to establish foreign branches, though it was not until 1876 that the Mitsui Bussan Kaisha (known in Europe and America as Mitsui & Company) was organized for general trading purposes, with special reference to foreign trade. This company now has 21 branches in the principal cities of the empire as well as 36 offices in foreign countries, the largest and most important trading concern in the world.

In the same year the old Mitsui Ryogae Ten (exchange shop) was transformed into the Mitsui Bank, the first and by far the largest private banking establishment in Japan. As a result of

the acquisition of the famous coal mines from the Government in 1889, the Mitsui Mining Company was etablished to take over the mining activities, conducted up to that time by the Mitsui Bussan Kaisha and the Mitsui Bank. The Mitsui organization grew and prospered, keeping pace with the development of the empire, and carrying the flag of the Rising Sun to all countries of the world. The abnormal growth of the Mitsui business during these years made it necessary to make radical changes in the system and constitution of their undertakings, and after long and thorough investigation of European and American methods a complete reorganization was effected in October 1909.

For centuries the Mitsui business had been conducted as a purely family concern composed of the eleven constituent families belonging to the house and known by the name of its ranking male representative. At the head of the entire House stands Baron Hachiroemon Mitsui, followed by the families headed by Motonosuke Mitsui, Genyomon Mitsui, Takayasu Mitsui, Hachirojio Mitsui, Saburosuke Mitsui, Fukotoro Mitsui, Morinosuke Mitsui, Takenosuke Mitsui, Yonosuke Mitsui and Tokoyomon Mitsui. Through all the centuries these eleven families have worked in complete harmony, co-ordinating their fortunes and activities for the common welfare.

Each of these family chiefs has been trained for his career, with very definite duties to perform. There is always room at the top of a Mitsui concern for able excutives, and in the roster of those who have managed their various enterprises and retired, or who have left the firm to start business for themselves, are the names of many of the most successful business men in Japan. At the same time, the chiefs of the eleven Mitsui families are not living in ease and luxury while others are directing their business. Baron Hachiroemon Mitsui, the head of the house, is President of the Mitsui Gomei Kaisha, the holding company for all the Mitsui enterprises and the several subsidiaries intimately related to them. Baron Takayasu Mitsui is the



Kikusaburo Fukui, Managing Director of the Mitsui Gomei Kaisha

Tokutaro Sakai, Director of the Mitsui Gomei Kaisha

Nagabumi Ariga, Managing Director of the Mitsui Gomei Kaisha

president of the Mitsui Bank, Genyomon Mitsui presides over the Mitsui Bussan Kaisha, Motonosuke Mitsui is president of the Mitsui Mining Company, Yonosuke Mitsui presides over the Toshin Soko, Tokoyomon Mitsui heads the Oji Paper Company, and Morinosuke Mitsui the Shibaura Engineering Works.

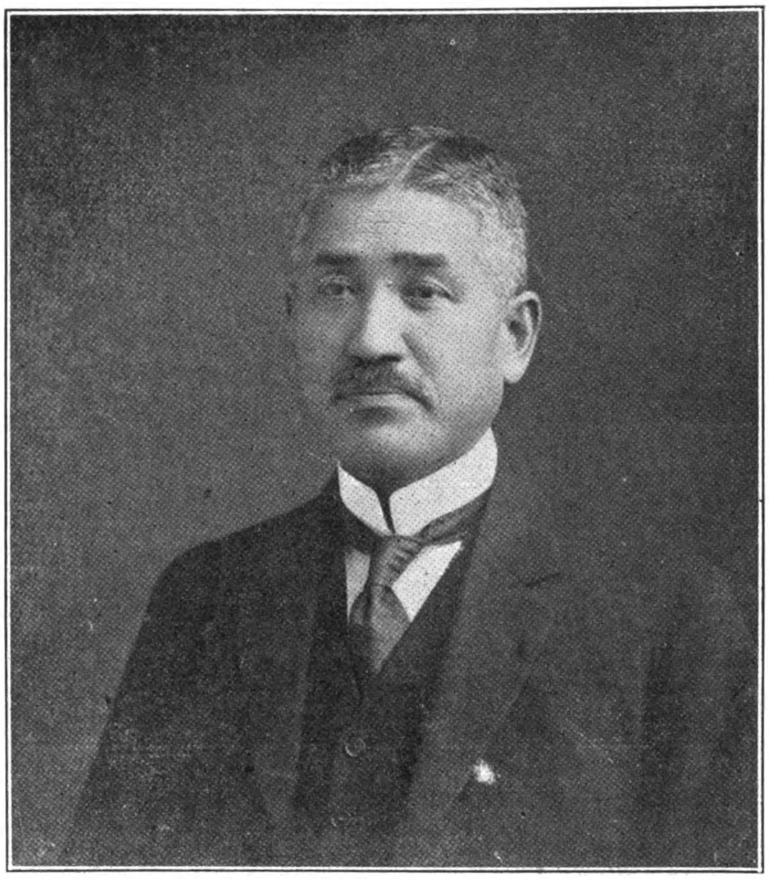
Many of the foremost big business men of Japan have been connected with the Mitsui and their enterprises in some form or other. The present group of directors are all tried and trusted executives who by loyalty, integrity, efficiency and all-round worth during a lifetime of allegiance to the Mitsui interests have reached the top of the ladder. At the head of this group stands Dr. Takuma Dan, who by sheer ability, creative force and executive fitness has risen from the bottom to the most commanding position in the commerical life of Japan, one of the world's really great captains of industry. Takuma Dan is an engineer, with the degree of Doctor, one of the men who have raised modern Japan to her present proud position as an industrial nation, a fitting director-general for a family whose wealth has been so largely responsible for this transformation. Dr. Dan, born in 1858, is a native of Fukuoka, a mining town in Kyushu. In 1871 he accompanied Lord Kuroda, of the Fukuoka Clan, to America, remaining in Boston to be educated as a mining engineer. He graduated with honors from the Massachusetts Institute of Technology, and after his return to Japan spent three years as lecturer at the Osaka Technical College and in 1881 was made engineer of the great Miike coal mine, then owned and operated by the Government. Here Takuma Dan laid the foundation of his subsequent career, specializing in and making himself the most competent authority on the mining possibilities of the Miike region. When the Mitsui purchased the Miike properties from the Government in 1889, Dr. Dan entered their employ as chief engineer. We find the young engineer gradually forcing himself up to positions of importance in the Mitsui Mining Company, then into the auditorship and directorate, and from there to the supreme direction of the properties. From a simple coal mine the Miike properties have been developed into one of the greatest industrial and engineering centers in the Far East. The mines themselves were enlarged, their output increased, a magnificent harbor for handling coal and facilitating exports, a smelter refinery, an iron works and dye works, with their subsidiary bye-product plants, have been added to the original mining installation. Wealth was created from waste. This was the work of Takuma Dan. He took the Mitsui fortune and created for it a new foundation. From the small beginning in 1892 the Mitsui Mining Department has evolved into the present Mitsui Mining Company, Ltd., with its capital of Y.100,000,000 and an annual coal output equal to one-quarter of the total mined in the empire. The creative force behind this development was rewarded by the Mitsui Family Council by making him director-general of all its vast enterprises. Dr. Takuma Dan, the engineer educated at the "Boston Tech," had reached the top, a fitting tribute to his untiring energy and executive ability. His usefulness will continue as long as he lives, and when the day arrives to lay down the cares of the greatest business organization in the world of to-day he, like his brilliant predecessor, Baron Takashi Masuda, will retire behind the scenes to become Adviser to the Mitsui Family. Dr. Dan personifies the basic precept of the Mitsui code: "Business is Humanity." Behind a dynamic personality and keen business exterior is one of the most humam and lovable characters that it has been our good fortune to meet in any country of the world. That Takuma Dan is accepted by the other Japanese captains of big business as their leader is not altogether due to his exalted position. His leadership in the world of Japanese finance, commerce and industry has been attained and held by those high qualities of character and disposition which endear men to their associates.

Yunosuke Yasukawa, Senior Managing Director of the Mitsui Bussan Kaisha, the Greatest Trading Concern in the World

It is difficult for an outsider to gather accurate information about the vast Mitsui holdings. They are so diversified and so interwoven into the very fabric of Japan's economic life that it is impossible even for Japanese to say when the Mitsui begins and ends. There are many captains of big business in America and Europe who have achieved world fame in some particular industry, but we know of none whose executive genius is called upon to direct such a varied assortment of big enterprises as the director-general of the Mitsui Gomei Kaisha. In addition to his duties as head of the Mitsui corporation, he presides over the Hokkaido Mining and Steamship Company, operating mines and iron works in Hokkaido and a line of steamships. This company is capitalized at Y.70,000,000. He is also managing director of the Japan Steel Works, the second largest in Japan, an Anglo-Japanese enterprise in Muroran, Hokkaido, where the big guns for the Japanese army and navy are manufactured. This corporation is capitalized at Y.30,000,000, all paid up. The Mitsui Mining Company with its many ramifications and manufacturing plants is capitalized at Y.100,000,000; the Mitsui Bank at the same figure; the Mitsui Bussan Kaisha is also a Y.100,000,000 corporation; the Mitsui Trust starts in business with Y.30,000,000; the Toshin Soko has a capital of Y.15,000,000; the Oji Paper Mill Company, with its manufacturing plants, forests and railways, is capitalized at Y.50,000,000; the Shibaura Engineering Works at Y.20,000,000. The Mitsui Bussan Kaisha operates a dock and shipbuilding yard near Okayama, a gigantic undertaking launched in the spring of 1918 in order to rival the Kawasaki and Mitsubishi yards. The post-war slump, the Washington Conference and the practical giving away of U.S. Shipping Board vessels for the Pacific service (the greatest shipping subsidy ever extended by any Government for the furtherance of its trade), have all united to kill the Japanese shipbuilding industry and cripple their trans-Pacific shipping lines. The great Mitsui dock and shipbuilding yard, like that of Asano's at Tsurumi, and many others erected in the boom days of the war, is now a dubious asset. The Mitsui, however, are operating their yard, and some months ago turned out the first motor-driven steamships made in Japan. Mitsui capital is found in many textile companies. In Shanghai the Mitsuis operate their own cotton mills. Near Osaka the Mitsui Bussan Kaisha operates one of the largest celluloid plants in Japan under the name of the Sakai Celluloid Company. The Chinese Government is a heavy debtor to the Mitsui for arms and other supplies. The Bussan Kaisha holds an exclusive radio concession from the Chinese Government and has erected a five-million-yen radio plant near Peking which is now in communication with the other

high-powered radio stations of Europe and America. The engineering department of the trading company holds many important agencies of American manufacturers not only in Japan, but for China. In fact, this Japanese firm is the best representative that America has in the Orient. Its volume of sales of American products surpasses that of all other American firms in China and Japan. Its sales of American locomotives, rolling stock, rails, bridges and railway supplies and machinery have done for Americans in China what they have never been able to do for themselves.

The Mitsuis are large shareholders in the South Manchuria Railway, whose properties are now valued at over a billion and a half yen. Since the Japanese have controlled the line they have expended by this time at least $100,000,000 gold for American materials. They have created in Asia an up-to-date American railway, equipped throughout in almost every detail with the most approved American appliances. A large proportion of this great volume of business has been placed in America through the New York office of the Mitsui Bussan Kaisha. Invariably a Mitsui man will be found on the board of directors of the South Manchuria Railway Company. The Mitsuis created the soyo bean industry and are the largest operators in beans and bean oil, the staple products of Manchuria, with their own oil mill and oil storage tanks at Dairen. Throughout all the ports of the Far East the Mitsuis own their own wharves, godowns and coal storage yards, doing an enormous business in bunker coal. The Mitsuis built and equipped with American material the Kiukiang-Nanchang railway, and if the Chinese ever repay their obligations and extend the line southwards and out to the sea at Foochow or Swatow, it will be another American-equipped line in the heart of China built with Japanese money.



Dr. Tamaki Makita, Senior Managing Director of the Mitsui Mining Company

The companies above enumerated have an aggregate capitalization of over Y.500,000,000. These figures are public property. It is not far from the truth to state that the Mitsui properties and investments total at least a billion yen, an enormous capital for Eastern Asia. The management and administration of these vast holdings calls for men of exceptional business ability, and places Dr. Takuma Dan well up amongst the very foremost of the world's great executives.

It is only necessary to pick up the *Japan Year Book* and scan the section devoted to "Who's Who in Japan" to gather an idea of the careers of the men now directing the various Mitsui companies and those who have retired to enjoy a well-earned rest or who have left the firm to start business on their own account. After Dr. Dan comes his immediate associates, the managing directors of the Mitsui Gomei Kaisha, the holding company for the family fortune. Here we find Nagabumi Ariga, brother to the man who for many years has been adviser to the Chinese Government. Mr. Ariga is a young man of sixty, who holds that his work is just beginning, a specialist in commercial law, the legal brains of the Mitsui organization. Kikisaboru Fukui, another young man of fifty-nine, has seen forty-two years of service with the Mitsui and is still going strong. Mr. Fukui has come up the ladder through the management of several of the important Asiatic branches of the Mitsui Bussan Kaisha, and its New York office, to the head of the trading company, and from there to the holding company. His vast commercial experience makes him one of the most important members of the inner council. Another director of the holding company is Mr. T. Sakai, a Harvard graduate educated for the ministry, who made a name for himself in the Foreign Office before the Mitsui council invited him to join their organization. Mr. Sakai is another enthusiastic worker nearing his sixties, and, as mentioned elsewhere, it was due to his personality, diplomacy, good nature and exact knowledge of the American character which made the work of the American Relief Commission such a wonderful success after the earthquake. The other member on the board of the holding company is Masataro Oshima, elevated to this position after 33 years of service with the Mitsui Bank. He is the financial expert of the organization.

The senior managing director of the Mitsui Bussan Kaisha is Yonosuke Yasukawa, born in 1870, and entering the Mitsui organization when he was 9 years of age. After serving as manager of many of its branches he was elevated to the directorate in 1917 and is now the active head of the trading company. Tamaki Makita, a doctor of engineering, is the senior managing director of the Mitsui Mining Company. He entered the Mitsui employ as a mining expert and has forged his way to the place vacated by Dr. Dan. Umekichi Yoneyama, the president of the newly-established Mitsui Trust Company, is a gifted financier who studied in America and afterwards entered the Mitsui Bank. Subsequently, he made a tour of America and Europe investigating banking methods, and when the Mitsui Bank was organized as a limited company was chosen as its managing director, a post which he still holds in connection with his present duties as head of the trust company.

Seihin Ikeda, managing director of the Mitsui Bank, is held by his financial associates in Japan and America as one of the brainiest international financiers of the day. He was born in 1868, and studied at Keio and Harvard. Entering the Mitsui banking department he rose to be manager of its important Osaka branch, and then toured America and Europe to study and report on modern banking methods for his superiors. It was on the strength of his report that the Mitsui family changed the organization of the bank from a limited partnership into a joint stock corporation in 1909.

The managing head of the Oji Paper Mill Company, an important Mitsui subsidiary, is Ginjiro Fujiwara, who started his commercial career in the Mitsui Bank and was shifted to the Mitsui Bussan Kaisha, where he subsequently became manager of the Shanghai and Formosan offices, establishing a record for business efficiency and knowledge of Far Eastern markets that his elevation to the management of the Oji Paper Mills came as a matter of course. At the head of the Shibaura Engineering Works, whose new plant at Tsumuri will revolutionize manufacturing methods in Japan, stands Kenzo Iwahara, a former managing director of the Mitsui Bussan Kaisha, who rose to the top through his remarkable trading ability, having managed the London, Osaka and Kobe branches and established the New York office of the company in 1896. After retiring from the trading company he was brought back into active service to preside over the great electrical and engineering works that has already contributed so largely to establish a high reputation for Japanese-made machinery.

Mr. George Marvin, writing in *Asia*, was enabled through the courtesy of the Mitsui family to give to the world the code which governs the operations of this "human corporation."

The distinguishing spirit of the House of Mitsui is specifically defined in these precepts from the family code as laid down in the

The Original Mitsui Store in Old Yedo, situated on the Historic Site at Suruga-cho in Nihonbashi, which has since been the Business Headquarters of the Family. (From "Asia.")

eighteenth century by Sojika Koji (Hachirobei II.), one of the leaders in the development of the family :

1.—*The members of the House should deal with one another in close friendship and with kindness. Beware that contentions among the kin do not in the end ruin the entire House.*

2.—*Do not needlessly increase the number of families of the House. Everything has its limits. Know that over-expansion, which you may covet, will beget confusion and trouble.*

3.—*Thrift enriches the house, while luxury ruins a man. Practise the former but avoid the latter. Thus lay a lasting foundation for the prosperity and perpetuation of our House.*

4.—*In making marriage, incurring debts or underwriting others' debts, act always according to the advice of the Council of the Family.*

5.—*Set aside a certain part of the annual income and divide it among the members of the House according to their rank. Give also to those who marry into outside families.*

6.—*The life-work of a man lasts as long as he lives. Therefore, do not, without reason, seek the luxury and ease of retirement.*

7.—*Cause to be sent for auditing to the main office the financial reports from all branch houses ; organize your finances and prevent disintegration.*

8.—*The essential of a business enterprise is to employ men of great abilities and take advantage of their special talents. Replace those who are aged and decrepit with young men of promise.*

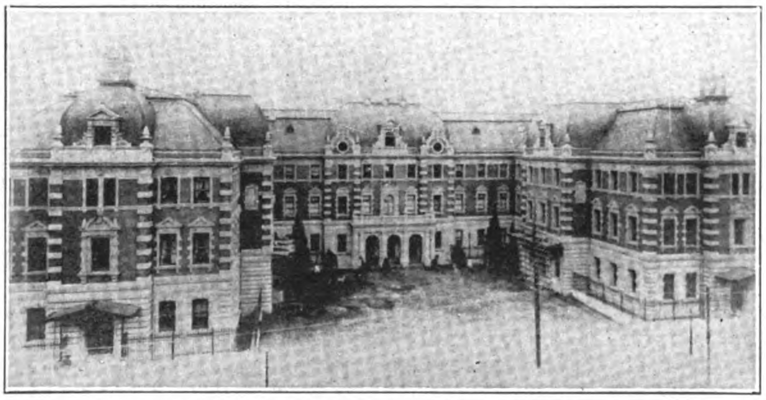
9.—*Unless one concentrates, one fails. Our House has its own enterprises, which are ample to provide for any man's life. Never touch another business.*

10.—*He who does not know, cannot lead. Make your sons begin with the mean tasks of apprentice, and, when they have gradually learned the secrets of the business, let them take a post in the branch houses to practise their knowledge.*

11.—*Sound judgment is essential in all things, especially in business enterprises. Know that a small sacrifice to-day is preferable to a great loss to-morrow.*

12.—*The members of the House should practise mutual caution and counsel lest they should blunder. If there be among you any evil-doer, deal with him accordingly at the Council of the family.*

13.—*You who have been born in the land of gods, worship your gods, revere your lord, love your country, and do your duties as citizens.*

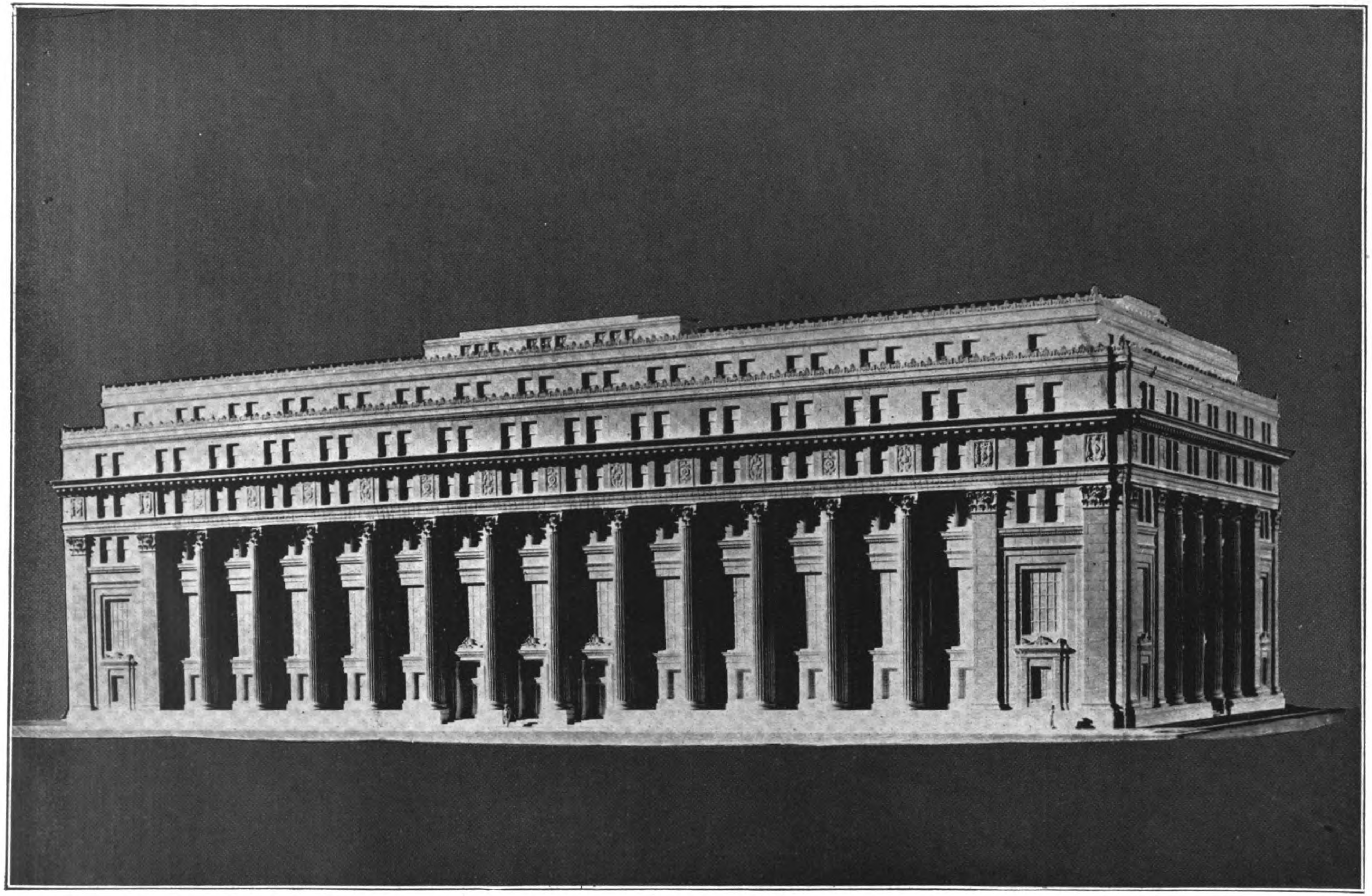


The Beautiful Mitsui Head Office Building at Suruga-cho that was Gutted by the Conflagration which followed the Great Earthquake

Following these precepts to the letter, the Mitsuis have endured and prospered where other great organizations have lived out their usefulness and faded into oblivion. The sixth precept compels attention. A few months ago an American sat at tiffin with Dr. Dan and his associate directors in one of the private dining-rooms of the Imperial Hotel in Tokyo, and in the conversation the American casually mentioned that he was fifty-five years of age and was looking forward to the time when he might retire before he got too old to enjoy life. The statement was met by a shout of laughter and the retort : " You are only a boy, altogether too young to retire. Your real work and value in life is just commencing." As the American looked around the table into the smiling faces of this grey-haired group of men all older than himself, and remembered the sixth precept of the Mitsui code, he realized that they were right. A man with all his faculties has no right to seek the luxury and ease of retirement as long as the world needs his services. These Mitsui directors, heads of the greatest commercial, financial and industrial organizations in Japan, with interlocking directorates and immense

PROPOSED MITSUI BUILDING

To House The Mitsui Gomei Kaisha, Mitsui Bank and Mitsui Trust Company, Ltd., When completed it will be the Largest Structure in the World Used Exclusively for Banking Business, and will cost to erect Yen 15,000,000



Architects: Trowbridge and Livingston, 527 Fifth Avenue, New York

holdings in other enterprises, had reached the top of the ladder through loyalty and efficient knowledge of the business entrusted to their direction. When they grow too old or infirm to take an active part in the great organization they have helped to build up, they will retire as counsellors, to be consulted by their successors on all matters. "*The life work of a man lasts as long as he lives.*"

With such a code, breathing fair-play to everybody, asking only for the right to equal opportunity that will enable Japan to trade, and by that trade provide employment for the millions condemned to stay at home by the operation of exclusion laws in other countries, the Mitsui mirrors the sentiment of the Japanese nation. If the fundamental problem of Japan is to be solved by keeping the surplus population at home, absorbing the people into new industries, it goes without saying that the door to world trade must be maintained wide open so that their manufactured products may compete on terms of absolute equality. The philanthropists and capitalists of Japan may create the industries, but without the markets, industry is no solution to a problem as grave and pressing and the one confronting present-day Japan. These markets must be created, developed and held by fair treatment and honorable business methods. There are other Japanese trading firms in the field helping to expand these markets, but it is no reflection on their ability and usefulness to state that if Japan is to pull through in the struggle for existence along these lines, the brunt of the fight will be borne by their standard-bearer, the Mitsui Bussan Kaisha. This is the great task that the Mitsui firm, through their trading organization, has set for itself. To accomplish this requires courage, initiative, enterprise, a high order of commercial intelligence, and a perfect knowledge of foreign markets and exchange.

The Mitsuis have led the vanguard in the expansion of Japanese commerce, carrying the flag to all countries of the world where legitimate trading can be carried on. Following the blazed trail of the Mitsuis have come the consular and diplomatic officials. For these reasons the Mitsuis have acquired the reputation in Japan of being positive where others are negative, but this aggressiveness is merely a manifestation of the national necessity, compelling the Mitsuis, because of their great wealth and experience, to assume leadership in the vital struggle for existence which faces the people of Japan. Japan may be industrialized, but if she is to survive as a manufacturing nation, the Mitsuis will be her salvation. The future of Japan is therefore bound up in the future of the Mitsuis. If the Mitsuis should fail, the industrial structure of the nation would collapse like a house of cards. Herein lies the strength of the Mitsuis. It may meet with reverses, but it cannot fail. *The Mitsuis are Japan.*

When the Mitsuis took stock of their properties after the earthquake and fire had wiped out the best part of Tokyo, they found that their handsome headquarters at Surugacho, as well as many branch offices in Tokyo and Yokohama, had been seriously damaged or reduced to ashes. The greatest organization in Japan was without a home, but only for a day. There was little hope of finding quarters or of erecting them within reasonable time, so the entire staff was brought together and business resumed in the palatial Mitsui mansion at Mita-Tsunamachi in Shiba. In this temporary headquarters, filled with the priceless art treasures of Japan, the Mitsui companies, under the personal control of their Director-General, Dr. Takuma Dan, buckled down to their task, and despite a handicap that would have broken the spirit of any ordinary organization, easily assumed the leadership in the great work of reconstruction that followed.

Hand in hand with the pressing demands upon their time to furnish supplies for the stricken area went the special relief work planned by the heads of the family. For many years the Mitsuis have endowed and conducted the largest charity hospital in Tokyo. It was founded in 1908 with an endowment of Y.1,250,000, to which a further Y.1,500,000 was added in 1919. Their other charities are legion, and on top of all this they set to work to erect barracks on their own account to house the homeless multitudes. From the first stage of the calamity the Mitsuis were in the van of rescue and relief work. Their numerous steamships, launches and lighters in the harbors of Tokyo and Yokohama saved thousands from perishing by fire or drowning. Anchored at Kobe, awaiting cargo and sailing directions, were several steamships belonging to the firm, and when communications with Tokyo and Yokohama were suddenly severed the Mitsui manager at that port, with a prescience of what it meant, hastily loaded a steamer with food and supplies and dispatched it under full speed to Yokohama. The first vessel to arrive with relief supplies after the disaster flew the Mitsui house flag, another reminder that "Business is humanity."

When Tokyo and Yokohama were cut off from the rest of Japan, the Mitsuis dispatched employees to all the cities and towns along the routes, and by relays of automobiles, motor cycles and other conveyances maintained communication between the Hokkaido and the Kansai district, while from Otaru, Nagoya, Osaka, Kobe, Nagasaki and other ports of Japan came a regular procession of steamers either owned or chartered by the Mitsuis, conveying supplies for relief work. The task then commenced has been carried on with unabating energy, the Mitsuis transporting, importing and supplying materials and machinery for public works and reconstruction from all parts of the world.

When the flames swept over Yokohama the Mitsui branch office suffered the general fate, but the silk warehouse of the firm miraculously escaped destruction. That warehouse contained several million yen worth of undamaged silk, and enabled Japan to carry on with the export of its prime commodity, an incident in the silk trade which had a rather disastrous effect upon certain Chinese silk operators who tried to take advantage of Japan's misfortune.

When the Emergency Relief Bureau was organized to assume control over the distribution of the vast quantities of supplies that came pouring in from all parts of the world, and the American Government designated General Frank McCoy and Colonel George Langhorne to act as the representatives of the American Red Cross in Japan, it was a Mitsui director who was appointed to head the Japanese Committee that accepted and distributed these supplies to the sufferers. In seeking for the proper man to work in harmony with the American mission, the Japanese Government most wisely selected Mr. Tokutaro Sakai, director of the Mitsui Gomei Kaisha and president of the Harvard Club of Japan, to head the committee composed of men from the leading families of Japan, whose names were a guarantee that the supplies would be distributed where they were most needed. Night and day for three months Mr. Sakai and his staff labored with hardly a respite, in order that the huge job of distributing the stream of supplies might be accomplished without a hitch. To his executive ability, tact and unvarying good nature under the most trying circumstances, is due to a large extent the success that crowned the work of the American relief commission.

All this time the Mitsuis were without a home. The Government injunction against the erection of permanent buildings until the new city plan could be decided upon was accepted by them without demur, and they were one of the first to give their consent to the new replotting scheme involving the surrender of much valuable land to the city. In the general disaster the Mitsui Bank Building was not so seriously damaged that it could not be repaired, and as soon as possible this branch of the organization returned to its quarters in Surugacho and reopened business at the old stand. The other companies were not so fortunate, and were housed in temporary barracks erected in the compound of the Mitsui Club in front of Hibiya Park. The Mitsui Gomei Kaisha and the Mitsui Trust Company have their offices in the building facing the park, while the Mitsui Mining Company and the Mitsui Bussan Kaisha are quartered in the temporary structures which fill the Club compound in the rear. There is little difference between these buildings and those erected for the Government offices that were destroyed. The vast turn-over that characterized the Mitsui activities before the disaster has expanded under these temporary conditions to a still greater volume.

Repair work on the old Mitsui buildings at Nihonbashi are proceeding rapidly. Two of these structures are again ready for occupancy, and with the addition of another temporary building, the Mitsui Bank, the Mitsui Bussan Kaisha, the Mitsui Mining Company and the Toshin Soko (the Mitsui Warehousing Company) will remove to these quarters in the near future. The present premises of the Mitsui Bank will then be demolished in order to erect on the site what will be the most imposing office building in Asia.

This building, illustrated on the preceding page, will easily take its place as the finest in Asia, comparing favorably with the largest buildings in the world. It will be of steel and reinforced concrete faced with Japanese granite, thoroughly fire and earthquake-proof throughout. The preliminary plans call for a five or six-storey structure, 415 feet long by 153 feet wide. It will face three streets, having sixteen enormous fluted Corinthian columns 76 feet high on the main front and eight columns of the same dimensions on each side. The steel work of the building will follow plans laid down by S. C. Weikopf, a New York engineer with offices at 11 East 42nd Street. The basements and ground floors will be occupied by the Mitsui Bank and the Mitsui Trust Company. The basements will be devoted entirely to an enormous system of safe deposit vaults of the latest and most approved model. Over 10,000 boxes will be installed for the safe custody of the Mitsui papers and for the use of their customers.

The proposed building has been designed by Trowbridge and

Livingston of New York, one of the best-known firms of American architects who have distinguished themselves by designing other great edifices in America and Europe, such as the Bankers' Trust Building in New York, the New York Stock Exchange, St. Regis Hotel, Altman Department Store, the Palace Hotel of San Francisco, and the Mellon National Bank of Pittsburg. The contract for the erection of the building has been signed with the construction firm of James Stewart & Company, of 30 Church Street, New York, at a total cost of Y.15,000,000. This concern also enjoys a high reputation for the quality of its work, having erected the State Capitols at Salt Lake City, Oklahoma City and Boise City, the Jefferson Memorial and the National Bank of Commerce in St.Louis, First National Bank buildings in Denver and Houston, and many other prominent structures throughout America. In England they constructed the Savoy Hotel in London and the Midland Hotel in Manchester, and have also carried out work in France and South America. It is estimated that about Y.6,000,000 will be spent in America for steel, cement, vault doors, hardware, sanitary equipment and other materials for this building.

The Mitsui Bank

The Mitsui Bank was one of the first to reopen business after the disaster, as the loss to the building and furniture was very slight (not exceeding Y.56,000), and although many of its customers suffered more or less, they were all companies or merchants of good standing whose assets were not materially impaired by their losses. The Mitsui Bank is capitalized at Y.100,000,000, of which Y.60,000,000 is paid up. The reserve fund at the end of 1924 stood at Y.50,600,000, with deposits of Y.408,000,000 and loans of Y.3,230,000. The bank has forged to the front rapidly as a medium for financing foreign trade, and even during the chaotic and uncertain days following the earthquake, the bank opened new foreign branches in London and Bombay, and is preparing to open another branch at Sourabaya in Java. For many years the bank has maintained branches in New York and Shanghai, financing a large part of the vast business of the Mitsui organizations. With the three new branches and others that are contemplated, the Mitsui Bank seems destined to become one of the world's great financial institutions.

The Toshin Soko

In addition to their many other activities, the Mitsuis conduct one of the largest warehousing enterprises in Japan, operating under the name of the Toshin Soko. The familiar Mitsui trade-mark on these structures is a frequent sight along the waterfronts of Tokyo, Yokohama, Nagoya, Yokkaichi, Osaka, Kobe, Moji and Shimonoseki. In Tokyo the main Toshin Soko's warehouse stands on the bank of the Sumida river in Nihonbashi, the commercial centre of the capital, while across the river in Fukagawa are the grain and rice warehouses located in the center of the cereal market. The Yokohama reinforced concrete warehouses stand within the Customs compound, handling a large share of the imports and exports of that port.

The earthquake and fire destroyed many of the Toshin Soko's best buildings, which were immediately replaced with temporary structures pending complete reconstruction in reinforced concrete. The three-storey silk warehouse in Yokohama from which the bulk of Japan's silk exports is shipped, is to be enlarged by the addition of a new four-storey reinforced concrete building. At Shibaura, the water gate to Tokyo, new warehouses covering 71,000 square feet of floor area were erected after the catastrophe in time to store a large percentage of the relief supplies which came pouring into the city from all parts of the world.

This branch of the Mitsui activities has kept pace with its sister companies in reconstructing and extending its facilities. We find that its capital has been increased from five to fifteen million, and from 343,000 square feet on August 31, 1923, the Toshin Soko has not only restored the space destroyed in Tokyo, but has now available over 384,000 square feet, about 33 per cent. of the total warehousing facilities of the Capital. It was the same in Yokohama, where the 123,000 square feet pre-quake capacity has been extended to 198,000 square feet, about 37 per cent. of the total facilities of the port. The stocks carried in the Tokyo warehouses prior to the quake were valued at Y.21,399,205, and the latest returns show that they are now storing goods valued at Y.20,222,507, about twenty-five per cent. of the total stored in all other warehouses. In Yokohama the increase in the value of the goods stored by the Toshin Soko is phenomenal. Just previous to the quake the value was only Y.3,312,360, but the latest reports show a value of Y.31,593,586 out of a total valuation of Y.33,491,924 of all goods stored in that port.

In Nagoya and Yokkaichi the Toshin Soko's warehouses are generally filled with large stocks of imported cotton for the supply of the many textile mills in those districts. This is one of the most important functions of the Mitsui. It is not generally known that the Mitsui own ninety per cent. of the stock in the largest cotton exporting company in the United States, an organization with American personnel which ships cotton not only to Japan and other ports of the Orient, but to Europe and South America as well. Their large interests in the textile industry of Japan have compelled them to eliminate middlemen, purchase the raw product from the planter, and ship direct from the Gulf Ports to Japan in order that the mills of that country may compete in the world's markets with their manufactured products.

In Osaka the Toshin Soko operates some 24,000 *tsubo* of warehousing space and has just completed a large reinforced concrete structure near the mouth of the Ajikawa River in close proximity to the harbor. In Kobe the Toshin warehouses connected with the piers and steamship side by railway lines, are a feature of the Customs compound. A new five-storey reinforced concrete warehouse is now under erection inside the Kobe Customs compound and the company is starting work on a reinforced concrete pier 600-ft. long and 120-ft. wide. The Nagoya warehouse has a capacity of 182,450 square feet, carrying stocks valued at nearly Y.2,000,000; the Osaka branch covers 854,000 square feet, storing stocks valued at Y.46,000,000; the Kobe warehouses cover 1,111,150 square feet, with goods stored to the value of Y.32,000,000. The toal warehousing area of the company is now 27,000,000 square feet. The total value of goods now stored by the various warehouses of the Toshin Soko is Y.150,000,000, or about one-third of the total warehousing business of the empire.

The Mitsui Trust Company

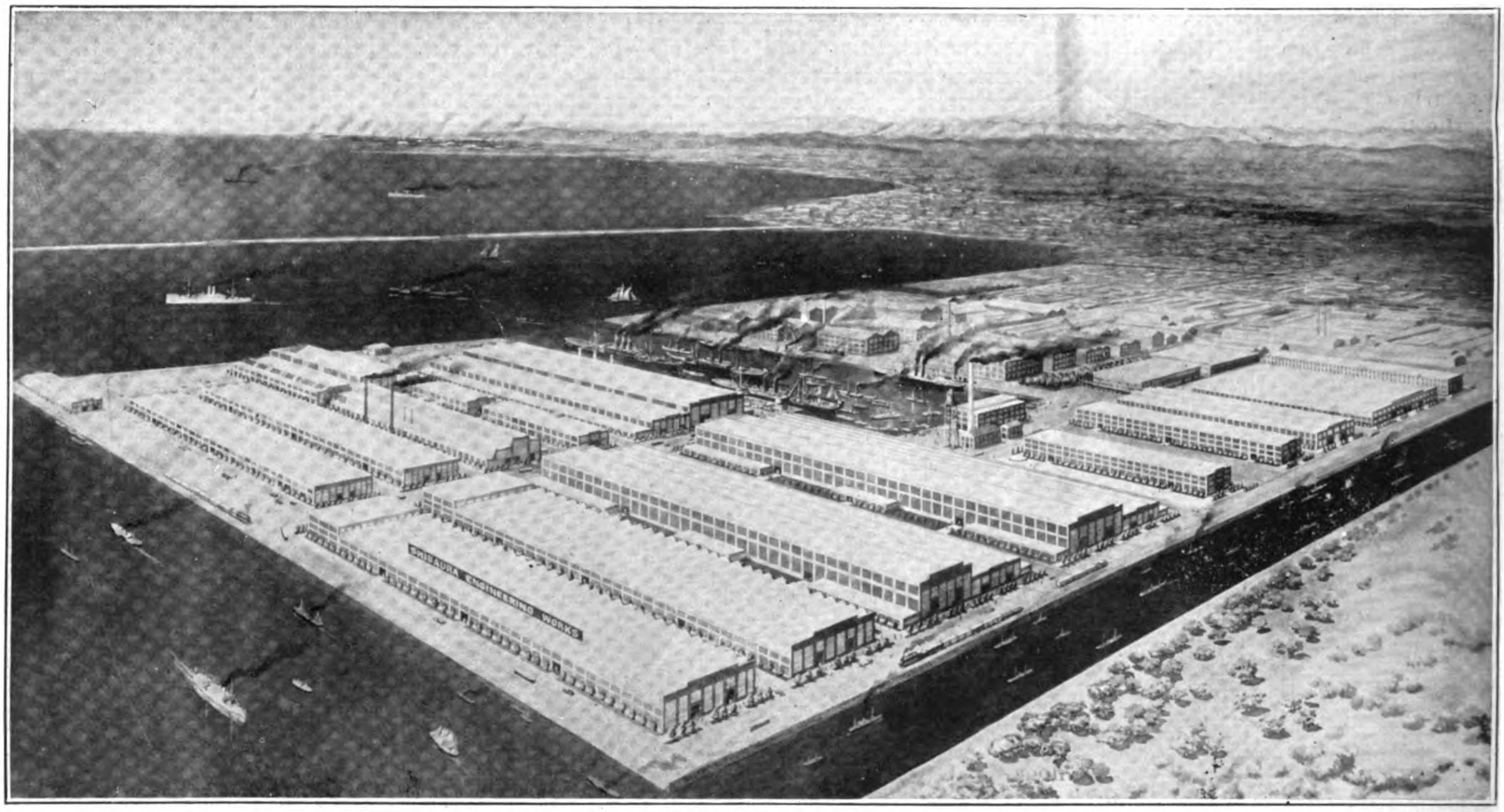
For many years trust companies had been carrying on an extensive and lucrative business in Japan, free from governmental supervision or regulation. As a consequence of this lax state of affairs over 500 concerns with an aggregate authorized capital of Y.347,000,000 had entered the field with a paid-up capital of only Y.109,000,000. Much of the business done was quite foreign to the established rules governing trust companies in other countries. Many companies were on an unsound basis. This situation became so flagrant that the Government appointed a commission to study the laws and workings of trust companies in Europe and America. The Japanese trust company law had been modelled somewhat on the lines of the German, but the Diet after careful consideration finally decided to adopt the spirit of the English system, passing a new law, which took effect January 1, 1923. Under its provisions a trust company must have a minimum capital of Y.1,000,000 and its activities restricted to the handling of trust funds, negotiable paper, monetary claims, movable property and real estate, leases and acting as trustees. In addition, all companies were required to obtain new permits to continue in business. This had the beneficial effect of wiping out all but thirty companies, which have applied for and received charters to date.

The first to file an application under the new law was the Mitsui Trust Company. The plans for establishing this venture had been drawn up by the Mitsui Council long before the earthquake, but it was not until after the disaster that in devising plans for reconstruction the Mitsui decided to launch the new company as part of their contribution to the financial machinery for the restoration of the city. The Mitsui Trust Company is capitalized at Y.30,000,000, divided into 300,000 shares of Y.100 each, of which the Mitsui Gomei Kaisha own nearly one-half, the remainder being in the hands of the Mitsui subsidiaries and individuals closely connected therewith. The functions of the new company will be the ordinary fiduciary acts provided by the trust law of Japan, supplemented by safe-deposit service; guaranty of credits; acting as agents in real estate or leases or in financing operations; insurance of public loans, corporate debentures, or corporate stocks; the disbursement of dividends; the handling of fiscal matters; and the purchase, disposal, or management of properties or liquidation of businesses.

As a result of the first year's operation, the company holds in trust over Y.43,000,000 in cash and Y.13,000,000 in securities, one of the strongest testimonials to the standing of the Mitsui in financial circles.

Although it is the latest addition to the Mitsui group, the trust company has a great future before it and will expand its usefulness with the increasing prosperity of its allied companies. In addition to the thirty trust companies operating under the new law there are

(Continued on page 534.)



General View of the New Plant of the Shibaura Engineering Works at Tsurumi, as it will appear when completed

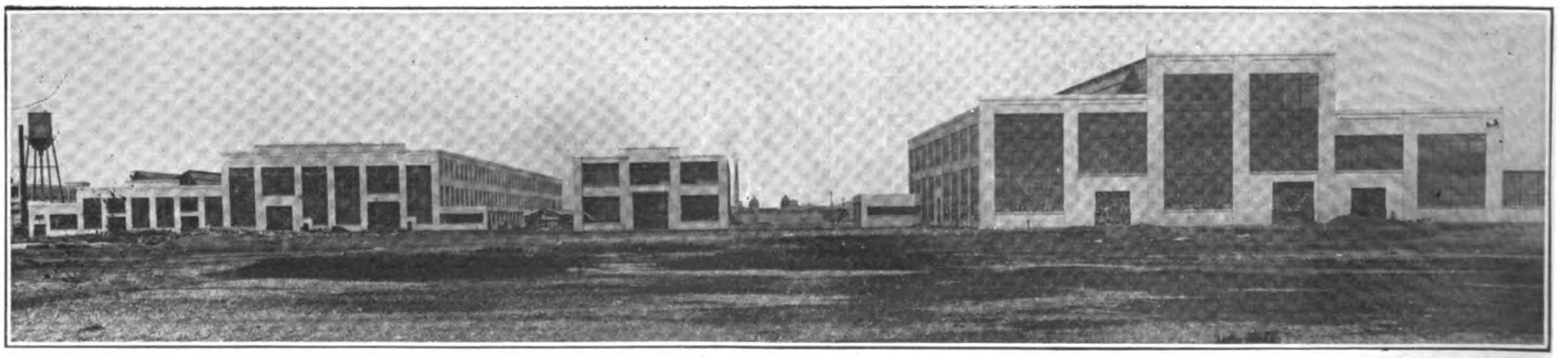
"SHIBAURA"

The Model Industrial Plant of the Shibaura Engineering Works at Tsurumi will Revolutionize Japanese Manufacturing Methods

THE first construction stage of what will ultimately be the largest electrical manufacturing plant in Asia is now nearing completion on the reclaimed area at the new industrial centre of Tsurumi. Here, with deep water facilities for vessels of 10,000 tons, raw materials will be discharged and the finished products shipped out to all parts of Asia in competition with those of Europe and America. In fifty years of brilliant and successful operation, the Shibaura Engineering Works of Tokyo have arrived at that point where the demand for their electrical products is so great that it has been impossible for the manufacturing capacity of the plant to keep pace with it. Long before the earthquake, the erection of a new plant had been decided upon by the directors of the company, and at the time of the disaster construction had just been started.

The old plant at Shibaura, in Tokyo, covering an area of 20 acres, withstood the earthquake, but was reduced to ashes in the terrific conflagration which followed. The reconstruction and rehabilitation of this plant in the short space of four months is another tribute to the skill and capacity of the Japanese engineer. Temporary buildings were erected, machines and tools repaired and the works brought once more into full manufacturing swing. This, however, is merely an emergency measure in order to enable the company to meet the enormous demand for its specialties.

The work of foreign electrical manufacturing companies in Japan is kept constantly before the technical world by up-to-date publicity methods, and the fact is sometimes lost sight of that there exist Japanese manufacturers whose electrical machinery and apparatus is specified and installed in the majority of the new medium-sized plants now being erected. Among those who have established a high reputation for the excellence and efficiency of its products is the Shibaura Engineering Works. The enormous new plant now in process of erection at Tsurumi is an indication that the company not only intends to manufacture on a far larger



Large Machine Shop Pattern Shop Forge Shop

View of the Completed First Section of the New Plant of the Shibaura Engineering Works at Tsurumi, as it appears to-day. Looking North from Yokohama Side

scale in the future, but is determined to get out and seek its share of the Asiatic electrical business.

The location of the new works is ideal. In addition to adequate harbor facilities, it has direct connection with the main line of the Japanese State railways. The yearly producing capacity of the Tokyo plant is valued at Y.20,000,000 ; what the output will be when the new works are operating to capacity is not difficult to foresee, especially as the whole force, from the president down, are imbued with the firm idea of placing their works and its products in the front ranks of the world's manufacturers of electrical machinery. The Company is under the direct management of its president, Mr. K. Iwahara, who has at his call the best engineering talent of the General Electric Company and the highly trained and expert engineers of his own country who have forced recognition of their merits from the engineers of other countries.

THE NEW PROJECT.—After some years of operation in quarters which became more crowded each year, it became apparent to the officials of the Company that present efficient manufacture and future expansion of operations demanded a new and more modern plant. In 1922 definite plans were launched to accomplish this.

In conceiving this project, they drew upon their own experience over a period of years, that of other plants operating in Japan, and the vast experience of the General Electric Company operating many similar plants throughout the world.

A very thorough preliminary study was made of all factors pertinent to design and operation, and out of this study grew a definite plan comprising sixteen separate buildings, individually fitted for a particular purpose, and collectively forming a complete manufacturing unit.

THE BUILDING PROGRAM.—The total floor space projected was 1,750,000 square feet, or approximately 40 acres, and the total estimated cost was $10,000,000.

It was decided to divide the construction into three stages, the first to consist of 350,000 square feet of permanent buildings and a temporary Power-house, the second to comprise 525,000 square feet, and the third to complete the balance of 875,000 square feet.

The buildings selected for the first stage were :

1.	Heavy Machine Shop No. 1	206,000 square feet
2.	Forge Shop	27,000 „ „
3.	Warehouse	76,000 „ „
4.	Pattern Shop	41,000 „ „
5.	Temporary Power-house	

THE SITE.—The site chosen consists of about one hundred acres of level ground situated in Tsurumi, a rapidly developing industrial centre between Tokyo and Yokohama. It fronts on to Tokyo Bay and is directly opposite the Port of Yokohama. The land has recently been made by hydraulic fill.

At the present time direct small boat service is available from Yokohama to three sides of the property. It is quite probable that in the future ocean-going steamers can be brought alongside, and complete docking, loading, and unloading facilities installed.

On the land side a railroad siding will be available connecting with the main line from Tokyo to Yokohama and the western part of the country.

PRELIMINARY STUDY.—Preliminary to any detailed design, an extensive study was made of all conditions confronting builders in Japan.

Of primary importance is the effect of earthquakes, which occur periodically and which vary in intensity from a very slight tremor to a most destructive shock. All available records extending over a period of years were studied, and from these and the advice of experts in Japan, a basis of design was adopted.

In the wake of destructive earthquakes there is an immense fire hazard due to the large numbers of closely-grouped, light frame, wood building. Fire spreads very rapidly. In the design of the buildings and their fire-fighting equipment every attempt was made to minimize this danger.

Other lesser factors ordinarily encountered in Japan, such as typhoons, high winds, extremely heavy rains, condensation due to a high atmospheric humidity, and extended periods of high temperature were investigated and special provisions made to overcome their effects.

DETAILED DESIGN.—The type of foundation to be used, one of the vital points in earthquake resistant buildings, was decided upon after carefully investigating all possibilities. The decision was to use reinforced concrete piles driven to a safe resistance, capped with concrete, and these caps in turn to be tied together with reinforced concrete beams. A total of nearly three thousand concrete piles were driven to support the buildings and their machinery loads.

The structural frames, either of steel or reinforced concrete, were designed to resist all loads in the buildings proper, and provided with bracing sufficient to carry earthquake loads directly to the foundations. All members and connections were carefully detailed in accordance with this design.

Exterior and interior bracing walls were in all cases constructed of reinforced concrete, and securely bonded to the frame. Stairwells and elevator shafts are in fireproof enclosures.

Floors are solid slabs of reinforced concrete.

The structural design as a whole was made with only one object in view, *i.e.*, safety of human lives and invested capital.

THE MACHINE SHOP.—This large building is approximately 310 by 850-ft. in plan. It is of semi-fireproof construction, having a heavy steel frame, a wood plank roof deck, and reinforced concrete exterior walls. It is divided by columns only into six aisles. The two heavy machine aisles are each 72-ft. wide and 48 and 40-ft. high respectively, under the trusses. One is served by a 75-ton and the second by a 15-ton craneway. The two adjoining light machine aisles are each 50-ft. wide by 24-ft. high. One is served by a 5-ton, and the other by a 2-ton craneway. On either side of the machine aisles are smaller side aisles used for offices, tool rooms, and various other special purposes.

The side walls and end walls are provided with large areas of ventilated steel sash and nine lines of continuous sash are used for the entire length of the building on monitors on the interior roofs. All overhead sash is mechanically operated from stations distributed through the building. This arrangement of sash provides excellent interior lighting and ventilation.

Special foundations on concrete piles have been built-in for all heavy machinery. A reinforced concrete floor has been laid over the entire area. Special cast steel testing floors were built in two places, and the balance of the finished floor is creosoted wood block layed on the concrete base.

The entire interior is painted gloss white. The combined effect of this paint and the large sash area is interior daylight, with no shadows in the building.

The railroad reaches the building at either end through large doors, which are provided with rolling steel shutters.

THE FORGE SHOP.—This building is approximately 173 by 209-ft. in plan, and of semi-fireproof construction similar to that of the Machine Shop. One end was made temporary, and concrete piles were driven for a future 400 foot extension of the building.

Special foundations on wood piles were built-in for the hammers and other heavy machinery. The floor over a part of the building is dirt, and the balance is concrete with cement finish. Mezzanine floors were constructed to accommodate tool rooms and toilets above the general floor level.

Large areas of sidewall sash and four lines of continuous sash in the monitor insure excellent lighting and ventilation. All overhead sash is mechanically operated.

The interior of the building is not painted.

Rolling steel doors are provided for railroad entrances at either end.

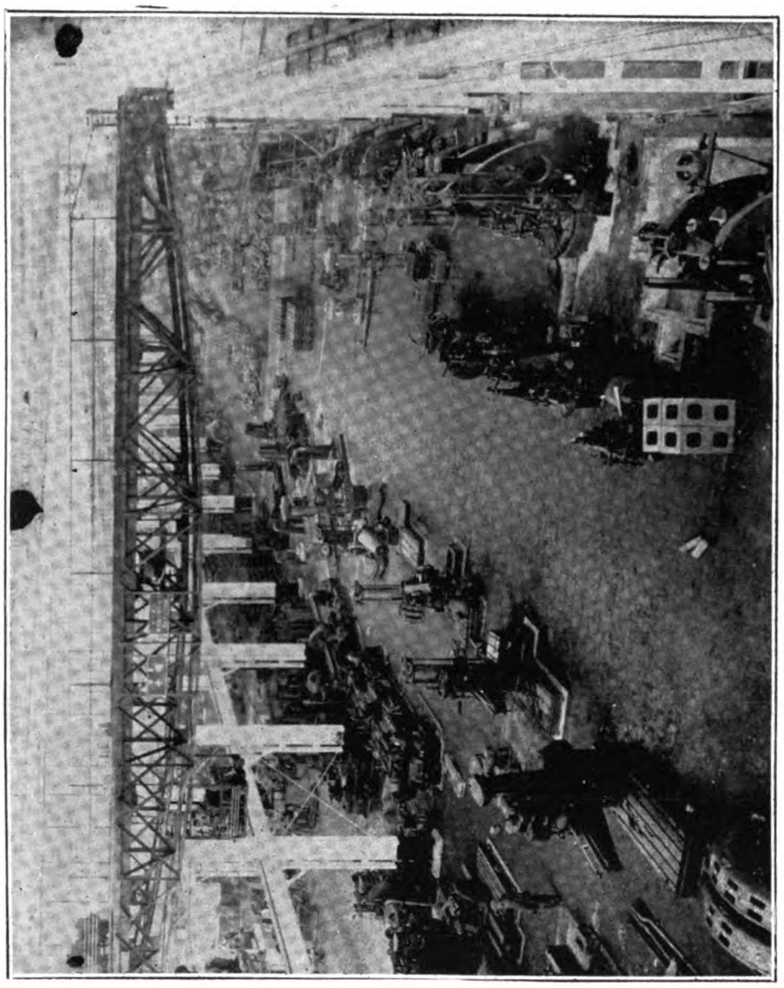
The main aisle is served by a 5-ton craneway and each of the side aisles by a 2-ton crane.

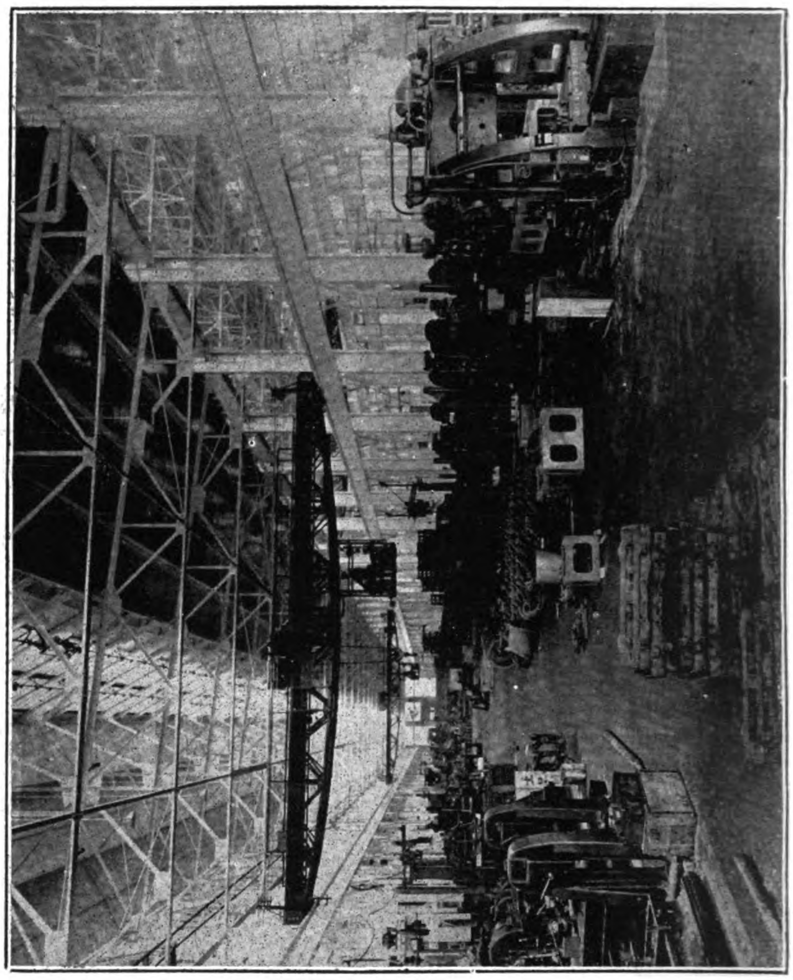
THE WAREHOUSE.—This building is approximately 69 by 368-ft. in plan, and is three stories in height. It is of reinforced concrete construction, flat slab type, and strictly fireproof throughout. The building is served by two elevators and two stairwells, one extending to the roof. These are entirely enclosed in concrete walls with automatic fire doors and rolling steel shutters. Toilets and wash rooms are built on mezzanine floors adjacent to the stairs.

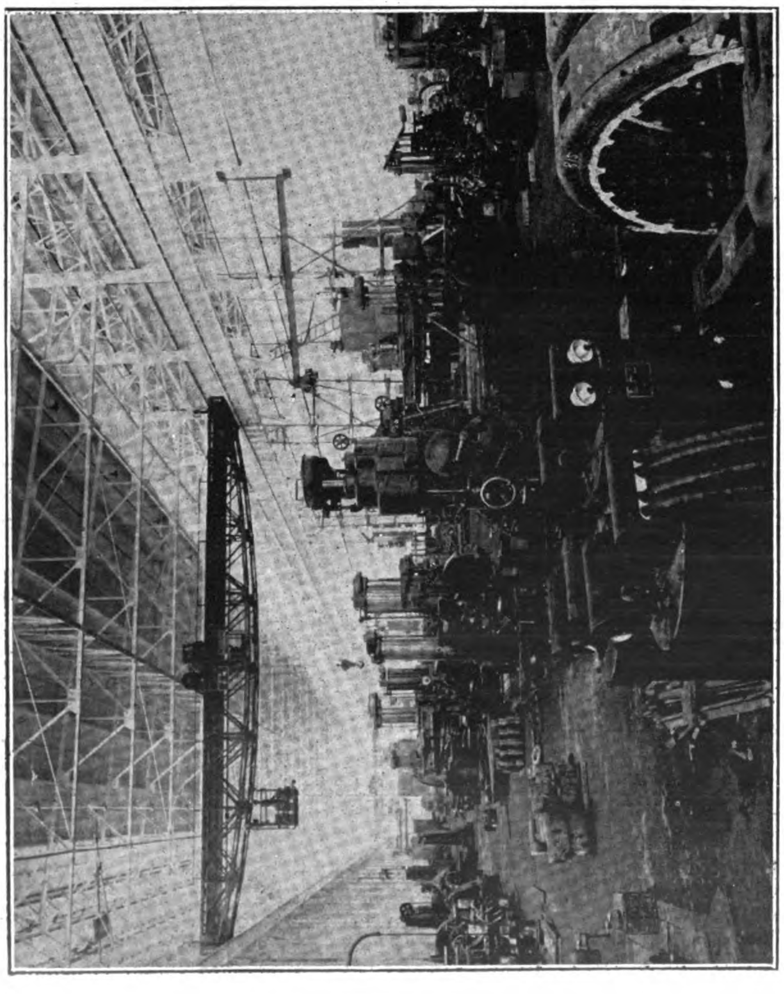
Large units of sash are used in side and end walls at each floor level, these insuring ample light and ventilation in all parts of the building. Steel sash is used.

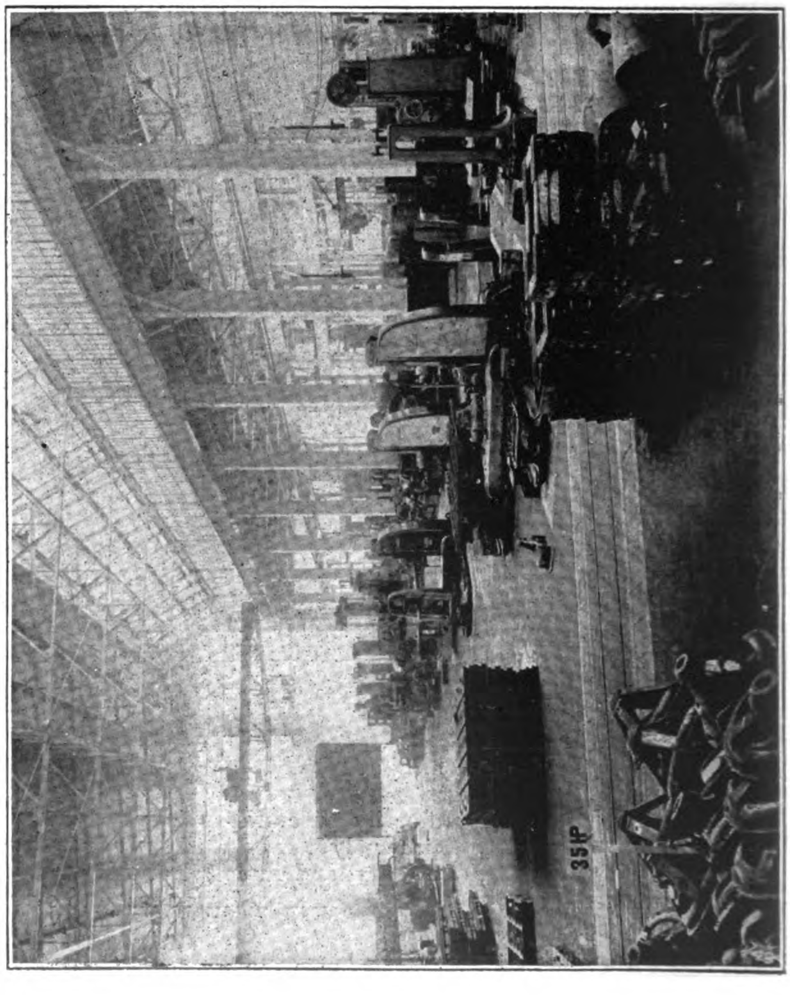
The finish floors over a large area are hard maple, and throughout the balance of the building, cement finish over the concrete slab.

A covered loading platform adjacent to the railroad siding extends along one entire side of the building at floor level, and at the level of the cars to be loaded. A cement finish is applied over this floor, and the canopy overhead is of wood plank on a steel frame.









INTERIOR OF LARGE MACHINE SHOP OF THE NEW SHIBAURA ENGINEERING WORKS AT TSURUMI

A small craneway is provided in each aisle on the first floor for handling materials for shipment.

Part of this building will be used temporarily for office space, and this interior has been painted gloss white with a dark green wainscote to a height of three feet above the floor on walls and columns. Stair wells are similarly painted. The balance of the building is plain.

THE PATTERN SHOP.—This building is approximately 69 by 298-ft. in plan, and is two stories in height. Construction is similar to that of the Warehouse, and strictly fireproof. The building is served by one elevator and two stair wells, all enclosed in reinforced concrete walls with automatic fire doors and rolling steel shutters. Large rolling steel doors are used in each end.

Finish floors are of maple and of creosoted wood block.

The interior is painted gloss white with dark green wainscote as in the Warehouse, and ample steel sidewall sash is provided for excellent light and ventilation.

THE POWER HOUSE.—This building is approximately 50 by 84-ft. in plan, and is of temporary construction only. The exposed steel frame is covered with corrugated siding and roofing. The building and equipment foundations are of reinforced concrete.

The power plant consists of two 600-horsepower boilers, one open feed water heater, two fire pumps, one service pump, three boiler feed pumps, three vacuum pumps, five fuel oil pumps, and two hydraulic pumps.

This plant supplies steam for heating, steam hammers, drying ovens, and other machinery, oil for the furnaces and pressure oil burners, and water at 400 pounds pressure for the hydraulic presses.

A system of reinforced concrete tunnels radiates from this plant to all buildings and carries steam, exhaust, return, oil, and hydraulic pipe lines. Expansion joints, all hangers, and anchors were carefully designed to eliminate danger of earthquake breakage.

BUILDING EQUIPMENT.—Each building, except the Forge Shop, has a vacuum heating system installed. The Machine Shop has in addition twelve steam unit heaters. All steam is supplied from the central power plant.

Special study was given to electric illumination. Fixtures were located, and shades were designed to produce an even distribution of light on a plane six feet above each floor. This eliminates all shadows, and makes individual machine lighting unnecessary.

All buildings have modern toilets, lavatories, and locker rooms in which all fixtures are porcelain china and connected with water and waste pipes. Each lavatory is supplied with hot and cold water. The Forge Shop has both shower baths and Japanese bathing pools.

A modern sewage disposal plant, including Biolytic tanks, pumping stations, dosing tanks, filter beds, and chemical treating apparatus has been installed to serve all buildings. Waste is carried through this system and discharged into the bay free from injurious bacteria. All the underground piping is laid on a concrete mat over wood piles and encased in concrete.

A separate underground system carries drainage from the entire property and the roofs, and discharges at ten different points into the bay. All piping in this system was laid with tight but flexible joints.

A complete automatic sprinkler system is installed and forty frost-proof, two-way fire hydrants. These are fed by a fifty thousand gallon elevated tank and two automatically controlled fire pumps of one thousand gallon per minute capacity in the Power House.

Water for toilet and manufacturing purposes is supplied by an automatic pump of one hundred gallons per minute capacity.

CONSTRUCTION.—Assembling of equipment and purchasing of materials for this unit of the project started just previous to the great earthquake of September 1, 1923. This caused a suspension of operations until December 1923, at which time construction work actually started. The work proceeded without difficulty and was carried through to completion in April 1925.

Structural steel, steel sash, rolling steel doors, and some few other items in the construction were imported. The balance of the material was purchased locally.

Construction was done by an American firm, who placed superintendents and assistants in charge, and the work was executed entirely with Japanese labor.

During construction, constant supervision, strict inspection, and regular tests were maintained to make certain that all items were actually built-in in the field as detailed on the plans and called for in the specifications, and that materials used were of the highest grade and properly applied.

MATERIALS AND QUANTITIES.—For the foundations under buildings and machinery, 2,615 special reinforced concrete piles were driven by the Raymond Concrete Pile Company of New York. The average length of pile was twenty-five feet.

For the Machine Shop and the Forge Shop, three thousand tons of structural steel were furnished by the American Bridge Company. This material was shipped partially fabricated.

Over 26,000 cubic yards of concrete were placed, including 1,500 tons of reinforcing steel. Cement was furnished by the Asano Cement Company, gravel and sand were obtained locally, and reinforcing steel was supplied by the Truscon Steel Company of Japan.

Bayley-Springfield steel windows were used. 95,000 square feet of sidewall sash and 54,000 square feet of continuous top-pivoted, sash were furnished and fabricated on the site by the William Bayley Company of Springfield, Ohio, U.S.A.

3,500 rolls of roofing and 1,100 barrels of asphalt were furnished by the Carey Company of Cincinnati, Ohio, and were applied by Z. Horikoshi & Company of Tokyo.

One and one half million pieces of wood block flooring were used. This material was furnished by the Nippon Wood Block Company of Tokyo.

About two million board feet of lumber were used throughout the work.

Piping installed on the site consisted of 18,000 linear feet of salt glazed tile pipe, 6,000 linear feet of copper downspouts, 12,000 linear feet of cast-iron pipe, 24,000 linear feet of heating pipes and steam lines, 13,000 linear feet of plumbing pipes, 11,000 linear feet of sprinkler lines, 6,000 linear feet of compressed air lines, 3,000 linear feet of gas piping, 4,000 linear feet of hydraulic lines, 3,000 linear feet of oil piping, thirty miles of electrical conduit, and 12,000 linear feet of asbestos covering used on steam, exhaust, and hot water lines. Tile and cast-iron pipe was furnished largely by Mitsui Bussan Kaisha Ltd., of Tokyo. The balance was manufactured by the National Tube Company and the Nippon Kokan, and was furnished largely by Ishibashi Shoten. The Grinnel system of automatic sprinklers was used.

Other items of materials in lesser quantities, and too numerous to mention, were furnished by manufacturers in Tokyo, Yokohama, Osaka, and other parts of Japan. Prominent among these were Mitsui Bussan Kaisha Ltd., the Ishikawajima Dockyards, the Kodama Iron Works, Kensetsu Kogyosha, and many others.

The Shimidzu-Gumi organization of Tokyo furnished a large part of the labor used on the work.

CONCLUSION.—The first stage of this large development now completed, and embodying the best in plant design, buildings, and machinery, stands as a monument to the careful planning and executive ability which have brought it to this point.

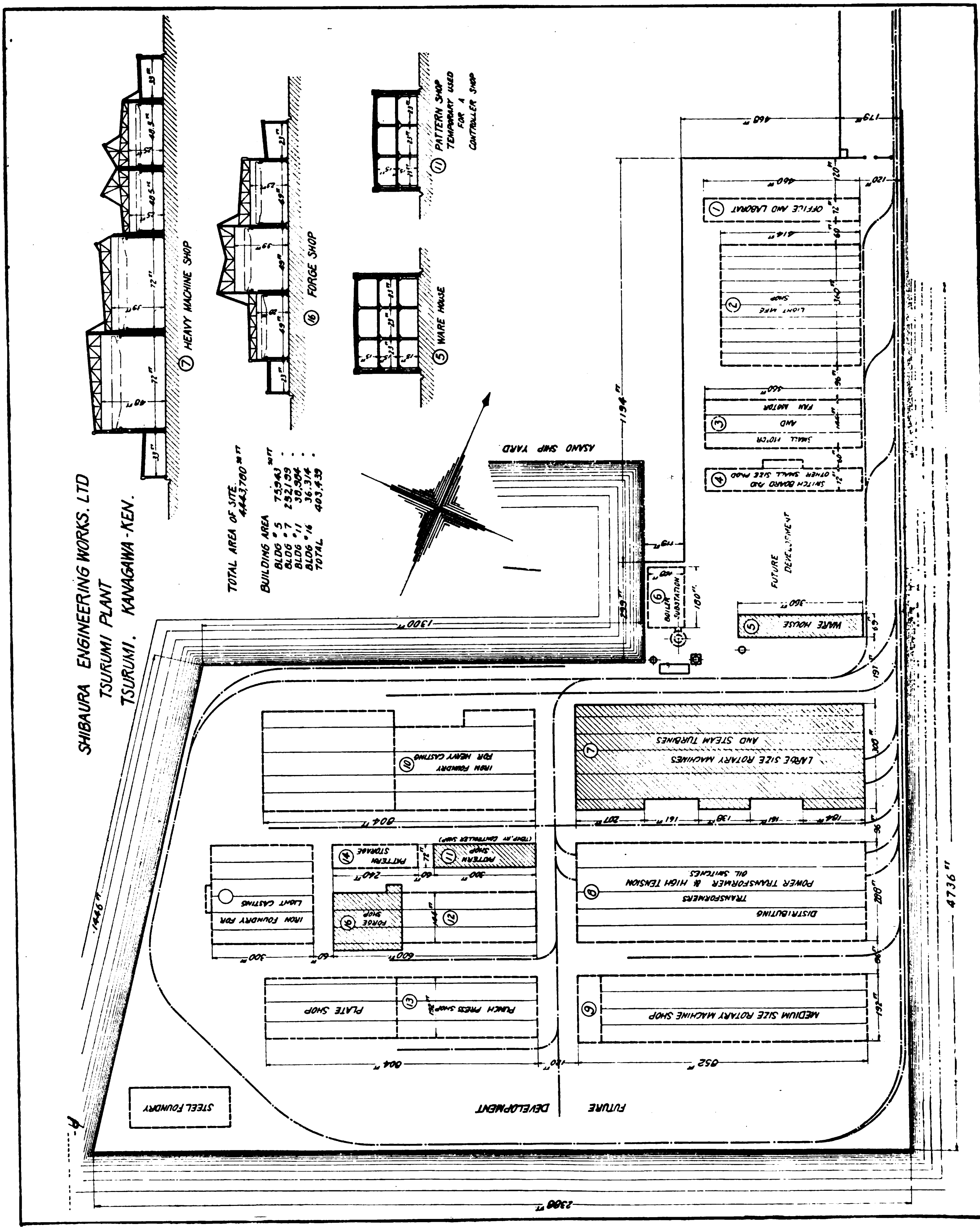
It marks the beginning of a new era of industrial building in Japan, in which larger and better buildings will be one phase of greater and more efficient production, which is the aim of all industries in their attempt to meet the competition of their own and other countries.

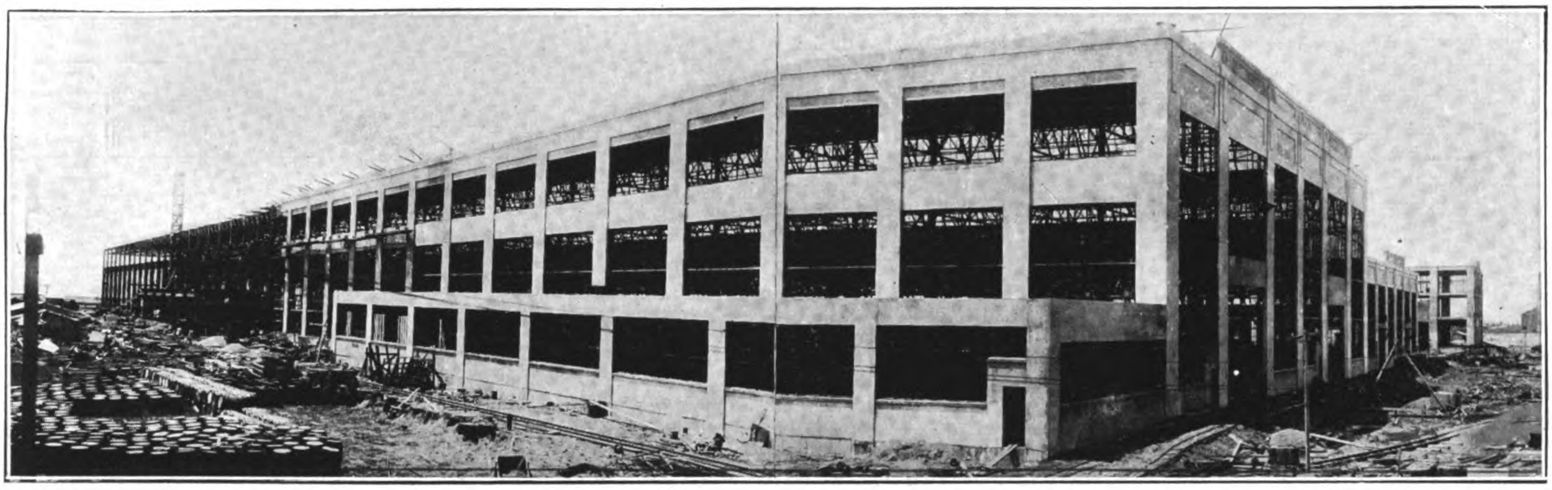
DESIGN AND CONSTRUCTION.—Plans and specifications for this work were made by the Shibaura Engineering Works, Ltd. The H. K. Ferguson Company of Cleveland and New York, U.S.A., were consulting engineers, and had the general contract for construction.

EQUIPMENT.—It is the intention of the Shibaura Engineering Works that the manufacture of electrical apparatus, in the new plant, shall be conducted on an equally efficient basis, as in the best American shops. With that end in view, a party of competent engineers from the Shibaura Engineering Works spent several months in America, studying the very latest practices, and the equipment used by the largest manufacturers. With the assistance of the manufacturing experts of the General Electric Company, the best obtainable standard machine tools, special purpose tools, and other equipment were purchased for the new plant through the Engineering Department of Mitsui Company. No expense was spared, the object being to purchase those tools which represented the last word in modern tool design and efficiency. All these machine tools are individually motor-driven.

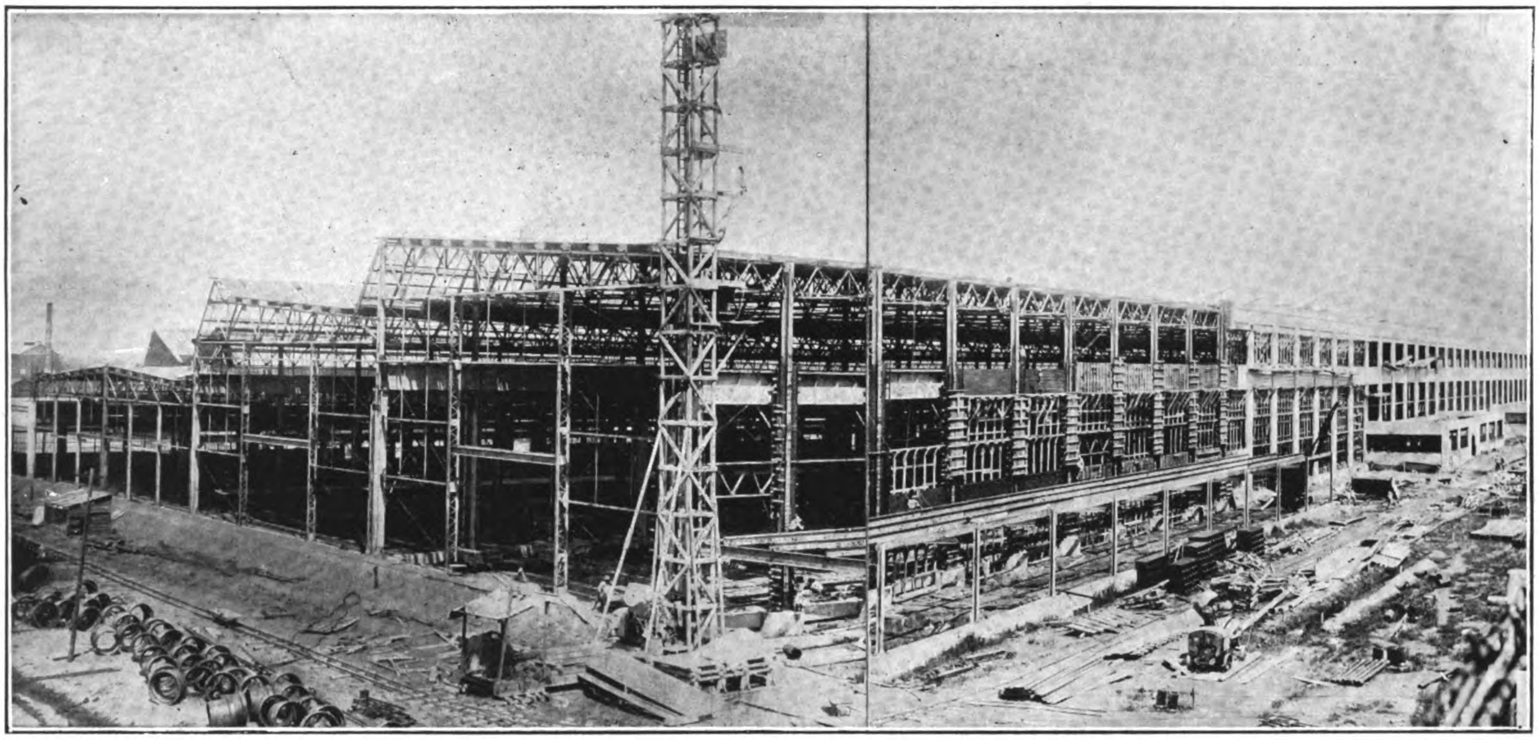
The buildings already completed, and in which the machinery is largely installed, are as follows :

Large Machine Shop, consisting of four main bays, and two side bays, total length 850-ft., width 310-ft., area 264,000 sq. ft. This

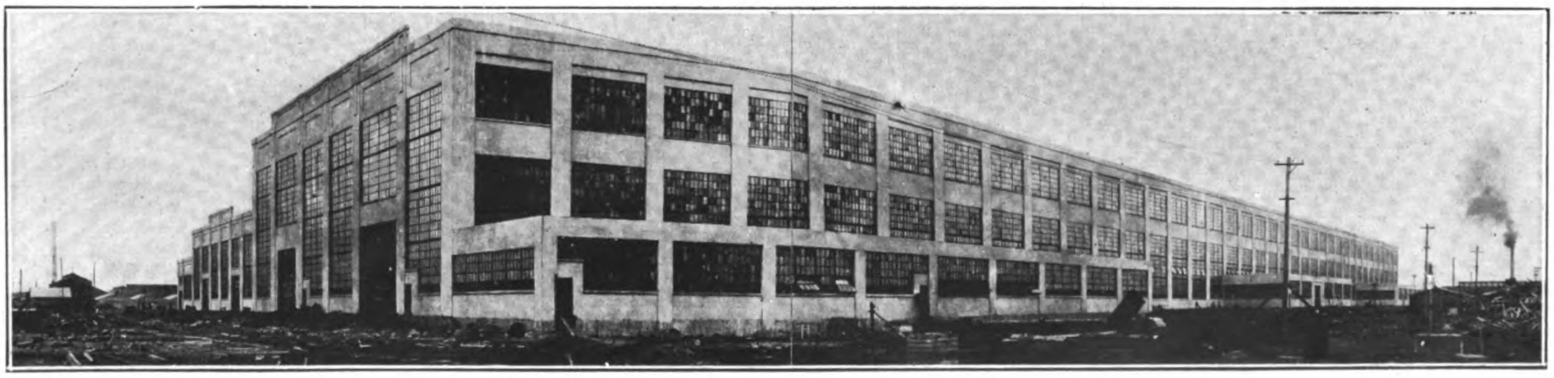

SHIBAURA ENGINEERING WORKS. LTD
TSURUMI PLANT
TSURUMI. KANAGAWA-KEN.
⑦ HEAVY MACHINE SHOP
⑯ FORGE SHOP
⑤ WARE HOUSE
⑪ PATTERN SHOP TEMPORARY USED FOR A CONTROLLER SHOP
TOTAL AREA OF SITE
BUILDING AREA
ASANO SHIP YARD
OFFICE AND LABORAT
LIGHT WARE SHOP
SMALL MOTOR AND FAN MOTOR
SWITCH BOARD AND OTHER SMALL SIZE PROD
FUTURE DEVELOPMENT
WARE HOUSE
BOILER SUBSTATION
LARGE SIZE ROTARY MACHINES AND STEAM TURBINES
IRON FOUNDRY FOR HEAVY CASTING
PATTERN STORAGE
PATTERN SHOP
DISTRIBUTING TRANSFORMERS
POWER TRANSFORMER & HIGH TENSION OIL SWITCHES
IRON FOUNDRY FOR LIGHT CASTING
FORGE SHOP
PUNCH PRESS SHOP
PLATE SHOP
MEDIUM SIZE ROTARY MACHINE SHOP
STEEL FOUNDRY
FUTURE DEVELOPMENT



General View of Machine Shop, Showing the Various Stages of Construction



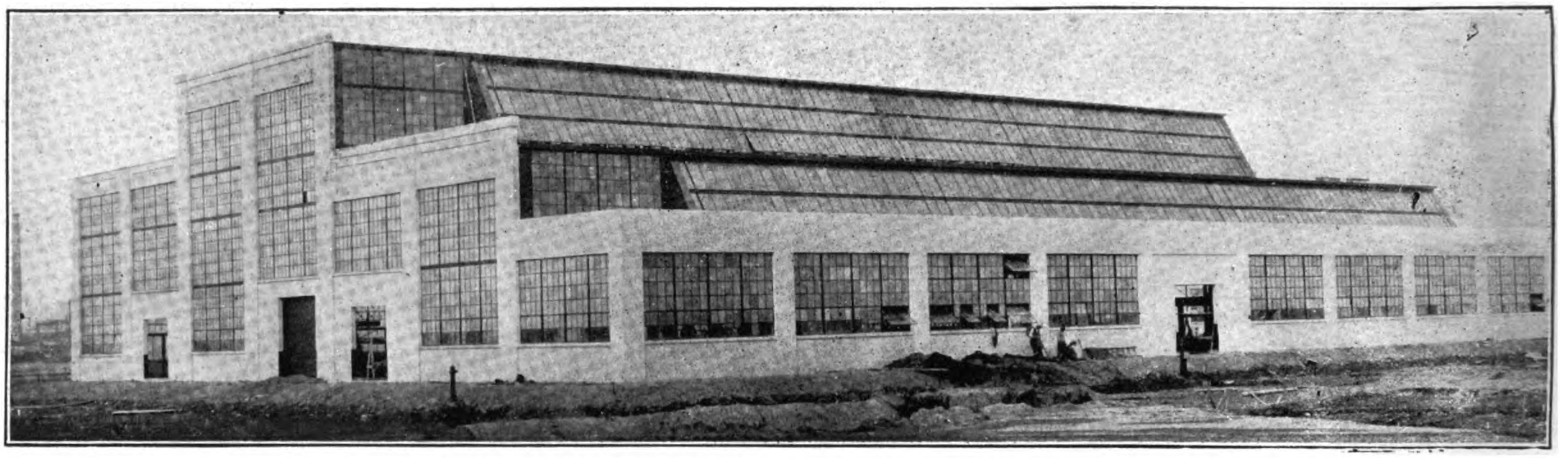
Machine Shop from West End



The Large Machine Shop of the New Plant of the Shibaura Engineering Works at Tsurumi, Showing the Building in Course of Construction and Completed

building is being equipped for the manufacture of A.C. and D.C. Generators for water wheel or steam drive, Rotary Converters, Synchronous Condensers, Steel Mill Motors, Railway Motors, D.C. and Induction Motors. The building will be served by electric travelling cranes ranging in capacity from 100 to 15-tons, with an ample number of jib cranes, and auxiliary hoists to serve individual tools, etc. This large shop, which for the present will contain the punch press, coil winding, and tool-making shops, is being equipped with steam and electric ovens, and electric furnces,a all designed for high efficiency, and absolute control.

Forge Shop: In the Forge Shop, with a floor area of 28,000 square feet, are now being installed a 500-ton Davy forging press, steam and air hammers, and oil-fired furnaces ; the latter to be equipped with recuperators, and operated under conditions of high efficiency. As this shop affords sufficient space for the present ; a portion of it will be used for a Plate Shop, Pipe Shop and Welding Shop.



The Forge Shop of the New Plant of the Shibaura Engineering Works

Pattern Shop : The Pattern Shop has been located temporarily in the warehouse, a three-story steel and concrete building, with a total floor area of 77,760 square feet. The very latest woodworking tools have been installed, and are in operation.

The building originally designed for the Pattern and Carpenter Shop is a two-story steel and concrete structure, with a floor area of 43,000 square feet. This building for the present will be used for the manufacture of electric control apparatus.

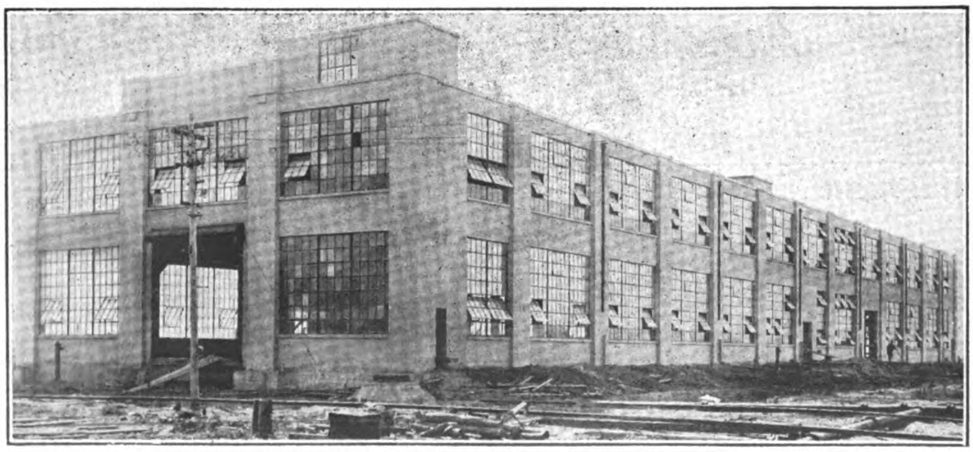
The warehouse, mentioned above, is of very substantial and fireproof construction, admirably suited to the purpose for which it was designed. For the present, and pending the erection of the office building, the warehouse will contain the executive and engineering offices, sufficient floor space remaining to serve its original purpose.

The floors of all of the buildings, where heavy machining work will be done, are of concrete and wood block, while iron floors of large and sufficient area are provided for large portable machine tool work, erecting, and testing purposes. As the percentage of glass area in all of the buildings is very high, the lighting is excellent, so that manufacturing of high order can be carried on under the best conditions obtainable.

It is the intention of the Shibaura Engineering Works to organize the work of manufacturing in the new plant, in the most efficient manner, and in accordance with the best modern practice. To ensure this, they have borrowed from the General Electric Company a manufacturing engineer, Mr. A. K. Warren, who for several years has been in charge of one of the largest manufacturing departments of the General Electric Company and other experts to supervise mechanical and electrical operations and foundry work, as well as an experienced man to assist in organizing the production, stock-keeping, and cost departments.

Among the largest machine tools to be installed at the present time are a 25-ft. Niles vertical boring mill, a 10-ft. by 10-ft. by 24-ft. Pond planer, an 84-in. by 30-ft. bed lathe, a 102-in. stroke Newton slotter, a 24-in. by 192-in. Norton cylindrical grinder, a 4-spindle Newton horizontal boring machine, a 10-ft. Cincinnati Bickford radial drill, a 6-in. spindle by 10-ft. Niles boring, milling and drilling machine.

A large number of heavy portable machine tools have been purchased, which will be operated upon a heavy iron floor which has been laid for the purpose ; amongst these portable tools are two 96-in. and two 60-in. stroke Newton slotters, two 4-in. spindle by 8-ft., and two 4-in. spindle by 9-ft. Sellers boring, milling and drilling machines.



The Pattern Shop of the New Plant of the Shibaura Engineering Works

More than two hundred and fifty large and medium-sized machine tools were purchased in the United States, in addition to a large amount of special equipment, such as steam and air hammers, oil-fired forging and heat-treating furnaces, electric annealing and tempering furnaces, baling presses, metal washing and cleaning machines, coil winding machines, and impregnating equipment, etc.

The orders for machine tools and other equipment were well distributed ; amongst those manufacturers receiving important orders may be mentioned :

The Consolidated Machine Tool Corporation of America, who furnished several Bett's heavy duty vertical boring mills.

The Niles, Vement Pond Co., Plainfield, N.J. : Heavy duty planers, horizontal boring, milling and drilling machine ; Pond engine lathes.

Bethlehem Steel Export Corporation, N.Y. : Detrick and Harvey openside planers.

Bullard Machine Tool Co., Bridgeport, Conn. : Vertical turret lathes, maxi-mill type.

Potter and Johnston Machine Co., Pawtucket, R.I. : 6 C and 6 A automatic chucking and turning machines.

International Machine Tool Co. : 24 and 26-in. Libby turret lathes.

American Tool Works, Cincinnati, Ohio : Several large heavy engine lathes.

The Hendey Machine Co., of N.Y. : Tool-makers' lathes.

Barrett Machine Tool Co., Meadville, Pa. : Horizontal boring mills.

The Newton Machine Tool Works, Philadelphia, Pa. : Slotting machines, duplex, and slab-milling machines, etc.

William Sellers & Co., Philadelphia, Pa. : Large portable type boring, milling and frilling machines, universal tool grinders and drill grinders.

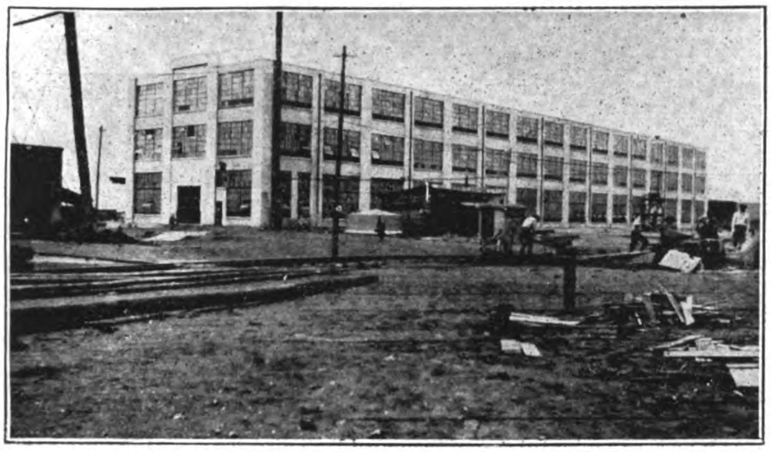
The Ingersoll Milling Machine Co. : Planer type milling machines.

The Van Norman Machine Tool Co., Springfield, Ohio : Duplex milling machines.

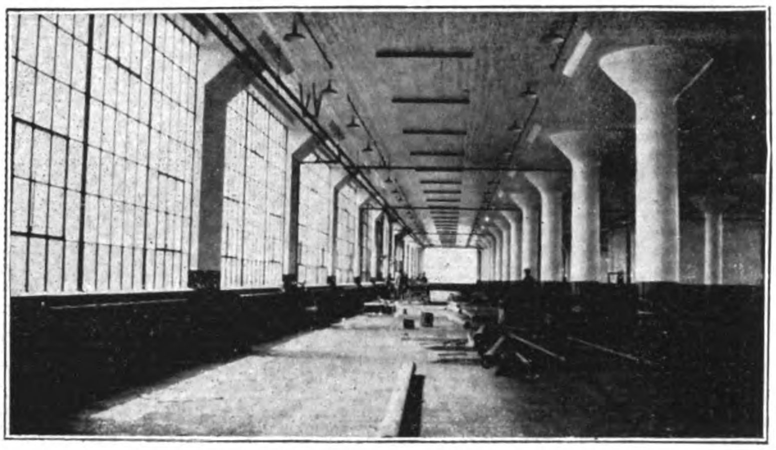
The Cincinnati Milling Machine Co., Cincinnati, Ohio : Plain standard, vertical and universal high-power milling machines.

The Norton Company, Worcester, Mass. : Large, medium and small cylindrical grinders ; also universal tool grinders.

The Cincinnati Bickford Tool Co., Cincinnati, Ohio : Radial aud upright drills.



Warehouse Building



Interior of Pattern Shop

THE NEW PLANT OF THE SHIBAURA ENGINEERING WORKS

The Fitchburg Machine Works, Fitchburg, Mass.: Lo-swing lathes for shaft work.

Manning, Maxwell & Moore, N.Y.: Boye and Emmes lathes, etc.

Pratt & Whitney Co., Hartford, Conn.: Vertical shapers, die sinking machines, fig boring machines, centering machines, contour cutter grinders, etc.

Brown & Sharpe Mfg. Co., Providence, R.I.: Universal, plain and vertical milling machines, surface and universal grinding machines and small tools.

The Heald Machine Co., Worcester, Mass.: Internal grinding machines.

Gisholt Machine Co., Madison, Wisconsin: Precision balancing machines.

J. N. Lapointe Co., New London, Conn.: Broaching machine.

Walter H. Forster Co., N. Y.: Bolt turning, facing and centering machines.

Landis Machine Co., Waynesboro, Pa.: Double-head bolt threading machines.

Ferracute Machine Co., Bridgeton, N.J.: External and internal notching presses.

Waterbury Farrel Foundry and Machine Co., Waterbury, Conn.: Bench presses.

Andrews & George Co., New York: Marshalltown throatless rotary shears.

Logerman Brothers Co.: Hydraulic scrap metal baling press.

Oliver Machinery Co., Grand Rapids, Mich.: A large variety of wood working machinery.

J. A. Fay & Egan, Cincinnati, Ohio: Woodworking machinery, drum sanders, belt sanders, etc.

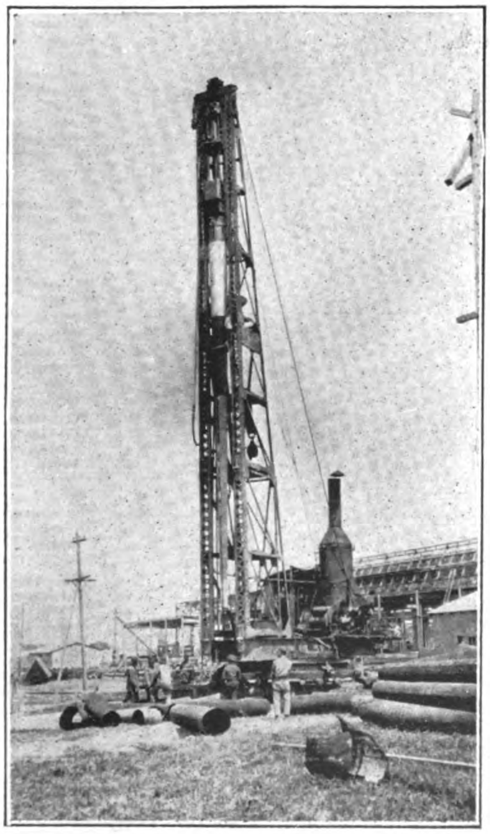
Massilon Foundry and Machine Co.: Steam hammers.

Nazel Engineering Machine Works: Air hammers.

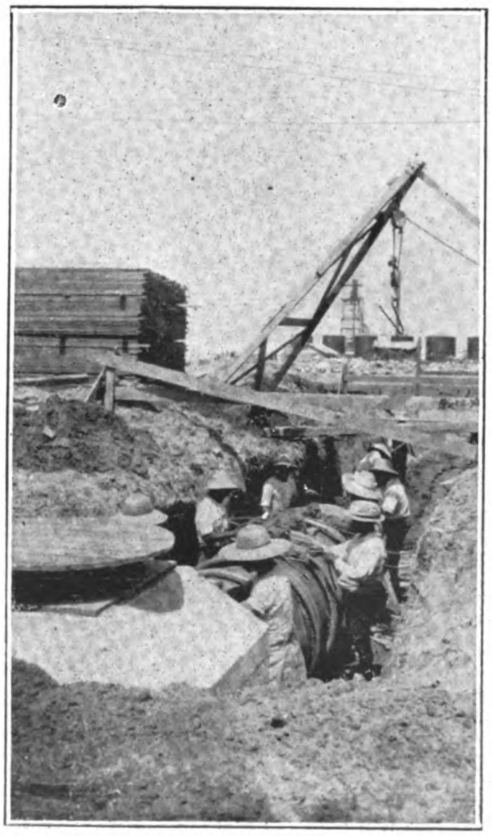
Ferguson Furnace Co., Toledo, Ohio: Oil-fired forging and heat treating furnaces.

J. P. Devine & Co.: Impregnating tanks, vacuum pumps, compressors, etc.

Thomson Welding Co., Lynn, Mass.: Butt welders, spot welders, etc.



Raymond Concrete Pile Driver



Laying Sewer Pipe

Warehouse and Water Tower

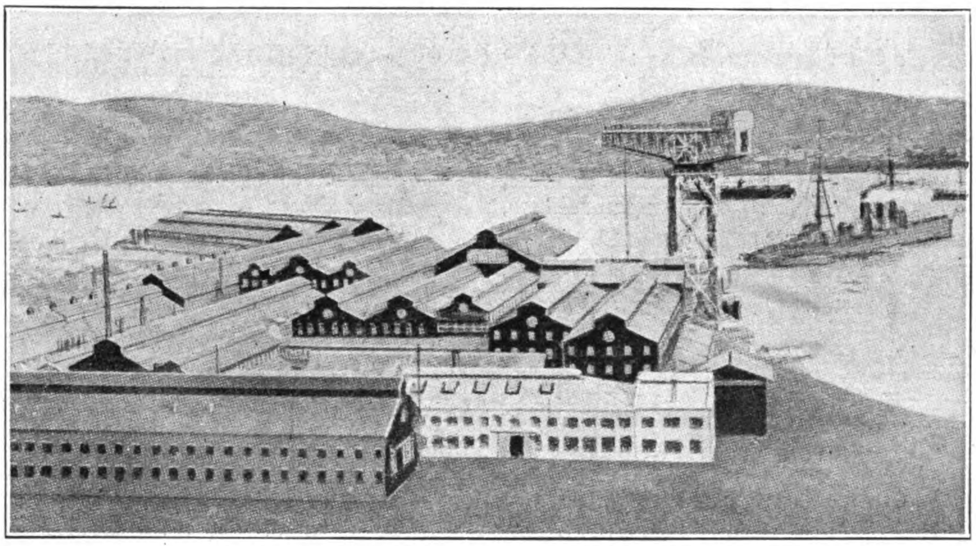
Electrical Manufacturing in Japan

The Mitsubishi and Hitachi Electrical Engineering Works

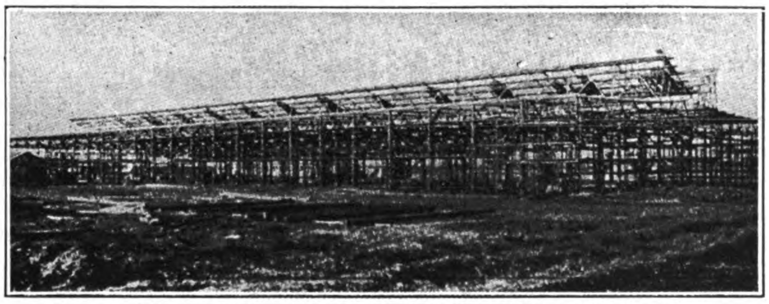
THAT the electrical services of Tokyo and Yokohama were restored so promptly after the earthquake and fire is due in large part to the remarkable growth of the electrical machinery industry in Japan, which is rapidly freeing the country from foreign importations in all except the heaviest units. While in no way minimizing the splendid co-operation of the great foreign electrical concerns in the rapid reconstruction work, it may be fairly said that on their Japanese competitors fell the task of furnishing the rush orders for the great bulk of the materials and machinery which made possible in such a short time the recovery of the tramway and lighting services of the devastated areas.

The development of the electrical manufacturing industry in Japan to its present high state of efficiency has taken place in the comparatively short space of fifteen years. Before 1910 the few factories then in operation were occupied with producing the smaller types of machines and accessories, but as utilization of water-power increased and intensified the demand for generators, motors and the thousand-and-one specialties connected with the use of electricity, the producing capacity of these factories was rapidly expanded. At first the design and general efficiency of these Japanese-made machines fell below the standards of Western manufacturers, traceable largely to the inexperience of the Japanese mechanic and technician as compared with the generations of skilled training behind their fellow-workers in Europe and America. These defects are being rapidly overcome, and at the present time the design and finish of the products of the four or five leading Japanese manufacturers are equal to those of the best foreign makers. Due, perhaps, to the limitations of the market and the obstacles to large scale production, these Japanese machines are not very much cheaper than those imported from abroad. Another factor which militates against cheap production is the rather exaggerated scale of wages and living costs, combined with a lack of essential raw materials which have to be imported. In nearly all the accessory lines, such as meters, transformers, switchboard apparatus, insulators, copper and insulated wire, incandescent lamps, fans, etc., the Japanese manufacturing establishments are now able to supply the domestic demand and even to export a large part of their output to other Asiatic countries.

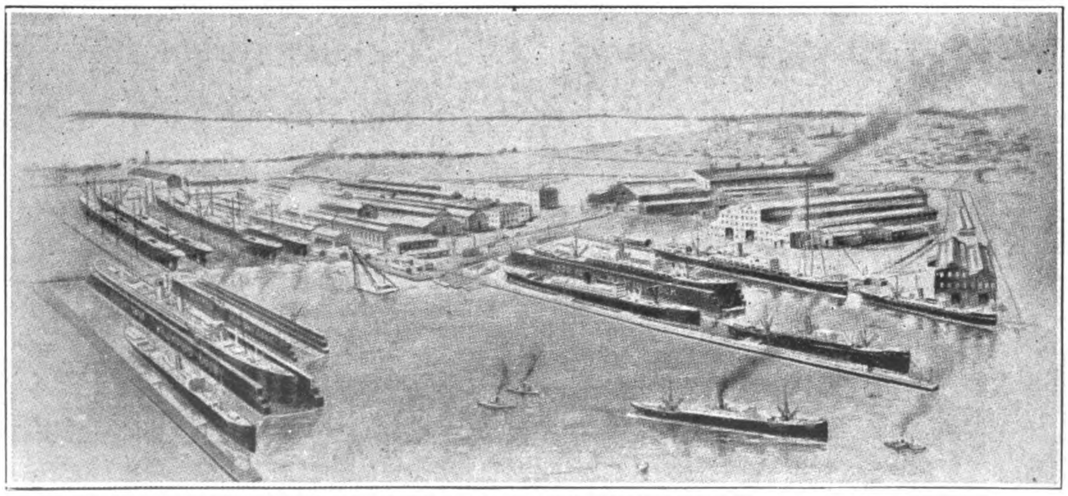
There are over fifteen manufacturers of electrical machinery and appliances in Japan whose products are noted for the high quality of their workmanship and efficiency, and although they have not yet arrived at that stage where their facilities permit the fabrication of the largest units, they practically dominate the home market for generating sets up to as high as 15,000 k.w. Amongst those whose products have achieved distinction stand the names of Shibuara, Mitsubishi, Hitachi, Fusi, Okumara, and the Dengyosha. The Shibaura Engineering Works, a Mitsui subsidiary, whose new plant at Tsurumi is fully described in another part of this journal, works in close co-operation with the General Electric Company of America, enjoying all manufacturing rights to its patents as well as an interchange of experts. The new plant is being erected with the set purpose of revolutionizing Japanese manufacturing methods along lines of American efficiency that will permit the company to market its products not only in Japan, but in other parts of the Far East in competition with American and European manufacturers.



Nagasaki Works of the Mitsubishi Electric Engineering Cc., Ltd.



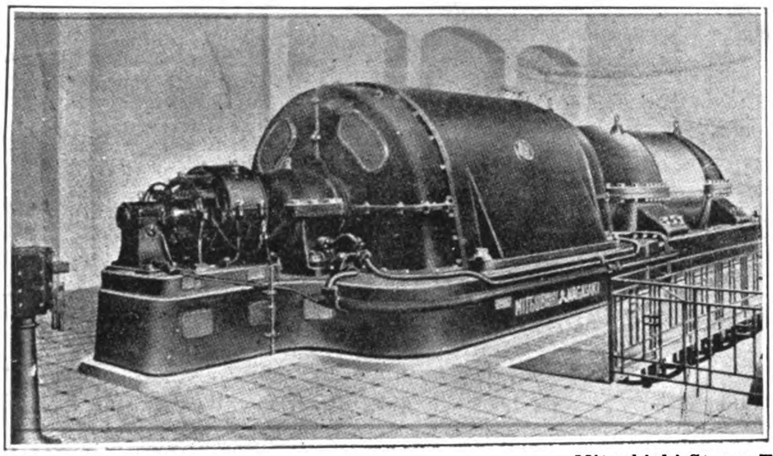
Nagoya Works of the Mitsubishi Electrical Engineering Co., Ltd., to be completed in 1926

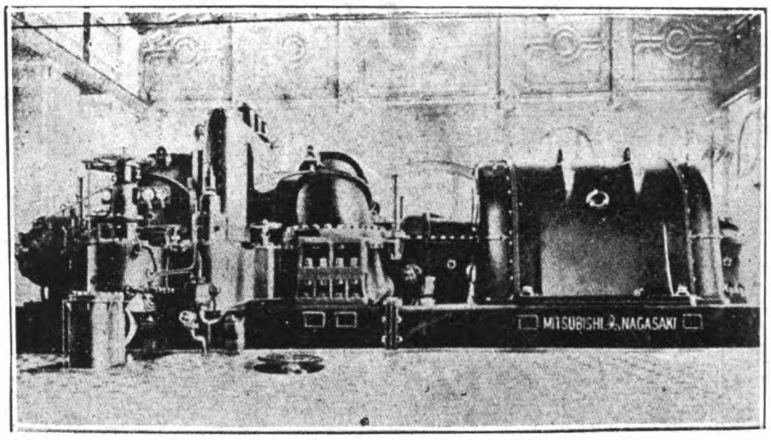


General View of the Kobe Works of the combined Mitsubishi Dockyard, Electric and Internal Combustion Engine Works at Kobe

The Mitsubishi Electrical Engineering Company

The Mitsubishi Electrical Engineering Company is another of the large Japanese electrical machinery manufacturers that has forged ahead, and





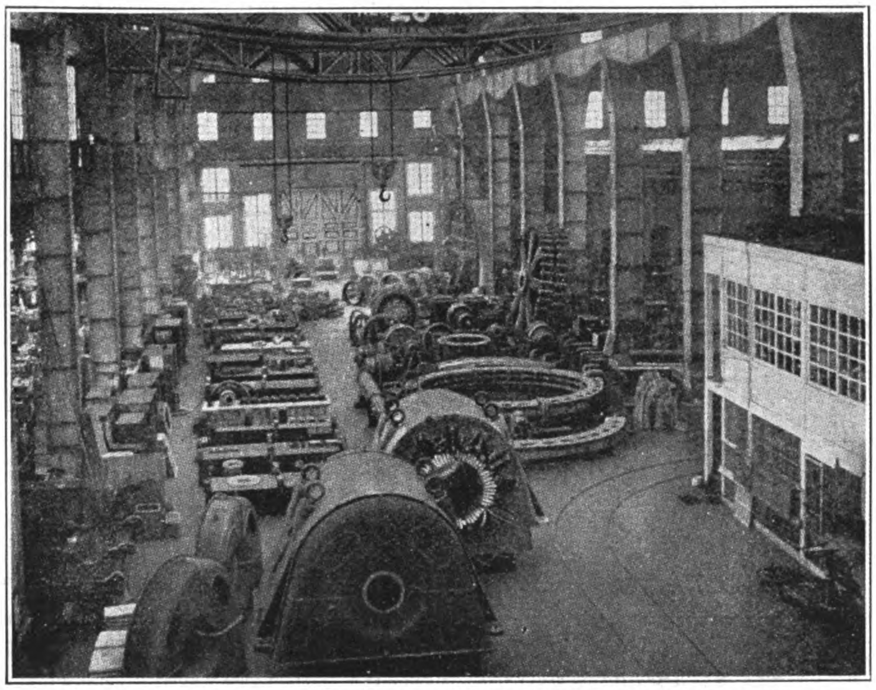
Mitsubishi Steam Turbo-Generating Sets

8,000 k.w. Generator Set **12,500 k.w. Set**

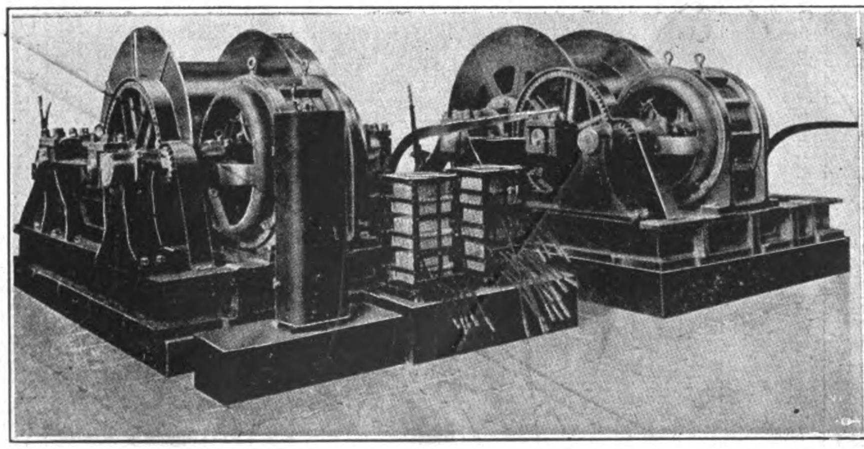
built up a great domestic business in the face of foreign competition.

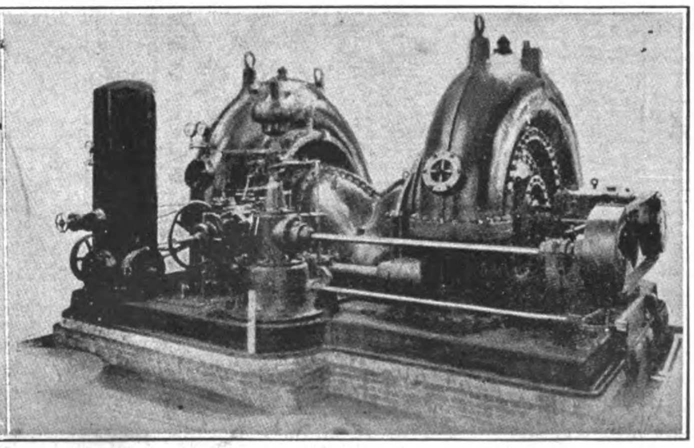
We had hoped to include in this number of THE FAR EASTERN REVIEW a detailed description of the activities of the Mitsubishi Electrical Manufacturing Company, whose organization and facilities enabled it to take such a prominent part in the rapid restoration of the electrical services in the devastated areas. The publication of this article must be deferred for some future number of this magazine.

The activities of the great Mitsubishi Consortium are so varied and widespread that it would require another special number of this magazine adequately to describe their many manufacturing and engineering plants. In the electrical field the Mitsubishi stands as one of the pioneers in developing the industry in Japan to its present proud position, being compelled to undertake the manufacture of electrical machinery and appliances in order to fill the big demand for ships constructed at their Nagasaki and Kobe shipyards and to supply the many mines and collieries owned and operated by their mining department. In exactly the same manner that the Shibaura and Hitachi Engineering Works and nearly all other prominent Japanese industrial undertakings were developed from purely private plants into great manufacturing concerns, the Mitsubishi Electrical Manufacturing Company had its origin in an electrical shop established in 1905 at the Mitsubishi shipyard at Nagasaki to manufacture electrical apparatus for their own requirements. This shop was followed by a similar one at the Mitsubishi Kobe shipyard, and both plants were soon called upon to manufacture electrical machinery for the general market. The rapid growth of the electrical industry during the war was met by a corresponding increase in the capacity of these plants until it became necessary to organize an electrical engineering company separate from the shipbuilding industry to operate them. This was done in February 1921, when the Mitsubishi Electrical Engineering Company, Ltd., was incorporated with a capital of Yen 15,000,000 and took over all the business of the Electrical Department of the Kobe shipyard with its assets and



Electric Erecting Shop at the Nagasaki Works of the Mitsubishi Electrical Engineering Co., Ltd.



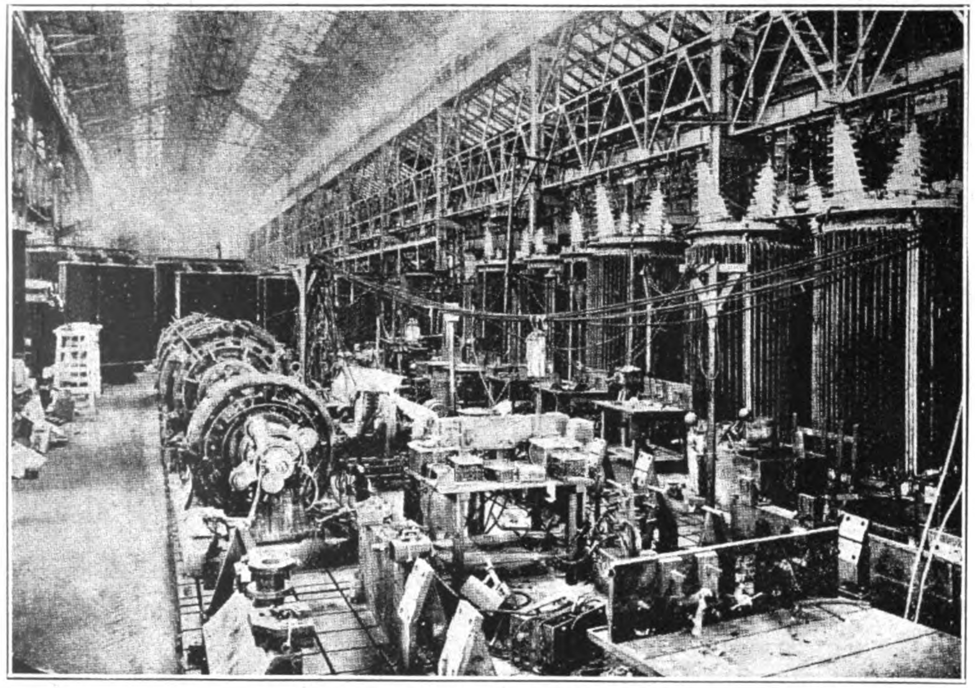


Mitsubishi Electrical Specialties

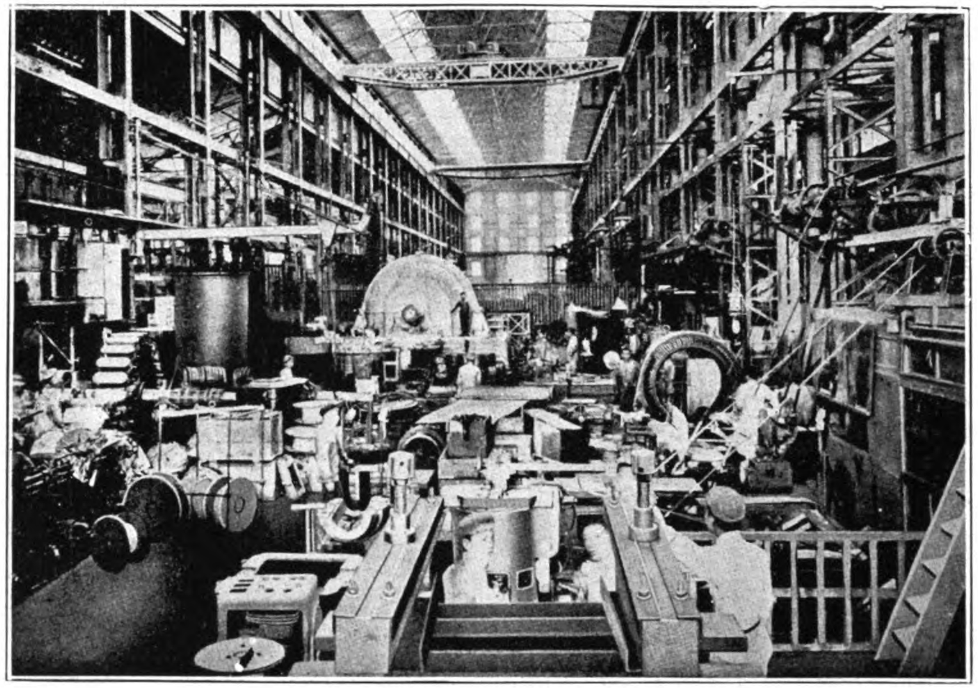
Single Drum Jaw Clutch Reversible Electric Winding Engine with Motor and Controller

10,500 h.p. Water Turbine

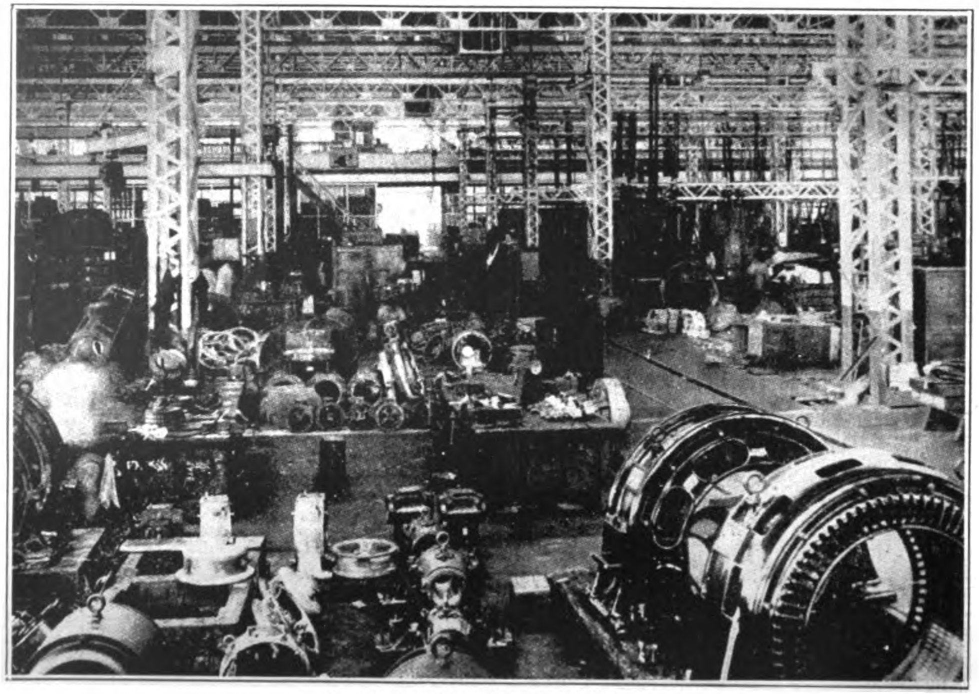
KOBE AND NAGASAKI SHOPS OF THE MITSUBISHI ELECTRICAL ENGINEERING CO., LTD.



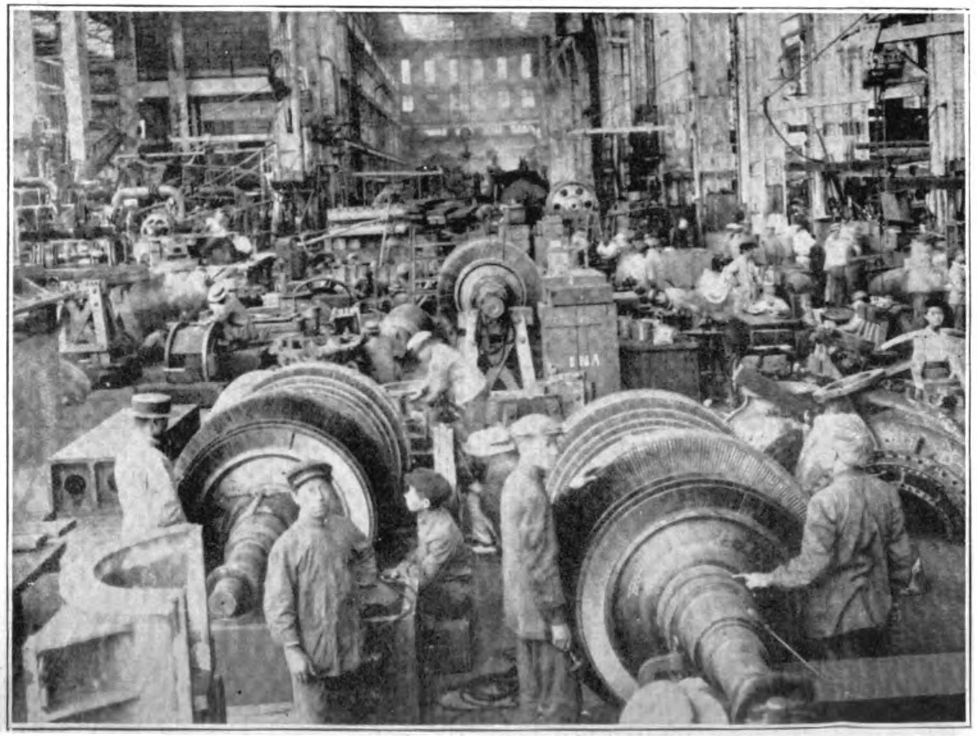
Transformer Testing Shop, Kobe Works



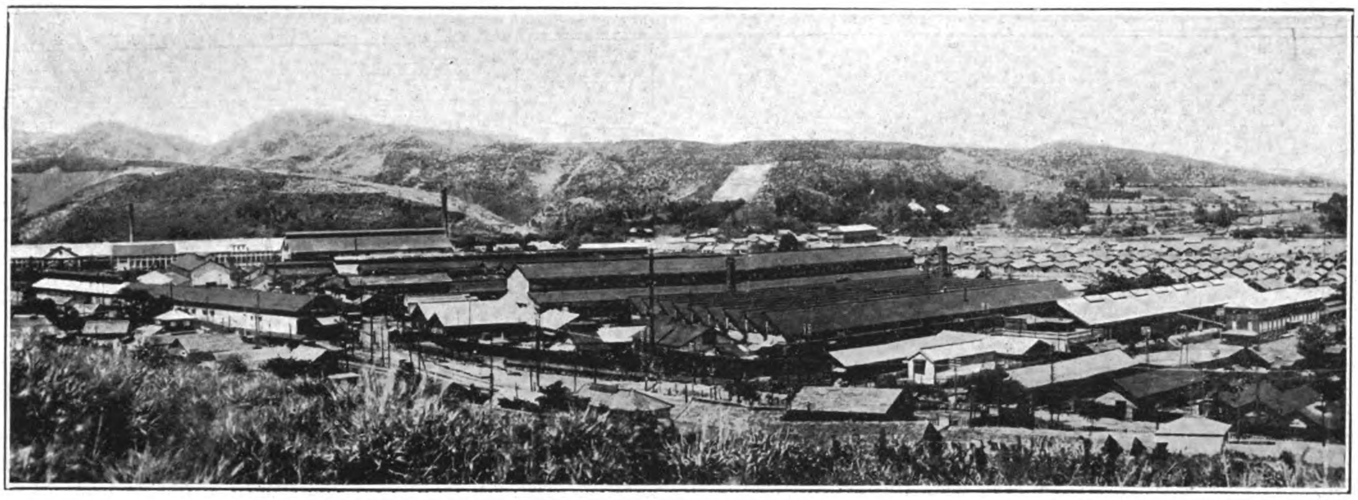
No. 2 Electric Shop, Kobe Works



Generator Shop, Nagasaki Works



Turbine Shop, Nagasaki Works

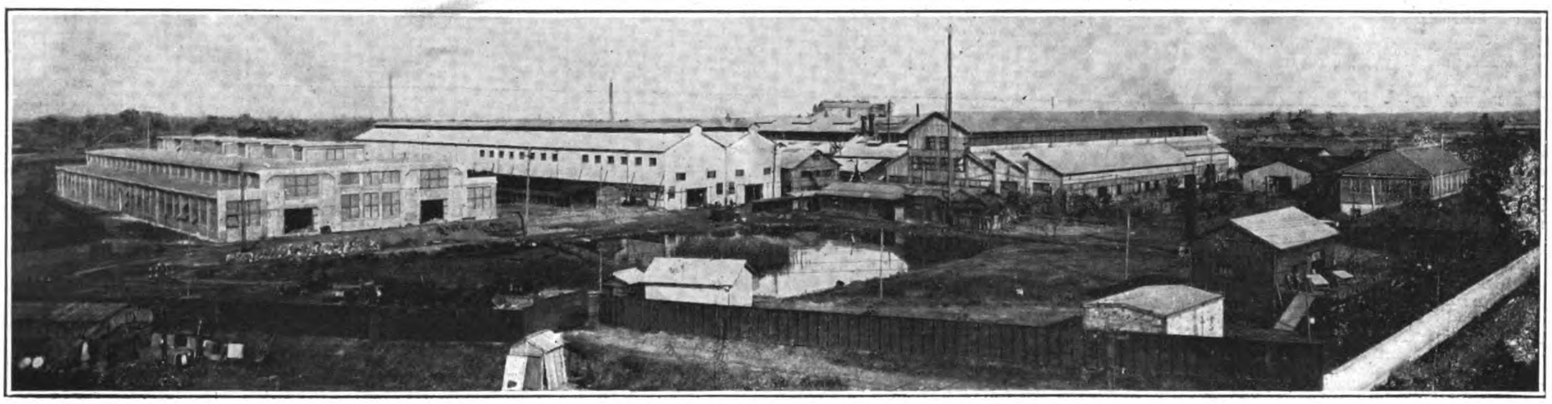


Hitachi Factory of the Hitachi Engineering Works, Ltd., located near Sukegawa, Ibariki]Prefecture

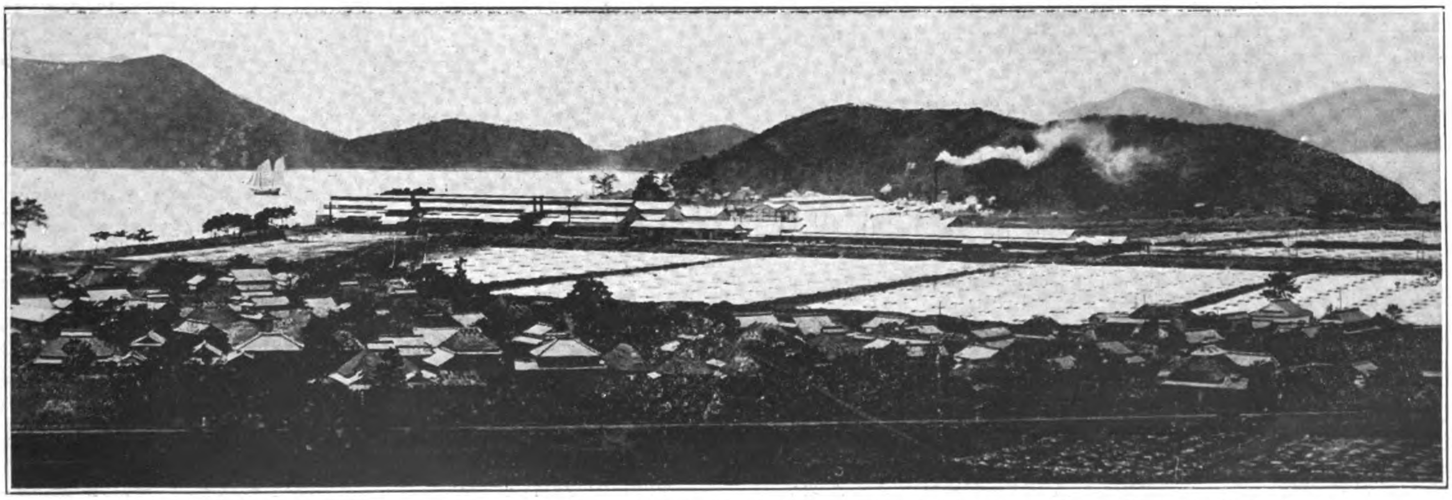
liabilities and a site purchased at Nagoya for the erection of a new works. The Electrical Department of the Nagasaki shipyard was then absorbed, giving the new company three of the best engineering plants in Japan for manufacturing purposes.

For many years prior to the organization of the Electrical Manufacturing Company, the Mitsubishi Company held the manufacturing rights for Parsons' steam turbines and alternators as well as the Ljungstrom turbines and generators. Many high-power sets for Japanese electrical plants had been turned out under these arrangements. Last year a working agreement was entered into between the Mitsubishi Electrical Engineering Company and the Westinghouse Electric and Manufacturing Company of America, under which the patents, designs and manufacturing knowledge of the latter company will become available for the Japanese company, a combination similar to that which binds the General Electric Company with the Shibaura Engineering Works and really strengthens the position of both Americans and Japanese in th Asiatic electrical world.

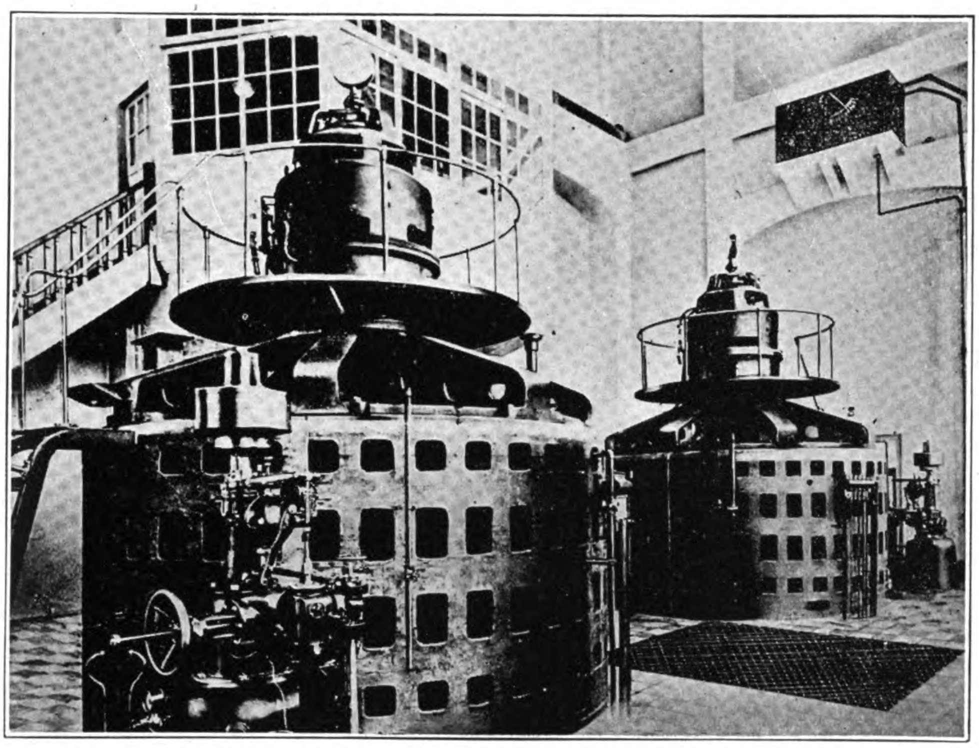
The Nagasaki Works of the Mitsubishi Electrical Manufacturing Company are located in the south-eastern part of the city of Nagasaki, covering an area of 5,000 *tsubo*, with a floor space of 3,000 *tsubo*. This plant is complete in every respect and is noted for the high quality of its products. The Kobe works are located near Wada Point, at the south-western entrance to Kobe harbor, alongside the workshops of the Mitsubishi Shipyard and the Mitsubishi Internal Combustion Engine Works, and cover an area of 5,800 *tsubo*, with 4,200 *tsubo* of floor space. The works specialize in the production of direct current generators and motors, traction motors, synchronous motors and generators, induction motors, commutator motors, single phase and fan motors, rotary converters, special machines, phase advancers, phase converters, high frequency generators, frequency changers, transformers, turbo-generators,



The Kameido Factory of the Hitachi Engineering Works, Ltd., located at Kameido, a suburb of Tokyo



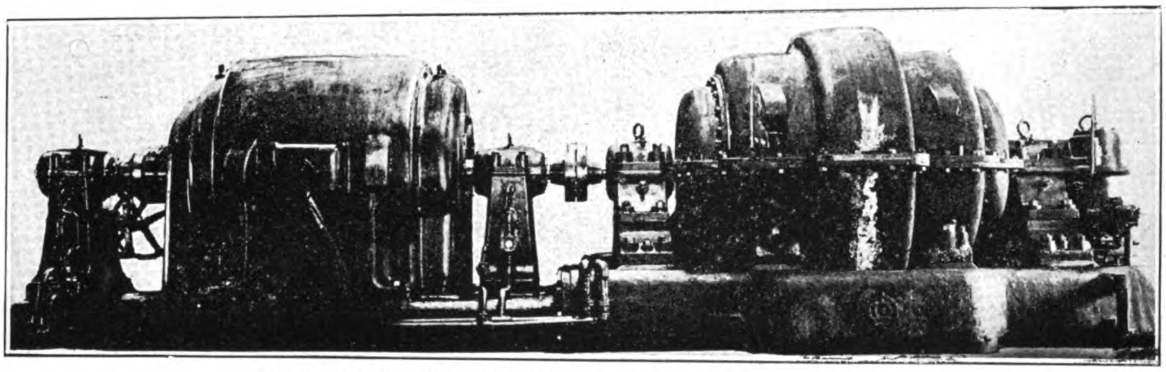
The Kasato Factory of the Hitachi Engineering Works, Ltd., located at Kasato, on the Inland Sea, in Yamaguchi Prefecture



Power House of the Kidogawa Hydro-Electric Company equipped with 4,440 k.v.a., 6,600 volt Generators driven by 7,400 h.p. Water Turbines furnished by the Hitachi Engineering Works, Ltd.

interests, rapidly making a name for itself in the engineering world that is bound to become more widely known throughout the Far East. For the present these Japanese makers of high-grade machinery have been concentrating their energies upon solidifying their position in the home market before venturing afield, and for this reason outside of electrical circles very little is heard of their activities. During the war, however, many large generating sets bearing the trade-marks of these companies were sold in other Far Eastern countries, where they now stand as sign-posts pointing to future possibilities. The time is rapidly approaching when the improved equipment and manufacturing facilities of these plants will require a larger market in order to maintain them in full operation, and then with proper publicity the names of Shibaura, Mitsubishi and Hitachi will become as well known in the Asiatic market as the older-established foreign manufacturers of electrical machinery.

The first step towards this ultimate goal is seen in the new Shibaura plant at Tsurmi, to be followed by the Mitsubishi-Westinghouse and the Furukawa-Siemens combinations. The Kuhara interests have not as yet linked their fortunes with any foreign electrical manufacturing concern, but are developing along purely Japanese lines, feeling their way cautiously, increasing the size and capacity of their output until their works are now able to turn out 10,000 k.v.a. generating units and 59-ton electric locomotives for the Imperial Government Railways which



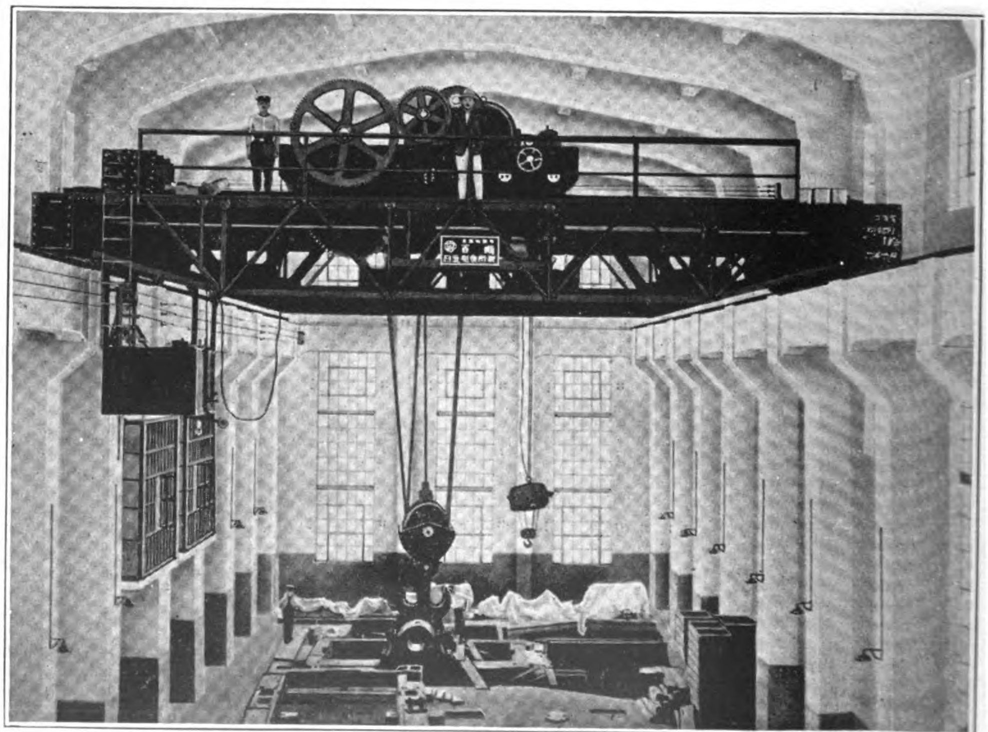
360 h.p. Turbo-Blower made by the Hitachi Engineering Works

electric locomotives, switchboards and instruments, switch and controlling gear and all kinds of electrical motors for special purposes. Up to 1924 these works had turned out a total of 121,250 k.w. generators for land service and 7,914 k.w. for marine work.

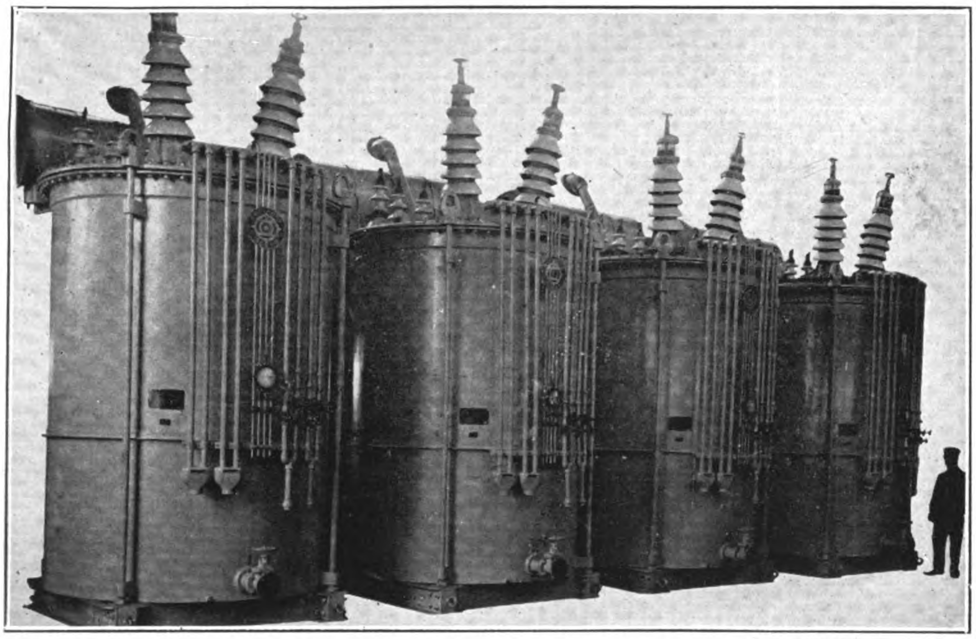
Its facilities and organization were maintained at such a high state of efficiency that when the great quake and fire destroyed the electrical communications of the stricken area they were able to supply immediately 1,500 50-h.p. traction motors for the Tokyo tramways, an accomplishment which did more to restore the tramway service than anything else. All these motors were combined with Westinghouse type air brake equipment manufactured at the Mitsubishi Works under an exclusive arrangement which gives them the manufacturing rights for Japan.

The new electrical manufacturing plant in course of construction at Nagoya will cover an area of 82,000 *tsubo*. The latest and most improved machinery and appliances are being installed, and the works when completed will be second to none in the Far East. With these three large plants, and the experience in engineering manufacturing enjoyed by the Mitsubishi experts and technicians, the new company will be an active and formidable factor in the Asiatic electrical market.

The third large Japanese electrical manufacturing concern is the Hitachi Engineering Works, Ltd., a subsidiary of the Kuhara

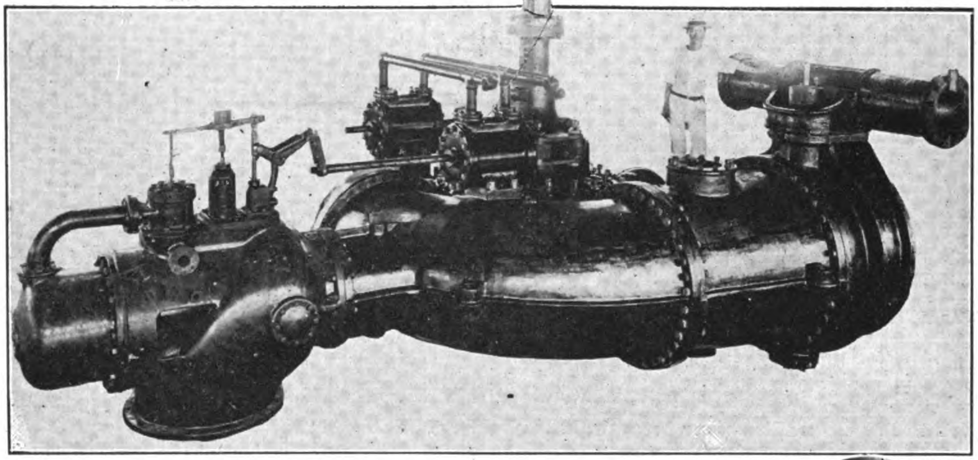


100-ton Hitachi Overhead Travelling Crane in the Generating Room of the Nagatsugawa Power House of the Shinyetsu Electric Company



10,000 k.v.a. Hitachi Oil Cooling Transformers for the Tokyo Electric Light Co., Ltd.

in every respect are equal to the workmanship of the best foreign manufacturers. Like the Mitsubishi, the Hitachi combination enjoys the advantage of combining with an electrical manufacturing plant two other engineering factories which turn out steam and water turbines, reciprocating engines, locomotives, mining and other machinery, enabling it to build complete units for any purpose. Its generating sets, both steam and hydro-electric, are now scattered throughout the empire in many of the important power plants.



5,700 h.p. Hitachi Turbine installed at the Power Plant of the Kinugawa Hydro-Electric Co.

The Hitachi Engineering Works

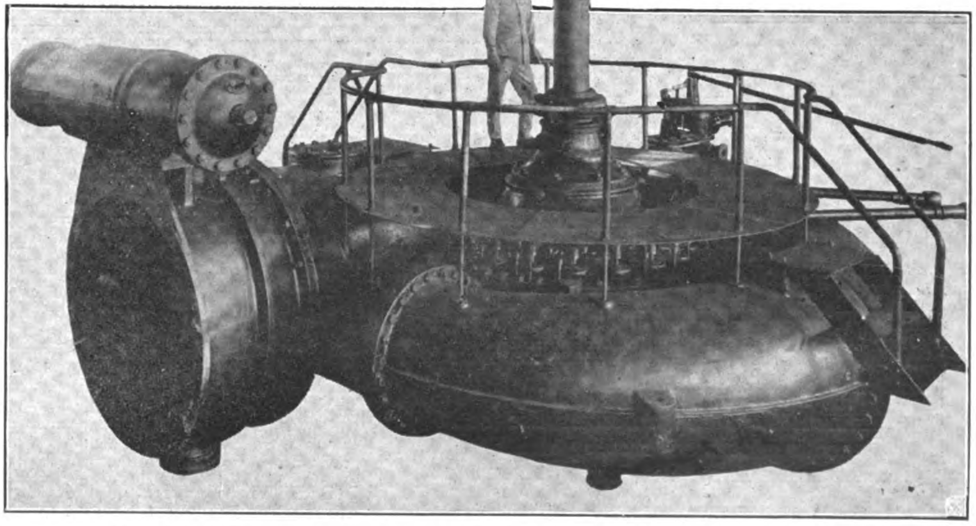
Like many other large Japanese enterprises, the Hitachi Engineering Works grew from a small beginning, being originally an adjunct to the Kuhara Mining Plant in Ibariki prefecture, created in 1909 for the purpose of manufacturing the mechanical equipment for the company's mines. The quality of the work turned out was so high that it was not long before the machine shop outstripped the private demands upon its manufacturing capacity, and two years later it was made independent of the mining plant and entered upon a general manufacturing career. When the Kuhara Mining Company, Limited, was organized in 1912 and took over the mining plant, the machine shop was incorporated in the new organization as the Hitachi Engineering Works. The great expansion of the plant as a result of the war induced the Kuhara interests to make another change by creating a limited company with a capital of Yen 10,000,000 to take over the works. The capital was half paid up at the time of its incorporation, and in the following year, when the company purchased the dockyard of the Nippon Kisen Kaisha at Kasato, the other half was called and paid in. With this plant and the Kameido works of the Kuhara Company in Tokyo, the Hitachi combination had three of the best-equipped engineering establishments in Japan for carrying forward its program. Their factories being located outside the earthquake area, the Hitachi Engineering Works were able to play a very important part in the reconstruction of the electrical services, restoring the rotary converters at the Kanda sub-station and the switching apparatus at the Eirakucho sub-station and repairing and equipping about 100 tramcars for the city of Tokyo. They are also furnishing more than eighty per cent. of the machinery and material for the extension and improvement of the Keihin Electric Line.

Hitachi Factory

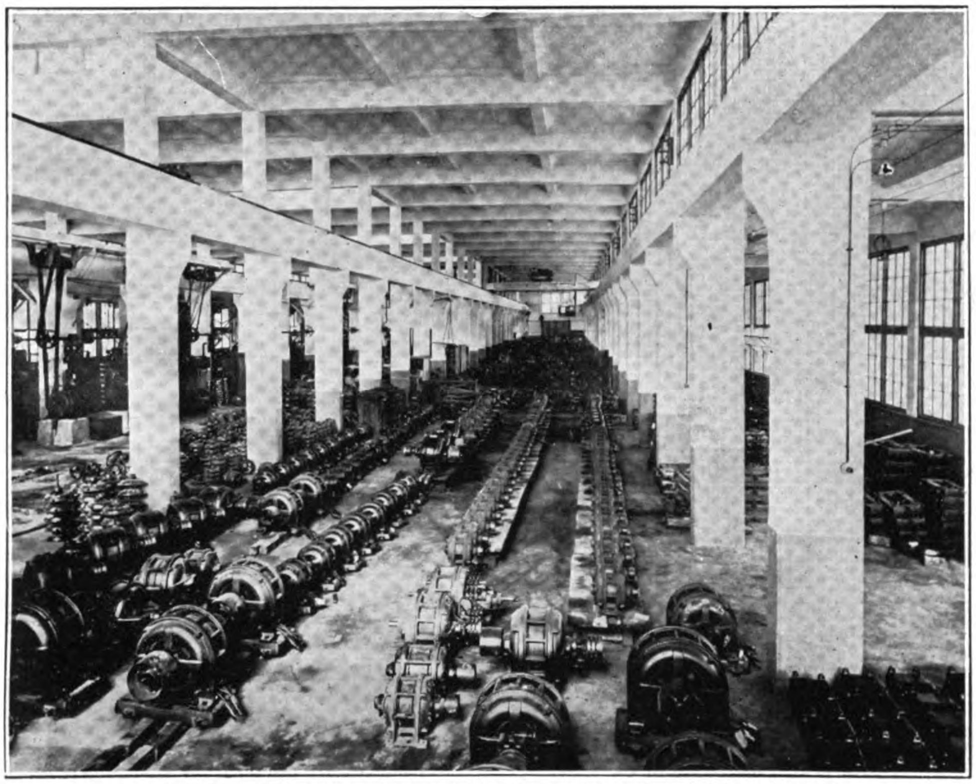
From its inception the Hitachi Works ha specialized in the manufacture of electrical machinery, but in 1908 it added a complete plant for the manufacture of bare and insulated copper wire, copper plates and copper bars, and when the demand for its main products outgrew the capacity of the original works they were remodelled in 1920 for the exclusive use of the wire factory and a site purchased in the immediate neighborhood on which a new electrical manufacturing plant was erected. These works are now devoted exclusively to the manufacture of generators, motors, rotary converters, switchboards, fans, lighting arresters, meters, transformers and other electrical machinery, apparatus and accessories. The annual turnover is valued at about Yen 15,000,000, but the full-time output will add another five million yen to this figure.

Hitachi Specialties

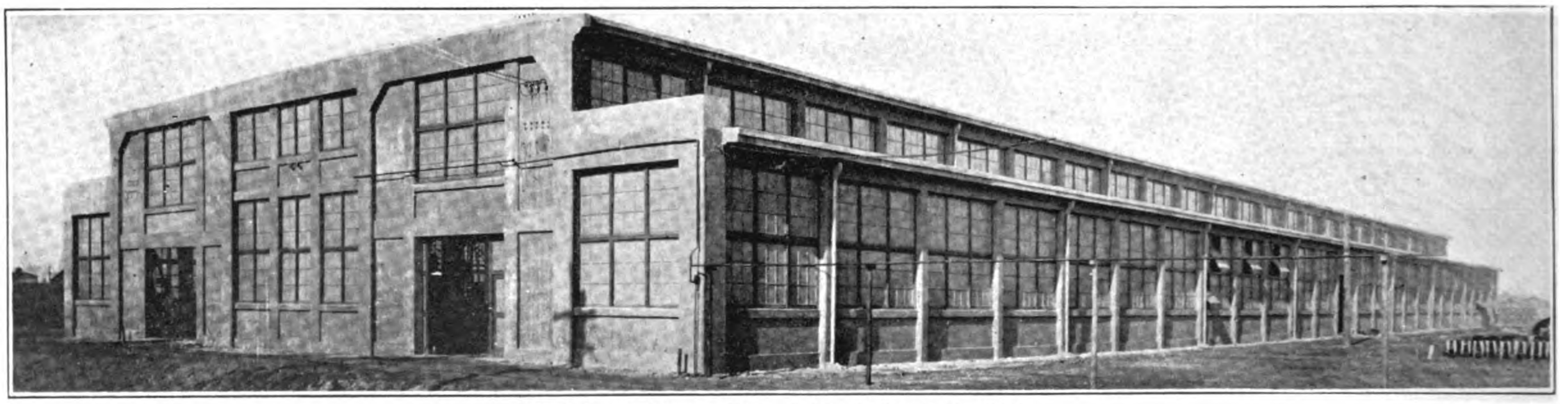
In the short space of sixteen years the Hitachi Engineering Works has established a reputation to be proud of, reflecting the highest credit on the ability of the Japanese engineers in mastering what had been held as beyond their ability to achieve. Every advance has been made only after the most thorough and painstaking study and experiments, and only after



4,500 h.p. Hitachi Water Turbine for the Hiroshima Electric Light Company



Small Motor Finishing Room in the Kameido Factory of the Hitachi Engineering Works, Ltd.



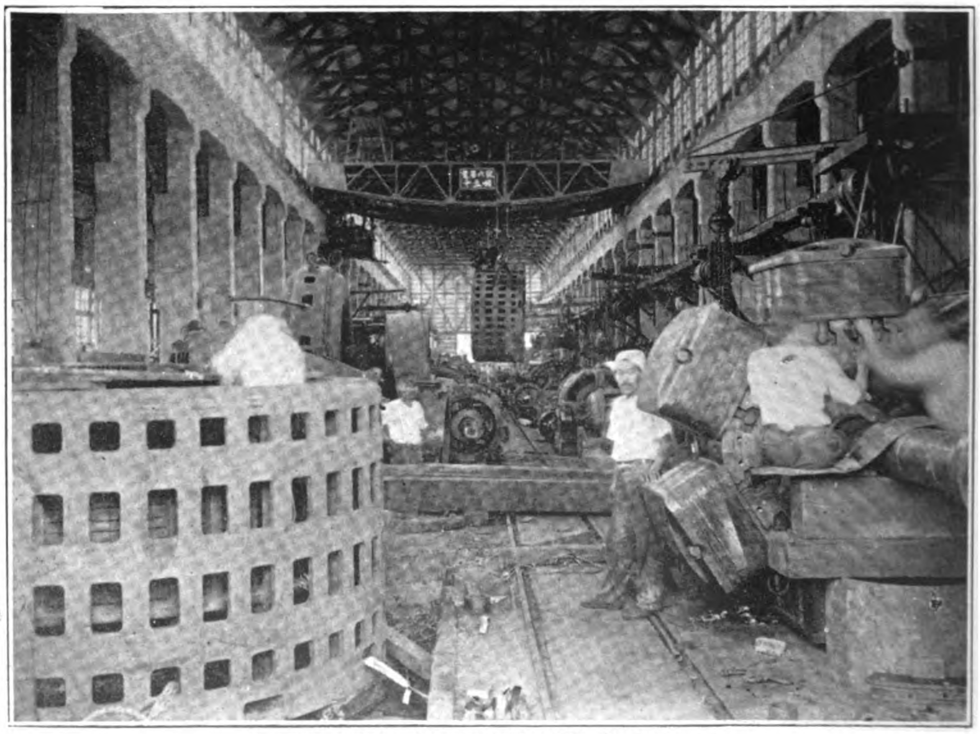
Electric Machinery Shop of the Kameido Factory

being assured of the quality of the product has it been placed on the market. The first small alternating generators were produced in 1909. In a few years the works were turning out high-speed 600 k.v.a. machines, and by 1920 had advanced to the stage where 1,000 k.v.a. turbo-generators operating at 3,000 r.p.m. were being made and sold in the market in active competition with foreign generating sets. The Takenosawa power station of the Kinugawa Electric Company (supplying the power for the Tokyo tramways) was then equipped with four Hitachi 4,444 k.v.a. vertical generators, and orders were then filled for 6,000 k.w. machines. For a long time it was considered that the Japanese could not successfully manufacture synchronous rotary converters, but here again the Hitachi Works demonstrated that this belief was unfounded, as in 1922 it turned out a 50 cycle, 600 volt, 1,000 k.w. machine, since when several other orders have been filled.

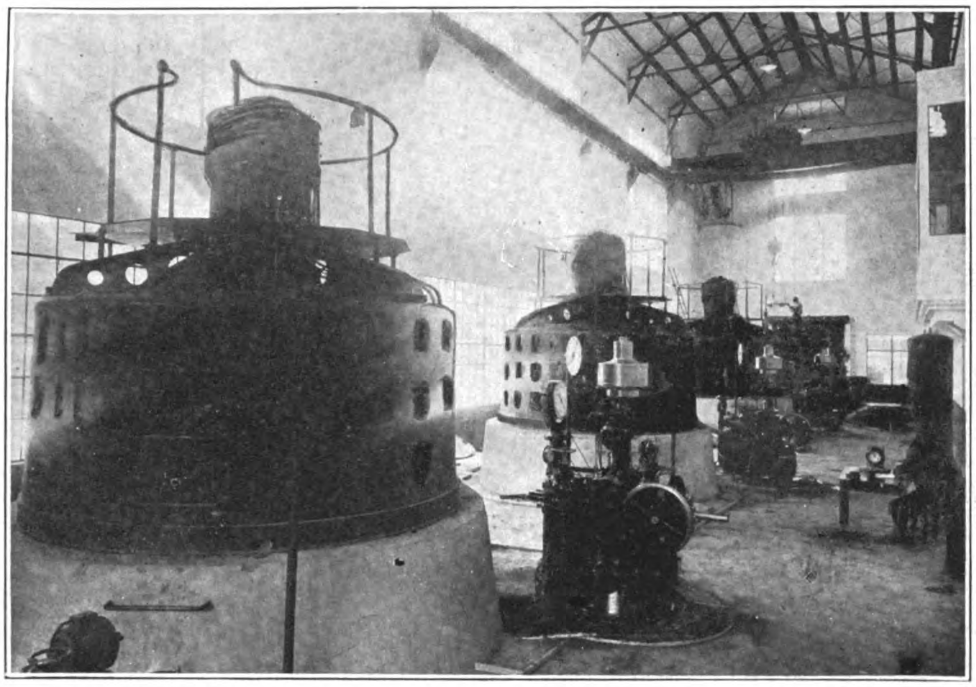
Aluminum lightning arresters for 66,000 volts alternating current bearing the Hitachi trade-mark and others for direct current are to be found in many of the power plants and sub-stations throughout Japan. The works also specialize in induction motors of large horsepower capacity supplied to mines, cement, paper and textile mills, for driving centrifugal pumps and blowers and for other purposes. High-speed induction motors have been turned out at the Hitachi works since 1911, when the first 275 h.p., 3,000 r.p.m. machine was made. Motors of over 600 h.p., operating at 3,600 r.p.m., are now among its standard products, while direct current motors for tramcars, cranes, hoists and other purposes, as well as for electric locomotives, have found a wide market.

Hitachi transformers are now accepted throughout Japan as equal to the best foreign makes, reaching the point where the works are now turning out 10,000 k.v.a. water-cooled apparatus. After overcoming many difficulties, three phase transformers up to 4,500 k.v.a. were made for the Aomi plant of the Electro-Chemical Manufacturing Company with a primary winding for 6,600 volts and secondary of 109 volts. They have also developed an oil circuit breaker of such merit that the Railway Department has installed 73,000 volt, 50,000 k.v.a. capacity breakers at the great Kawasaki sub-station, and the Daido Electric Power Company has one of 88,000 volt, 100,000 k.v.a. capacity at its Abiko sub-station.

In order to make the works self-contained, the Hitachi interests have also developed the manufacture of insulating paint and material for its own requirements and is now preparing



Large Electrical Shop of the Hitachi Factory



Komatsu Power House of the Tokyo Electric Light Company, equipped with 6,750 h.p. Water Turbines and 4,800 k.v.a., 6,600 v., 50-cycle Generators made by the Hitachi Engineering Works

to enter the market with these products. In the same manner they have perfected a high grade of oil for cooling transformers and circuit breakers which the Department of Communications has approved as being superior to the imported article. In the matter of electric meters, the Hitachi Works are now manufacturing apparatus of great accuracy, attaching them to all its switchboard work. They also own marble quarries located within two miles of the works from which are derived the slabs for switchboards, elaborated and polished at a special shop equipped with the most improved machinery.

Electric Locomotives

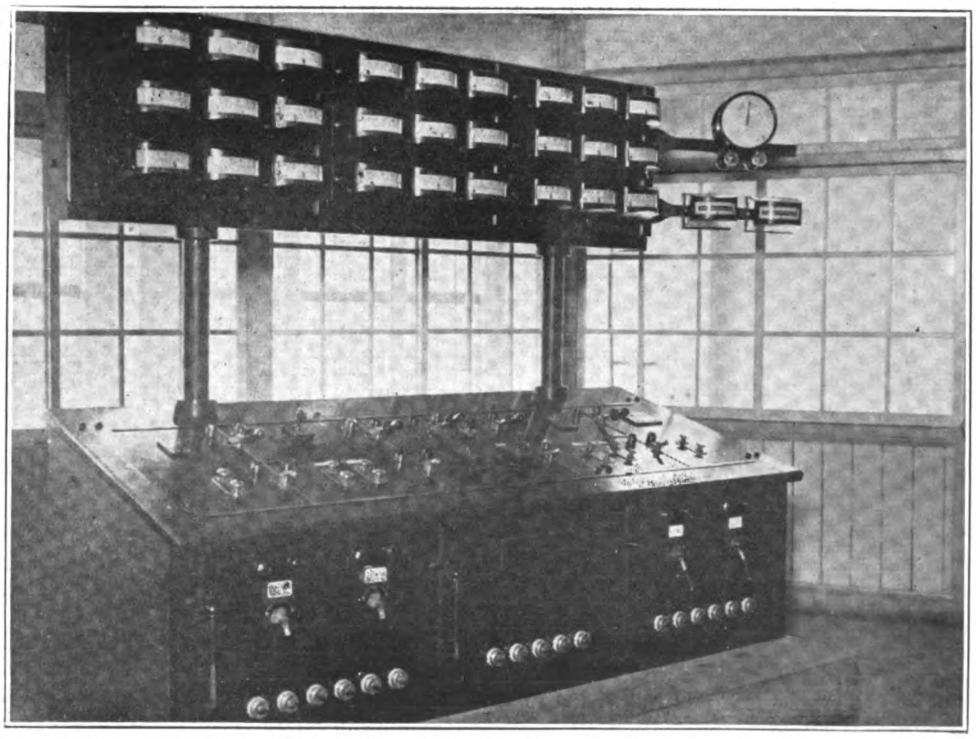
For many years the Hitachi Works specialized in the manufacture of electric locomotives for mining purposes, all the Kuhara mining properties being equipped with locomotives from these works. In acquiring the Kasato Works of the Nippon Kisen Kaisha the Kuhara interests were primarily concerned in utilizing this plant for the manufacture of steam locomotives as well as other heavy machinery. When the Railway Department determined to electrify the main lines and ordered eight test locomotives from approved western makers, following this up by placing orders for 36 with the English Electric Company, the Hitachi Engineering Works declined to accept what appeared to them as an official reflection on the ability of the Japanese to manufacture electric locomotives suitable for main line traffic. They had already successfully made electric locomotives for main line work in 1915 and were determined to prove their ability to meet all the requirements for the more important task of electrifying the State system. They set to work and turned out two main line electric locomotives on their own account, and so eminently successful were the trails that they were accepted by the Government and orders placed for two more. A prominent American electrical engineer who witnessed the test runs of these engines declared that they were every bit as good as any locomotive that could be turned out in America. "The Japanese can build electric locomotives as well as the best American manufacturers; the only point of advantage we possess," he concluded, "was in the matter of price. Due to our larger establishments and production capacity we can beat them in price, but not in quality." This high testimonial to the engineering ability of the Japanese is the best indication of how far they have advanced along lines which heretofore have been considered as a monopoly of the West, and if Japan should adopt a protectionist policy it would not be long before the Japanese manufacturers would supply all the requirements of their own market and reach out for foreign orders.

In the matter of steam locomotives the Kasato Works of the Hitachi Engineering Works are now amongst the three or four approved Japanese makers furnishing engines for the Imperial Government Railways, successfully making the largest 2-8-2 types, and supplying locomotives for the smaller private lines throughout the country.

Water Turbines

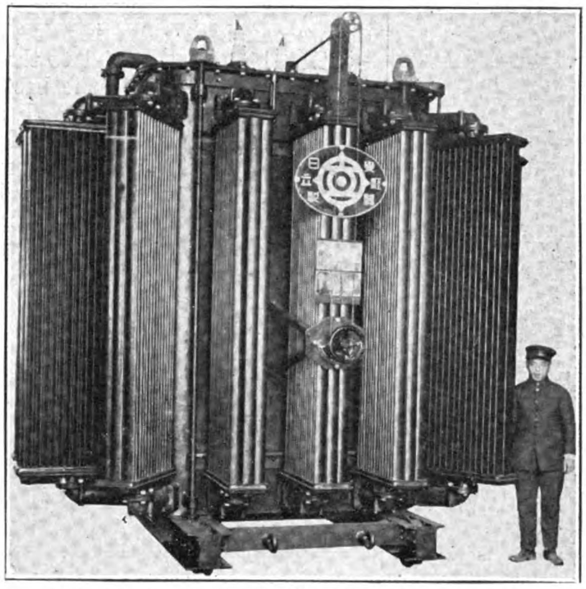
In the same way they concentrated on the manufacture of water wheels which before the war were supplied exclusively by foreign makers. When the war cut off further importations, the Hitachi Works determined to meet the home demand, and at great sacrifice undertook the experimental work in this line of engineering. When the first three water wheels from this factory were installed and placed in operation their success wiped out all doubt as to the ability of the Japanese to compete in this work. One of these 10,000 h.p. water wheels installed at the Iwamuro power-house of the Tone Electric Company (now incorporated with the Tokyo Electric Light Company) after five years of continuous operation is maintaining a standard of 87 per cent. efficiency.

A vertical axle water turbine of 7,400 h.p. erected at one of the Kinugawa Hydro-Electric Company's power-houses is one of the longest and most unique in Japan, a duplicate of which was subsequently ordered in 1919 by the Hokkaido Electric Company. The Keihin Electric Power Company has also installed a 14,000 h.p. vertical axle Hitachi water wheel, one of the largest in Japan. From this to blowers is a natural step, although the Hitachi Works have been manufacturing this type of machinery since its establishment in 1909. This also was the first attempt to make these machines in Japan. In fact, the Hitachi Works have established



Hitachi Switchboard for the Kinugawa Power House

such a high reputation for mining ventilators and blowers that it almost monopolizes the Japanese market, the latest type having a capacity of 45 cubic feet per minute at a pressure of 15 lbs., due to the development of high-speed electric motors. These blowers and turbine pumps are the specialty of the Kameido Works, there being no other factory in Japan producing a high lift pump. From 1909, when they manufactured the first 6-in. pump with a lift of 300-ft., they have developed this type to where it will lift 300 cubic feet of water per minute 4,500-ft. with 400 h.p. Many of these turbine pumps are to be found in the most important reclamation and river improvement works throughout the country, the Ibaraki reclamation using eight 36-in. diamter 300 h.p. and two 19-in. 100 h.p. pumps. They are also found in the new pumping stations of Tokyo's modern sewage system.



Hitachi Automatic Cooling Transformer, 4,599 k.v.a. 3-phase 69 cycles, 22,999-29,998 v : 11,888-18,888 v

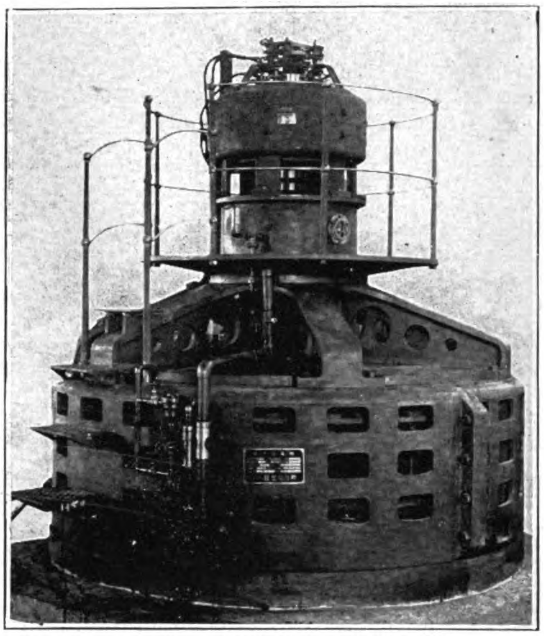
Kameido Factory

The Kameido Works, specializing in the manufacture of water wheels, turbines, cranes, pumps, ventilators, blowers, iron pipe and small size motors, are located in Kameido-machi, a suburb of Tokyo. The factory was established originally in 1908 at Tsukudashime, in the Kyobashi ward of Tokyo, for manufacturing machinery for the Kuhara Mining Plant. When the Kuhara Mining Company, Ltd., was organized in 1911, it was incorporated as part of this company under the name of the Tsukudashima Works, and, like the Hitachi Works, soon outgrew the private demands on its capacity, and was formally opened to supply the market with pumps, cranes, ventilating fans and other machinery. In 1916 the plant was removed from Tsukudashima to its present size and merged under the name of the Kameido Factory with the Hitachi works in 1918. In the following year the manufacturing plant for standard induction motors was transferred to this factory.

The earthquake and fire of September 1923 spared this factory, with the exception of a slight damage to the machine shop, which was quickly repaired and expanded during the following year. The works now cover 18,471 *tsubo* of ground area, with 6,353 *tsubo* devoted to buildings, employing about one thousand workmen and 111 in the office and technical staff. The value of the annual normal output of this plant is placed at Y. 4,800,000, with an emergency capacity of Y. 6,240,000.

Kasato Factory

The Kasato Factory situated in Shitamatsu-machi, in Yamaguchi prefecture, was originally the shipyard of the Nippon Kisen Kaisha. When purchased by the Kuhara interests it was planned to continue shipbuilding on a large scale, but the Disarmament Conference following shortly after, compelled a radical modification of this program, limiting the production of the plant to marine engines and other heavy machinery. In June 1920 the works received an order from the Imperial Railway Department for a large type locomotive, and so well did it meet with the official requirements and trial runs that other orders quickly followed and the works placed on the approved makers' list of theG overnment. The plant was incorporated with the Hitachi Engineering Works, Ltd., in 1920, under the name of the Kasato Factory. It covers 5,326 *tsubo* and employs nearly a thousand men. It specializes in the manufacture of steam and electric locomotives, bridge girders, structural steel, marine engines, railway machinery and copper castings. The normal output of the works is valued at Yen 3,000,000 annually, with a full capacity valued at Yen 4,000,000. The value of the total ordinary production of the three Hitachi plants is placed at Yen 22,000,000, with an emergency capacity of about Yen 30,000,000.



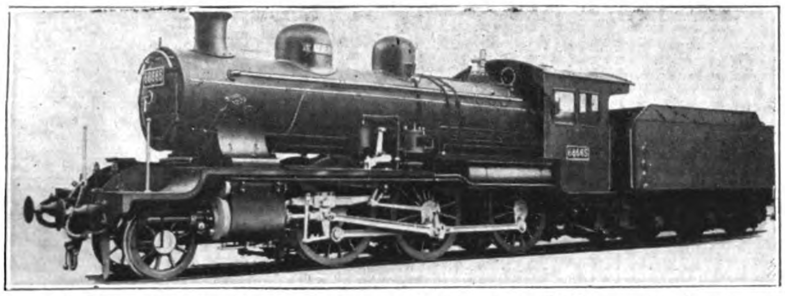
1,378 k.v.a. Hitachi Altertator, 2,588 v, 68 cycles

All of the copper used in these manufacturing plants comes from the mines of the Kuhara Mining Company, the pig-iron from China and Japan, and the other materials purchased from America or England whenever they cannot be supplied from Japanese sources. The main office of the Hitachi Engineering Works, Ltd., is in the Kuhara Building in Tokyo, under the direction of the Director-General, Mr. N. Odaira. The head of the Kasato factory is Mr. I. Furuyama. The Kameido factory is directed by Mr. S. Rokkaku and the Hitachi factory by Mr. N. Takao. Sales offices are maintained in every city of prominence in Japan and Korea.

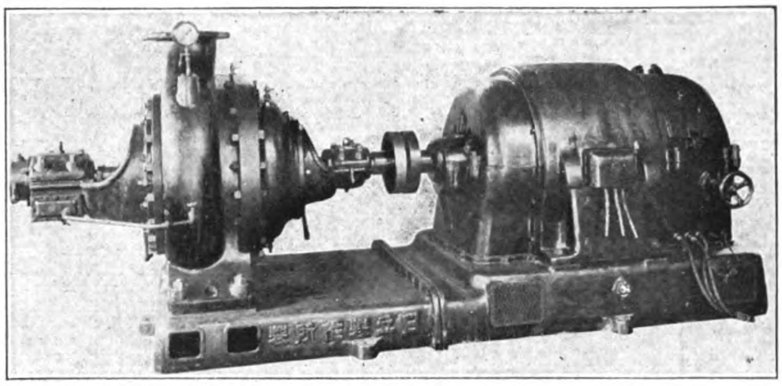
Social Welfare Work

The Hitachi Works in Ibariki Prefecture are spread over the towns of Hitachi-machi and Takasuzu-mura, about one mile from the Sukegawa station of the Government Tokiwa railway line, five and a half hours by train from Tokyo. An electric line connects the works with the main railway stations and sidings at Sukegawa. The works are very extensive, covering an area of nearly 70,000 *tsubo*, of which 21,313 *tsubo* are occupied by the Shibauchi main factory, 18,000 by the electrical works, and 30,000 by dormitories and workmen's houses. The main factory is made up of 68 buildings, covering 10,675 *tsubo*, and the electrical buildings cover 1,677 *tsubo*. The personnel includes some 353 officials and 3,042 workmen, which with their familes make a population of nearly 8,000, requiring 1,500 dwelling-houses.

Power for operating the works is derived from the Ishioka and Natsuigawa power stations of the Kuhara Mining Plant. These power-houses have a total capacity of 11,900 k.w. and supply 1,500 k.w. to the Hitachi works. The Mining Plant also furnishes the Hitachi works with water. Many of the large Japanese industrial companies have taken the lead in social service work for their employees, expending large sums annually to better their living conditions, provide sports and amusements, hospitals, day nurseries and schools for advanced courses in industry. The welfare of the worker is as much a part of the regular budget as legitimate manufacturing expenses. The Hitachi Engineering Works have followed the same wise and beneficent policy and established special schools maintained by the company for the benefit of their workers. Boys who have graduated from grammar school are admitted to what is called the Apprentice Training School, where they are given a two year course in Morality, Japanese and English languages, Mechanical Drawing, Electrical Engineering and Manufacturing, Foundry Lractice, and Office Administration. About fifty boys a year graduate from this school under the tutorship of picked men from amongst the technica, staff. Food, quarters and clothing are provided free by the company, in addition to an allowance for spending. The dormitory is a two-storey building, with lecture halls, recitation rooms, library, bath rooms and dining hall. This school is maintained at an expense of about Yen 35,000 a year.



2-6-0 Locomotive for the Japanese Government Railways, made at the Kasato Factory of the Hitachi Engineering Works



Hitachi 12-in. Two Stage Single Flow Double Suction Motor Pump delivering 300 c.m. againsta head of 450-ft. at 1,460 r.p.m: Motor 400 h.p., 2,000 v., 50 cycles. Made for the Ibaragi Coal Mine Co., Ltd.

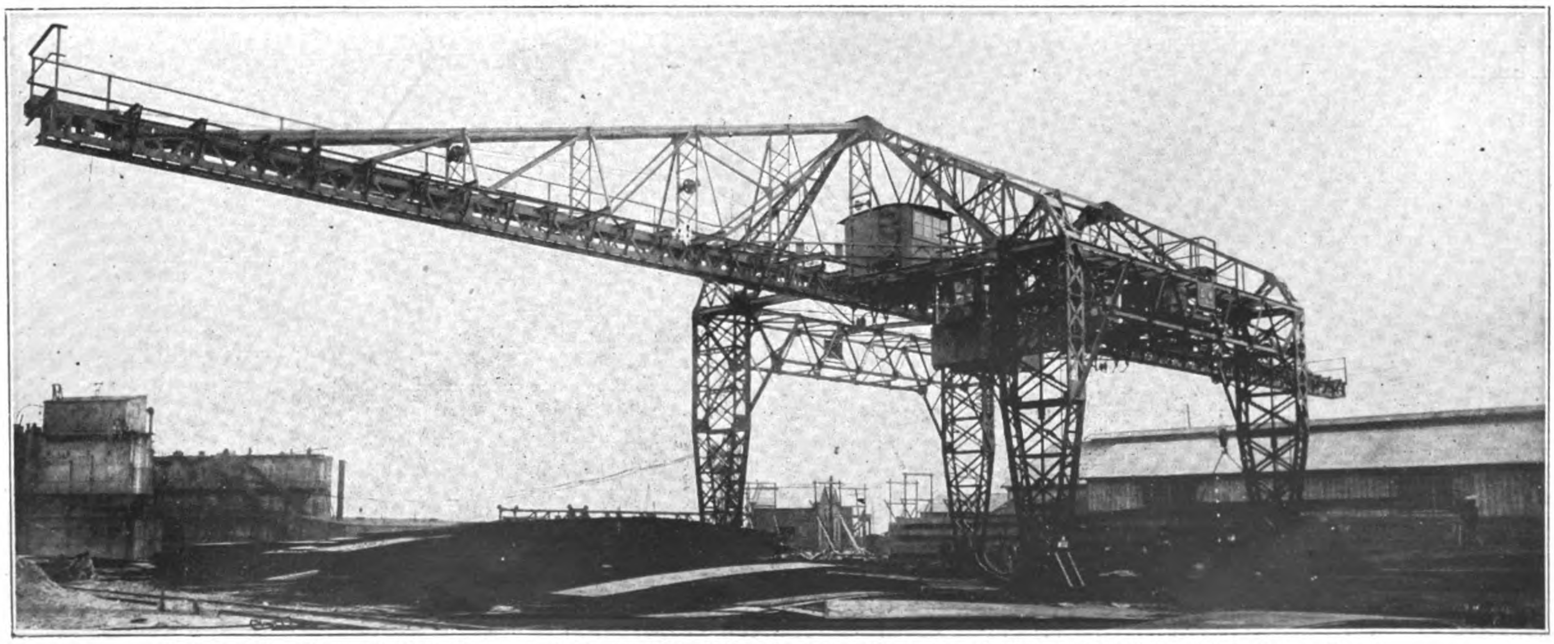
From the Apprentice School the graduates have the privilege of taking up a course in higher school, where lectures are given every afternoon from 4 to 6 p.m. by the experts of the company on practically the same subjects, with the addition of Physics, Mechanical Engineering, Inspection of Materials, etc. These schools are providing the Hitachi Works with at least 50 guaduates every year who take their place in the company's widespread organization either in the factory or in the sales department. All married employees, officials or working-men, are furnished with free houses, and the bachelors with rooms in the general dormitories. Food supplies, clothing and general commodities are sold to the employees from a co-operative store at actual cost. Medical attendance and hospital treatment, theater entertainment and electric tramway transporation on the company's lines are furnished the employees without charge. As a consequence of this broad policy, the Hitachi Company is building up an organization that makes for loyalty, co-operation and freedom from labor troubles a valuable asset.

The Kameido factory is situated on the outskirts of Tokyo on the Boso Railway Line, about a half mile distant from the famous Kameido Tenjin plum-blossom district. Freight from the Hitachi Factory is unloaded at the Sumidagawa station of the Tokiwa Line and transported by lighters to the Kameido factory. When the factory was erected in 1916 the surrounding district was a marshland waste, but during the war an impetus was given to reclamation and building until now it is a well-developed district, with tramway service into Tokyo, as well as a private motor bus line connecting the factory with the Tokyo head office. The ground area of the factory is 18,471 *tsubo*, with 6,352 *tsubo* devoted to sites for 50 buildings equipped with nearly 400 pieces of machinery of different kinds. The number of employees is about 1,100. The Tokyo Electric Light Company furnishes the current for the 4,500 h.p. of electric motors operating the machinery in the factory. The water supply is derived from artesian wells on the ground. All water wheels and turbines are tested at this plant before being shipped out for erection.

The Kasato factory is located about a mile and a half from the Nejigahama and Tokuyama stations of the Sanyo Line in Yamaguchi Prefecture, on the Inland Sea. A special branch line connects the works with the main railway and the piers for the accommodation of deep-water steamers carrying cargo to or from the works. The ground area of the factory is 42,402 *tsubo*, with an additional 4,251 *tsubo* in the railway right of way connecting the factory with the main line. The dormitories and other dwelling-houses embrace 21,383 *tsubo*. There are ten factory buildings with a floor area of 5,326 *tsubo*, and 27 office buildings and store-houses covering 4,114 *tsubo*, leaving ample space for future expansion. There are 900 workmen employed at these works, with eighty in the office force and technical staff, 17 of the latter being graduates from technical colleges.

This plant was hurriedly erected during the rush period of the Great War, and consequently little attention was paid to the buildings, but the mechanical equipment represents the very best procurable. The buildings are equipped with one 200-ton, three 100-ton and four 5-ton overhead travelling cranes and one 5-ton locomotive crane. In the blacksmith shop there are five steam hammers ranging from 800 to 2,000 lbs. and in the boiler shop is a 400-ton portable hydraulic riveter, a 100-ton hydraulic press, with drilling, grinding and sharpening machines. In all there are some 450 machines of various kinds, which, in addition to a steel-casting plant, enables the factory to handle the heaviest locomotives, marine and sugar machinery. The products of the Kasato factory are now mainly locomotives and heavy industrial machinery. Electric power to the extent of 4,600 k.w. is supplied by the Sanyo Electric Company.

In addition to the Imperial Railway Department, which has placed the Kasato factory on the approved locomotive makers' list, the Works have as steady clients such important enterprises as the Tokyo Municipal Electric Bureau, operating the tramways of Tokyo; the Kure, Yokosuka, Maizuru and Sasebo Navy Yards; the Government Steel Works at Yawata; the Kawasaki, Mitsubishi and Mitsui Shipyards; the Osaka Iron Works; South Manchuria Railway; the Ieyama, Ube, Osumi, Taiyo, and Chosen Railways; several of the Formosan sugar companies, and other important enterprises.



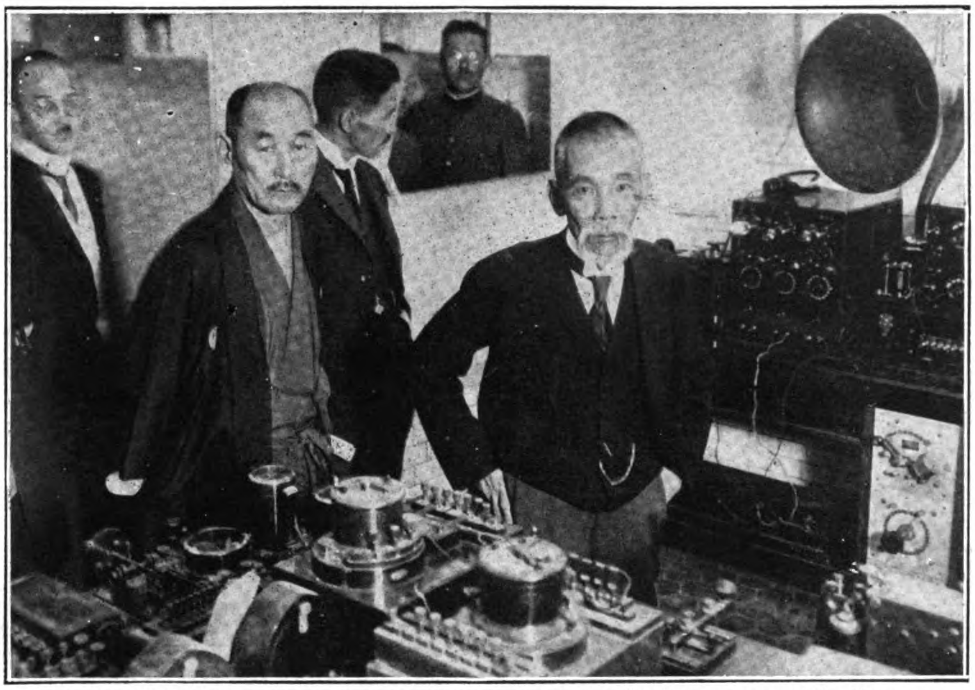
Five-ton Cantilever Goliath Crane made by the Hitachi Engineering Works for the Mitsubishi Kobe Shipbuilding Yards

Radio Development In Japan

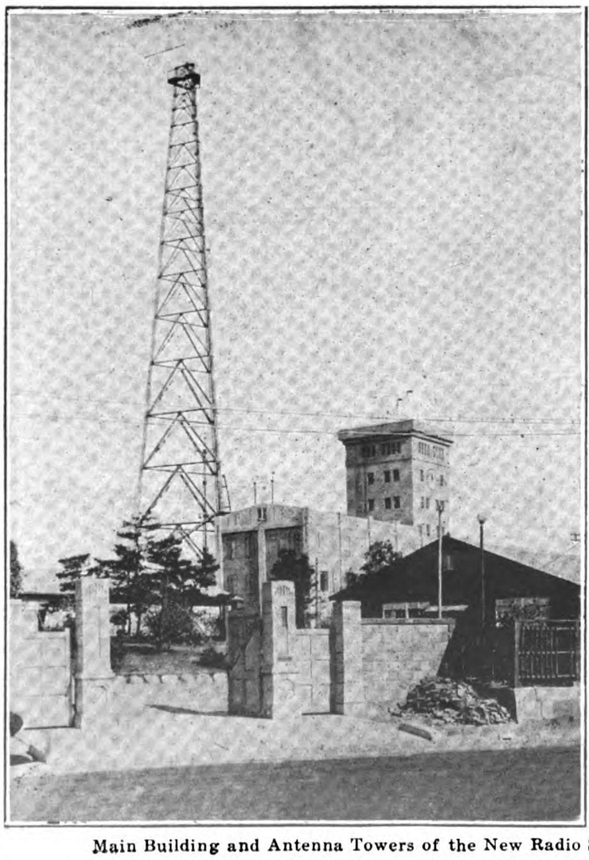
WITH the removal of many government restrictions imposed upon the operation of radio stations in Japan the industry has entered an entirely new stage of development during the past three months. The operation and erection of private transmitting stations over long distances has hitherto been a closed government monopoly, but with the change in the attitude of the Department of Communications, public enterprise has become interested in commercial transmission, reception and public broadcasting. This has resulted in an increase in the manufacture of radio apparatus in Japan and the growing independence of the country in the supply of material for all branches of wireless communication.

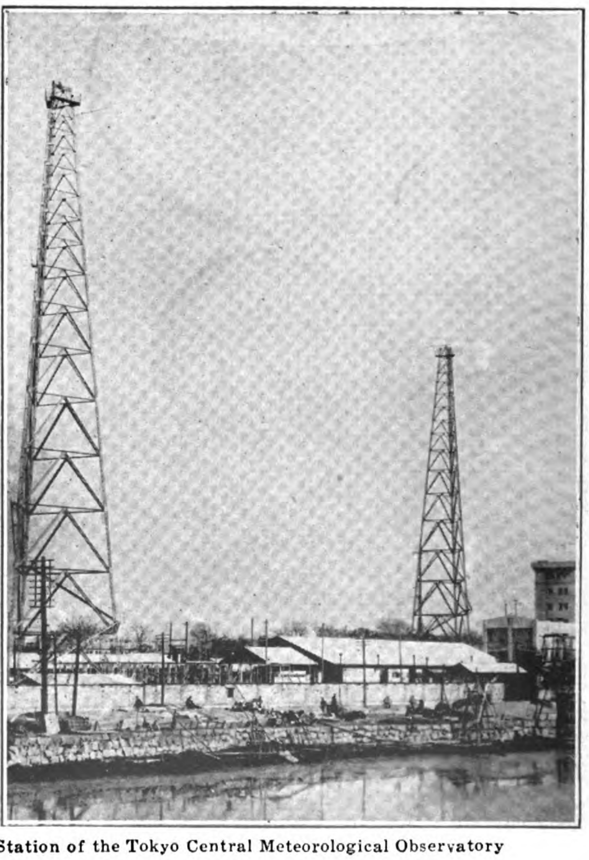
The most important development resulting from the removal of restrictions on private ownership of transmitting stations has been the formation of a new company with a capital of Y.20,000,000 which plans to improve the existing means of wireless communication with foreign countries and to build more powerful and modern stations for the extension of this service. The company, which is known as the Radio Corporation of Japan, will be a semi-government organization with a board of directors representing practically all the largest industrial interests of Japan.

Although not officially announced, it is understood that the financial interest of the government will be represented in the company through the contribution to the capital fund, of the entire plant and equipment of the Iwaki radio station and the land which had been set aside for the erection of a transmitting station for communication with Europe. The Iwaki station includes transmitting equipment of one 400 k.w. alternator and two 400 k.w. arc transmitters at Haranomachi and a receiving station at Tomioka. The antenna tower at Haranomachi is one of the most remarkable in the world. It is about six hundred feet high, one hundred and fifty feet higher than the Washington Monument, and is built of reinforced concrete under special designs of the engineers of the Department of Communications. The Iwaki station is used for direct communication with the United States and Hawaii and the company will endeavor to improve this service in co-operation with the Radio Corporation of America who control the American end of the trans-Pacific service.



Mr. Inukai, Minister of Communications, listening to the broadcasting program at the Museum attached to his department





Main Building and Antenna Towers of the New Radio Station of the Tokyo Central Meteorological Observatory

The turning over of this station to the company will mean an investment of about Y.200,000 on the part of the government, which with other material will bring the total up to about Y.2,300,000. The remainder of the necessary capital will be obtained through the interests represented on the board of directors which includes such well known men as Viscount Shibusawa, Baron Goh and Dr. Takuma Dan. The importance of the company in Japanese affairs can be well understood from a list of the promotors who are in addition to the three mentioned: Baron K. Nakashima (director of Furukawa Mining Company); Mr. C. Kadono (Vice-president of Okura and Company), Mr. K. Kimura (senior director of Mitsui Gomei Kaisha); Mr. F. Kuhara (president of Kuhara Trading Company); Mr. T. Isaka (president of the Yokohama Chamber of Commerce); Mr. K. Matsukata (president of Kawasaki Dockyard Company); Dr. Y. Ono (president

of the Industrial Bank of Japan); Mr. T. Yuki (Vice-president of Yasuda Bank); Mr. K. Inahata (president of the Osaka Chamber of Commerce); Mr. K. Iwahara (president of Shibaura Engineering Works); Baron Y. Togo, Mr. K. Kambe (president of Tokyo Electric Light Company); Baron H. Fujita (head of Fujita Gumi); Mr. K. Nakata (senior director of Sumitomo Goshi Kaisha); Mr. B. Konda (senior director of Toyo Kisen Kaisha); Mr. K. Hori (president of Osaka Shosen Kaisha); Mr. M. Kushida (chairman of the board of directors of Mitsubishi Bank); Mr. K. Nanjo (director of Mitsui Bussan Kaisha); Mr. K. Koike (president of Tokyo Gas Company); Mr. K. Uchida, Mr. M. Suenobi, and Mr. O. Matsukata. The erection of the long needed high-power station for duplex communication with Europe direct will be the largest undertaking of the company in the first stage of its development work. One of the prime reasons for the formation of the organization has been to obtain the necessary funds for this station and its erection will be undertaken at the first opportunity. The site of this station will be near the city of Nagoya, the transmitting equipment being at Kariya and the receiving station at Yokkaichi. Both the transmitter and receiver will be operated by remote controls at the central office in Nagoya.

Fig. 2: Receiving equipment at the Hirano Station, near Osaka. This station is in daily touch with Nauen, Bordeaux and other European stations for the receipt of news

The transmitter will be a high frequency generator with an antenna effect of above 120,000 meter amperes. The antenna will be of the inverted L type supported on eigth steel towers 250 meters in height. The Nagoya district is one of the greatest sources of electric power in Japan and the station is to be located there on account of the reliability and cheapness of the power which will be required to operate the station.

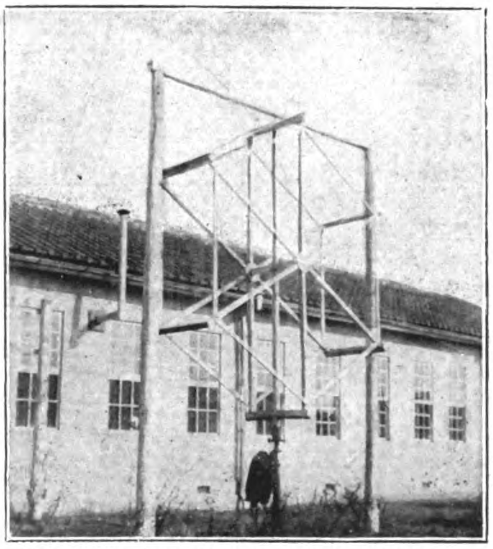


Fig. 1: The largest directional loop antenna in Japan, located at the Government's receiving station at Hirano. This antenna is used for both long and short distance work and is very selective on either wave band

The wireless system of communication in Japan will then be extended to include the South Seas and additional stations for the Far Eastern division and another American station of greater power. When the plans of the company are completed, Japan will have one of the most highly developed and efficient radio systems in the world.

The actual operation of the various new stations and the Iwaki equipment will be directly under the control of the Department of Communications, who will furnish the operating and engineering personnel. Maintainence and extensions will be financed by the company but will be carried out by the government. Close co-operation with the land wire telegraphs of Japan will be kept up in order that messages may be delivered through an existing organization with the greatest efficiency.

The formation of the Radio Corporation of Japan is the result of a long series of negotiations for the establishment of a central radio system. The complete plans have been worked out for all the needs of the industry for several years in advance and with the idea of utilizing the existing installations to the fullest extent. The bill authorizing the organization easily passed both houses of the Diet during the last session and actual work has begun on the carrying out of the original plans.

The starting of public broadcasting has been another stage of development resulting

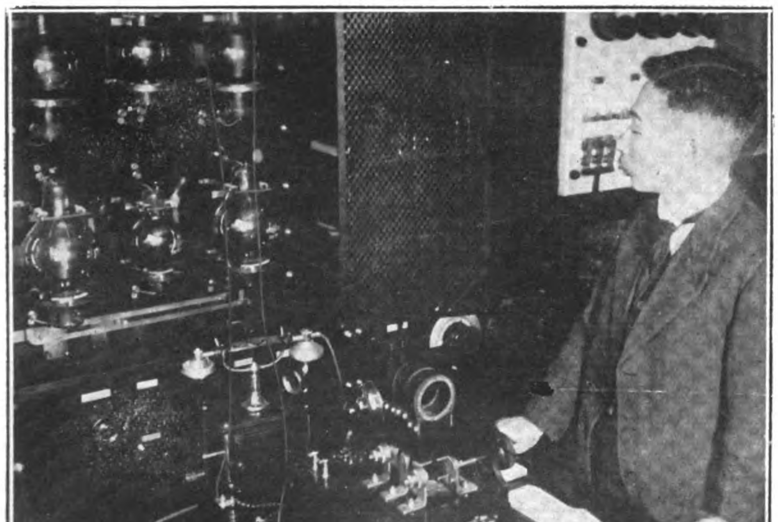


Fig. 10: Japanese made one kilowatt vacuum tube transmitter of the Tokyo Meteorological Observatory at Kanda. This station is one of the few in Japan using the Telefunken system of "feed-back" coupling

Fig. 11: Control room at the Kanda Radio Station, showing the receiving instruments in the center and the vacuum tube transmitter at the right, with the arc set to the left

from the broader policy of the government toward radio communication. Limited official sanction was given by the Department of Communications for the operation of private broadcasting stations in April, 1924, under a very restrictive set of regulations which were drafted and brought out at that time. The regulation of the broadcasting transmitters remains the same at present although changes have been made in the laws governing receiving sets.

As the regulations now stand, broadcasting stations are divided into two classes, one for short range work and the other for transmission over long distances. The smaller class of stations are limited to a wave length band of from 215 to 235 meters and an antenna power input of less than 150 watts. The range of these stations is officially set at a distance of not more than thirty kilometers.

Stations of the larger class are assigned to wave lengths between 360 and 385 meters and may have an antenna input up to one kilowatt. The districts to be served by such stations are limited to a radius of about 160 k.m., but there is no objection to receiving sets outside this range listening to the programs providing that they have a license to do so.

The department further requires that all broadcasting apparatus be constructed so as emit only a pure continuous wave with secondary waves and harmonics eliminated as far as is technically possible. The modulation of the carrier wave must also be good. There is no restriction in the natural wave length but the antenna must be erected in such a way that the wave length will not be affected by weather conditions or shifting of the wires. The aerial must be so constructed as not likely to injure men or animals in the vicinity.

Fig. 4: The broadcasting of Japanese music over the radio has been a great success, as it has been found that it is much easier to transmit this form of music without distortion than foreign music, which has greater complexity

Broadcasting studios must be built as nearly sound proof as possible and designed with special acoustic properties so that there will be little reflection from the walls of the room to interfere with the purity of the sounds transmitted through the microphones. Noises in the transmitting apparatus from the generators or from other causes in the machine itself must be brought as low as possible.

The government charges five hundred yen a year for a license to broadcast over the long distance and three hundred yen for the smaller stations. This sum is payable in advance.

Although the regulations do not so specify, it is understood that the department will grant a license to only one large station in each district such as Tokyo-Osaka or Nagoya. This is in order that there will not be any conflict in transmitting time or interference between the various programs. Restriction of power and wave lengths and of the sharpness of wave required will also be used to combat any interference or rivally which might reduce the efficiency of the system in general.

As soon as these regulations were announced in 1924 the government was deluged by applications from all sides for permission to build stations by the newspapers and the radio manufacturing companies. Unable to grant permission to all the applicants the Communications Bureau advised that an association be formed including all those interested in broadcasting around Tokyo and that the control of one large station be given to this organization for operation and financing. Petty jealousies among the prospective members as to the controlling interest in the association delayed its formation for a time but the Tokyo Broadcasting Association (Hosokyoku) became an accomplished fact in December, 1924.

Viscount Shimpei Goto is president of the association which includes representatives of the Japanese press, the radio manufacturers, the larger electrical companies and many prominent business men of Tokyo. An operating fund of three hundred thousand yen has been raised among the members which will be used for the construction of a modern broadcasting station and running expenses until the organization is put on a paying basis, when the fund will be returned to the subscribers. The income of the association is derived from a monthly fee of two yen a month which is charged each receiving set owner in the district, the number of which has now passed the ten thousand mark in Tokyo alone.

In order that broadcasting might begin as soon as possible after the formation of the association, the City of Tokyo loaned a transmitter to the bureau for temporary use until the main equipment is constructed. This transmitter of one kilowatt was erected at Shibaura and has been in operation since the first of March. (Fig. 3). The station operates on a wave length of 385 meters and has given satisfactory results, being heard in many places in China and Korea and as far north as the Hokkaido.

The large number of members in the association which controls the station has made it possible to secure a great deal of material for broadcasting and has made the programs practical as well as entertaining. A complete report of the movements in the morning session of the Stock Exchange, the Rice Exchange and the Raw Silk Market is sent out just before noon and includes the quotations of the principal key stocks and commodities. The closing prices are broadcasted at the close of the day's market late in the afternoon. A time signal is sent out at noon which is controlled from the Tokyo Observatory. Weather reports compiled by the Meterological Observatory are broadcasted daily at 9 a.m., noon and 4 p.m. Typhoon warnings and other information of this kind which is of interest to the general public is also put on the ether at this time.

The afternoon is devoted to the broadcasting of news which is supplied by the many newspapers who are members of the association and to speeches by prominent Japanese. Professors and educators give lectures in the early part of the evening and are usually followed by the feature of the day. Many foreigners have so far spoken to the radio audiences of Japan and all express their gratification at being able to come in touch with such a large audience as is possible over the radio.

Popular entertainment numbers are sent out late in the afternoon and close the programs in the evening. (Fig. 4). These include Japanese recitations and selections from famous plays

by some of the best actors, foreign music by local talent and visiting artists, and numbers of interest to children. The broadcasting station has become popular overnight in Japan and its patronage is growing by leaps and bounds.

The main broadcasting equipment for the permanent home of the Tokyo association has been ordered from the United States through the Western Electric Company and will soon arrive in Japan and be installed by the end of June. The apparatus consists of a vacuum tube transmitter with an input of one kilowatt and is of the most modern and efficient type which has been tried out for many years in America. A special building for the sole use of the broadcasting station is being erected on Atago Hill which commands the city of Tokyo. This building will be unique in that it is designed and built for the purpose of radio broadcasting only, it will have special studios for various kinds of programs and will be so made that spectators and visitors may watch the work of running the station without interfering in any way. The building, which is of reenforced concrete will cost over a hundred thousand yen.

When this permanent station is opened this summer in Tokyo, Japan will have one of the finest broadcasting stations in the world. It is estimated that the programs will be heard with ease throughout Japan, Korea and parts of China, although officially the district is supposed to include only the territory immediately around Tokyo. It is planned to hold transmission tests in co-operation with American broadcasting stations in order to link the two countries by broadcasting programs arranged at special periods.

The regulation of receiving sets is also under the jurisdiction of the Department of Communications through the local offices of the bureau in the various prefectures. The rules as first drafted greatly limited the use of receivers but the latest regulations make it a very simple matter to secure a license for a receiving station.

The basic rules for receiving apparatus divide such equipment into three classes. The first class of license includes only such receivers as have passed the requirements of the government Electrical Laboratory (Denki-shi-ken-sho). This is the standard form of license and is the one which will be issued to ordinary applicants.

The second class license covers apparatus which has been made by an individual radio fan or manufactured apparatus which has been altered after passing through the dealers hands, all " homemade " equipment comes under this class. Holders of the first and second class licenses are restricted to a receiving wave length of not more than four hundred meters.

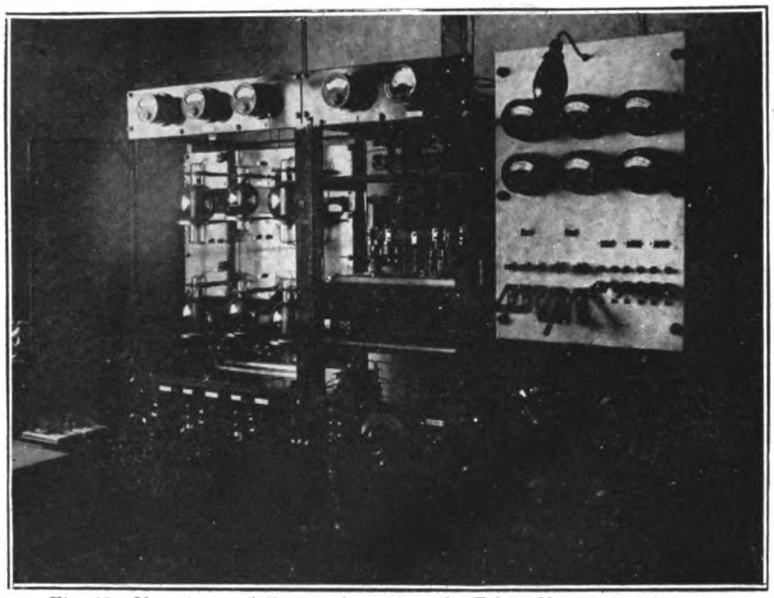


Fig. 12: Ma transmitting equipment at the Tokyo Observatory Station, showing the one kilowatt vacuum tube set made by the Nippon Radio Company under Telefunken patents

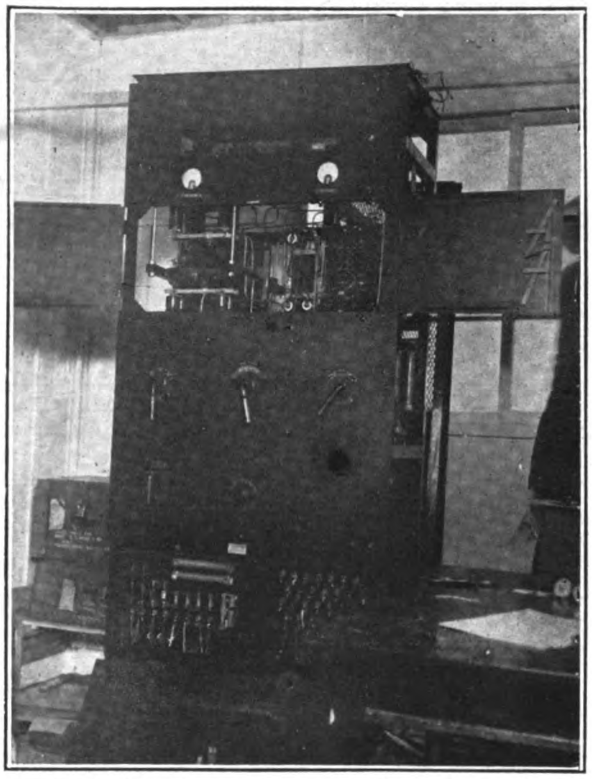
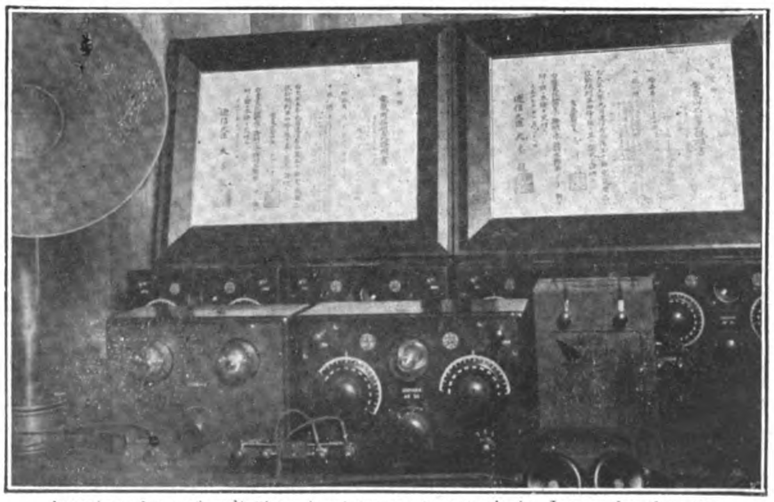


Fig. 3: One kilowatt vacuum tube transmitter made by the General Electric Company, used by the Tokyo Broadcasting Association at their new Shibaura Station



American type of radio broadcasting receiver made in Japan by the Annaka Electric Company. This set includes a vacuum tube detector and two stages of audio frequency amplification

The third class license is issued only to applicants who desire to experiment and who can prove that they are familiar with this science. This class of license will be greatly limited, according to the Department of Communications, as the general public is not acquainted with radio receivers to an extent which would justify the granting of unlimited licenses.

Japan has had the benefit of several years of broadcasting in America and England upon which to base the present regulations and it is generally thought that they include the best points of both systems. One of the features of the laws is the prohibition of receivers which cause oscillations in the antenna circuit. This kind of apparatus has proved to be a source of great annoyance in the United States where there are a great number of sets in a limited area around the large cities. Objections to this restriction have been raised in Japan, but the industry as a whole will be greatly benefited, as it would be impossible to permit regenerative apparatus in such small territories as will be served by the central broadcasting stations without causing great trouble to the users of sets of other design.

The broadcasting system in Japan is very similar to that of Germany, with exception that the fee for broadcast the reception is paid direct to Broadcasting Company. The American system of unlimited broadcasting was not found to be possible in Japan, but many points of the American idea are to be found in the present regulations.

In the classification of receiving sets, those approved by the Electrical Laboratory come under class 1, and while it is not necessary for the manufacturer of receiving apparatus to have his material passed by this bureau, it is a distinct advantage to secure the government approval. The Electrical Laboratory has drawn up the requirements which govern its approval of apparatus in a set of regulations which are now in force, and if apparatus does not conform to this standard, the special approval of the local office of the department of Communications must be secured before such sets will be granted a license to receive.

The Electrical Laboratory specifications require that a receiving set be so constructed that the wave length cannot be more than 400 meters. It is

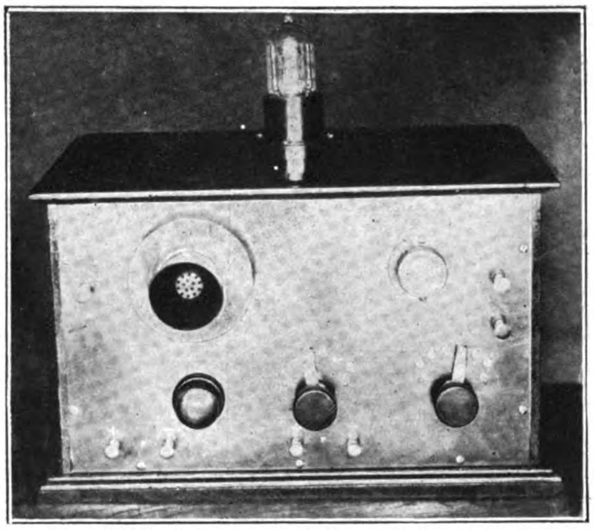


Fig. 7: Japanese five watt experimental transmitter for the use of schools and short distance transmission

also required that the set be non-regenerative, although some allowances will be made in this direction in favor of sets which do not produce a great amount of oscillation in the antenna circuit. The other most important requirements are that the set shall not be so constructed that the use of the electric light circuit or telephone wires is aimed at for the antenna circuit.

The market for receiving apparatus in Japan may be divided into two classes, one in which the sale depends upon the price of the article, and the other on the quality of the instrument and the range at which it will receive. In the first class the Japanese manufacturers have a virtue monopoly on account of the protective tariff and local manufacturing. The standard price for a vacuum tube set of Japanese manufacture, including a single tube detector complete with tubes, batteries, headset and antenna and earth equipment is from 115 to 120 yen. Crystal sets cost from twenty to forty-five yen. A two stage amplifier retails for about sixty to seventy-five yen. (Fig. 6 and 7). Foreign apparatus will be unable to compete with these retail prices on a cost basis, especially sets which use foreign made tubes.

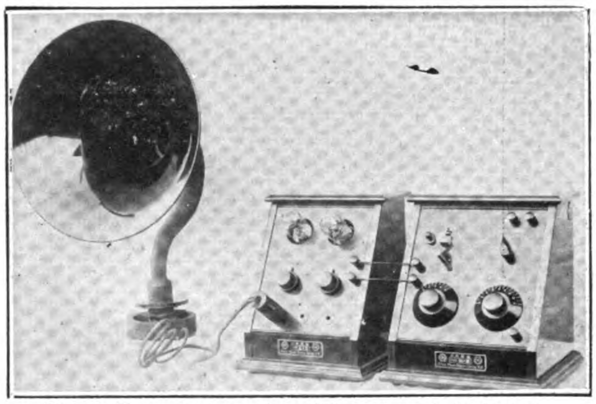


Fig. 6: European type of receiving set made in Japan for use in the reception of broadcasted programs. Crystal detector in connection with a two stage audio frequency amplifier

The field for foreign manufactured receiving sets is quite as large as that for the domestic made product and is in the receivers which will be wanted by a great many fans which will be capable of picking up all the various broadcasting stations throughout the country and in special cases, the stations at Shanghai, Hongkong and Manila. So far the Japanese have not made any sets in large numbers which will do this, while there have been a number of foreign sets of well known makers which have been quite successful in all these requirements. The market for accessories is specially open to foreign firms, and the demand includes good loudspeakers, headsets and various refinements.

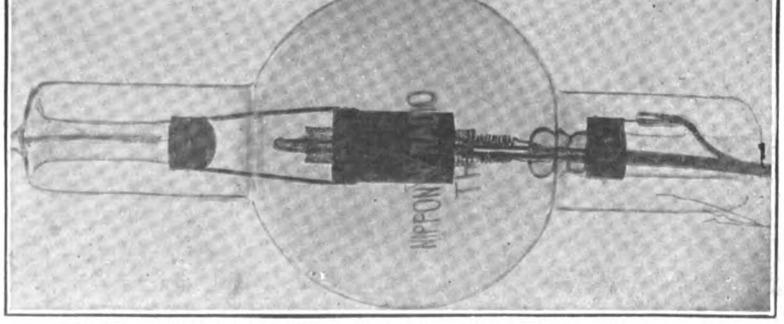


Fig. 7: 250 watt transmitter vacuum tube made by Japan Wireless Telegraph and Telephone Company under their own and Telefunken patents

The importer of radio apparatus must bear in mind that broadcasting is a comparatively new development in Japan and that the general public has not become familiar with the operation of complicated receiving sets. For this reason the apparatus should be made as foolproof and simple as possible also replacements of foreign made parts would mean a great expense and long delay for the user. If possible the set should be made for the use of Japanese vacuum tubes and batteries, as the cost of the imported material is almost prohibitive except in the case of the highest quality apparatus. Patent rights held in Japan will not permit the importation of a certain number of foreign made tubes.

Vacuum tubes are made in Japan by the Tokyo Electric Company under general electric patents and by the Nippon Radio Telephone and Telegraph Company under Telefunken patents. (Fig. 7). Other tubes are made in Japan but the patent rights are obscure and the importer who expects to use such tubes should be careful to investigate the exact standing of the material in question.

Conditions peculiar to the Japanese market also require an agent on the ground who is familiar with the territory and the special requirements of the country. With such an agent and with the kind of material outlined, the field is practically virgin territory and open to a large volume of business for a long time to come. Judging from the experience of the Tokyo Association, they will be a wave of enthusiasm for public broadcasting in Japan at least equal to the developments in England and the United States during the past two years. Osaka and Nagoya have both started experimental broadcasting and will have permanent stations within a short time.

The great increase recently in the use of radio communication generally together with the stimulation of decreased government restriction has immensely benefited the manufacture of apparatus in Japan. This industry is confined to a comparatively few firms, the largest being the Tokyo Electric Company, Shibaura Electric Works, the Nippon Electric Company, the Japan Radio Telegraph and Telephone Company and the Annaka Electric Manufacturing Company.

The Japan Radio Telegraph and Telephone Company have entered into an agreement with Siemens-Schukert whereby they manufacture apparatus under patents owned by the German Telefunken firm and have turned out considerable material under this agreement. They manufactured and erected the two modern stations owned by the Kobe Marine Observatory and the Tokyo Meterological Observatory, the first being established in Kobe in 1923. The latter station has just been completed at Kanda in Tokyo.

The Tokyo Observatory station is one of the best examples in the country of a plant manufactured throughout by a Japanese concern. (Fig. 8 and 9). The station equipment is a one kilowatt vacuum tube transmitter of the latest type for ordinary communication (Fig. 10, 11 and 12). The vacuum tube transmitter uses an exclusive Telefunken feature in what is known as the "feed-back" coupler and is also designed so as to use both tonic and ordinary sending as desired. The Observatory station is now sending out weather reports, storm and typhoon warnings and other information of interest to navigators on a regular schedule.

The Japan Radio Company specialize in the manufacture of portable sets for the Japanese Signal Corps and other Army and Navy equipment as well as vacuum tubes for receiving and transmitting, receiving sets and parts for broadcasting reception and commercial use and other kinds radio station equipment. The company maintains a staff of research engineers who are constantly working on new patents for the firm and improvements on existing system.

The Annaka Electric Manufacturing Company is one of the oldest firms engaged in the production of radio apparatus in Japan. This firm specializes in the manufacture of wired wireless sets, which are becoming a common form of communication between power stations and distributing centres. Several of these systems have been installed by the Japan Hydro-Electric Company, Tokyo Electric Company, Tokyo Electric Light Company, Kinugawa Power Company and government departments, where they are a great success and a distinct saving in the system of communication between isolated points of the power units. Annaka also manufacture vacuum tube transmitters for the railway department

and are working on a system of wired wireless for use in railway signalling. The company are large manufacturers of ship station equipment and receiving sets for broadcasting use.

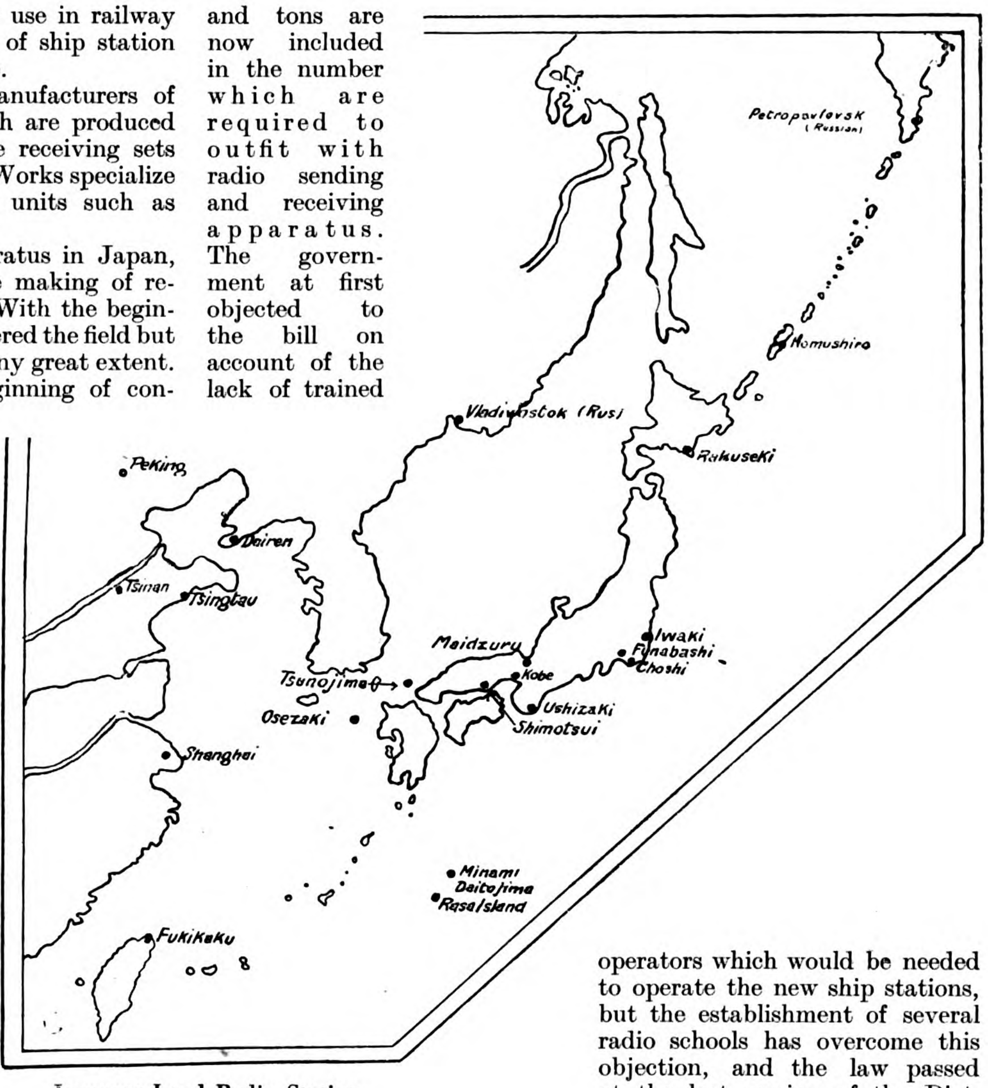
The Tokyo Electric Company are mainly manufacturers of vacuum tubes for transmitting and receiving which are produced under General Electric Patents, and vacuum tube receiving sets for the broadcasting system. The Shibaura Electric Works specialize in the manufacture of large power transmitting units such as Alexanderson alternators and transformers.

There are many other makers of radio apparatus in Japan, but their activities are confined principally to the making of receiving sets and small experimental transmitters. With the beginning of public broadcasting many new firms have entered the field but are not competing with the larger organizations to any great extent.

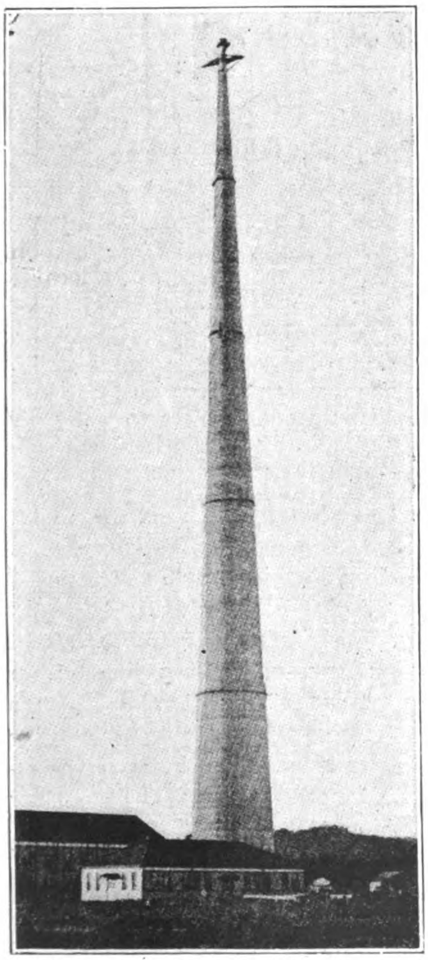
Other recent developments have been the beginning of construction of a sending station at Kemikawa and a receiving station at Iwatsuki, both locations being near the city of Tokyo. This new equipment will be used for direct communication with the Japanese colonies and in land stations.

The transmitters will be 50, 15, 6 and 3 k.w. vacuum tube sets. The antennas will include two of the fan type suspended on three hundred foot towers and two of the inverted L type on three 250-foot steel towers. The building of the receiving station was recently completed and the apparatus is now being installed. Recent tests of short wave communication were carried out with great success between Station 2 AC in New Zealand and the Japanese station at Iwatsuki. This station will eventually become the center of the radio network in Japan.

The Teishinsho also has a station at Hirano, near Osaka, through which news services have been arranged for direct reception from the German station at Nauen and the French station at Bordeaux. Hirano has four large receiving antennæ, twelve hundred feet long, on five towers, two hundred and fifty feet high.



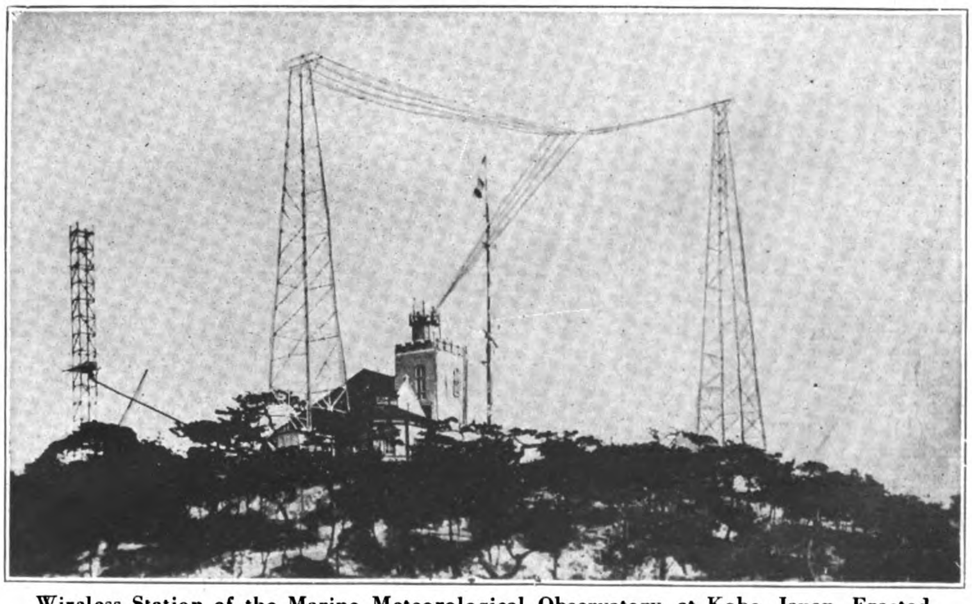
Japanese Land Radio Station



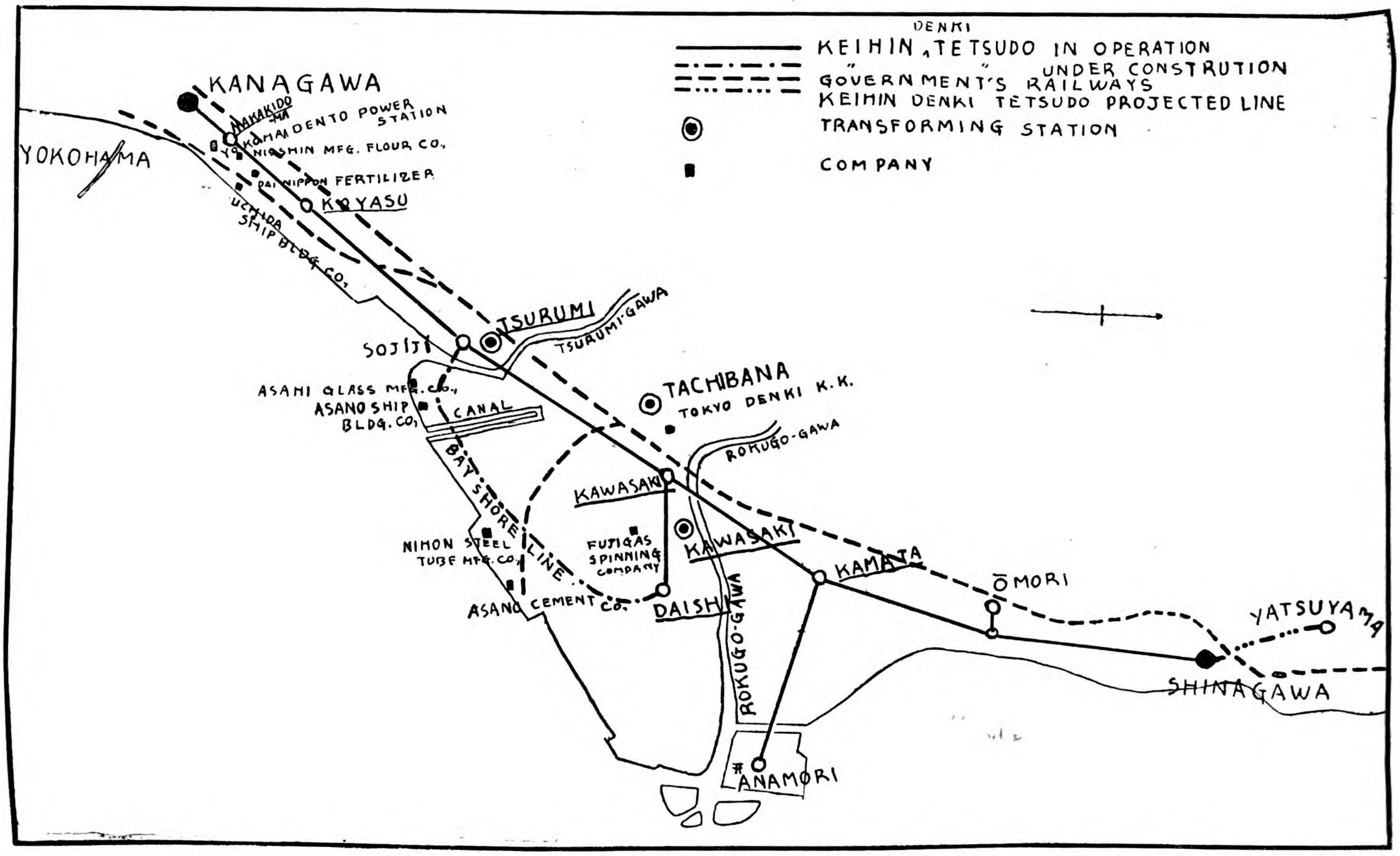
The Hara-no-Machi (Iwaki) Tower

Another impetus to the radio apparatus manufacturing industry in Japan is the change which has been made in the regulations which require wireless installations on shipboard. Vessels carrying over fifty passengers and crew and ships of above two thousand tons are now included in the number which are required to outfit with radio sending and receiving apparatus. The government at first objected to the bill on account of the lack of trained operators which would be needed to operate the new ship stations, but the establishment of several radio schools has overcome this objection, and the law passed at the last session of the Diet. This will mean an immediate increase in the demand for small transmitters of below five k.w., which will probably be bought exclusively from Japanese manufacturers.

There is no doubt but what Japan has gone ahead with large strides in the development of radio communication during the past year and has outlined plans for a truly magnificent system of radio, in comparison to rather backward progress previous to 1923. With the plans which are now going forward toward execution completed, Japan will have a system of public and commercial radio stations the equal of any country in the world.



Wireless Station of the Marine Meteorological Observatory, at Kobe, Japan. Erected and Equipped by the Nippon Musen Denshin Denwa Kabushiki Kaisha



Tokyo-Yokohama Electric Railway

The Tokyo-Yokohama (Keihin) Electric Railway

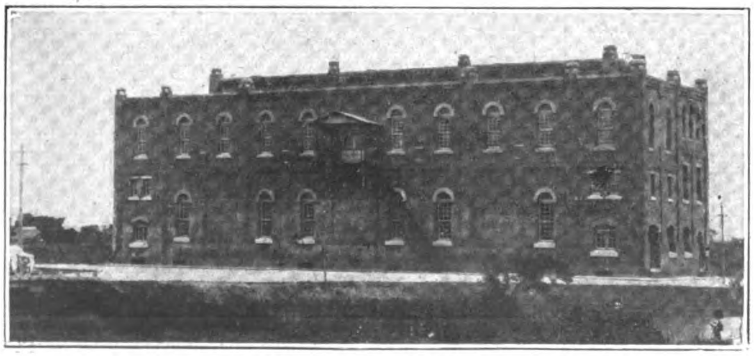
THE district between the port of Yokohama and Tokyo ten years ago was frequently described as "one long village." To-day a more apt description would be a "long industrial town." The change in Japanese life brought about by the progress made during the war period 1914-1920 (Spring) has been such that what was formerly pre-eminently an agricultural region, supplying farm products to two cities whose populations were about two and a quarter millions, is to-day a building ground for important factories whose needs are only partly served from the population of three millions which have crowded old Yokohama and Tokyo out into the country in a search for more space in which to live. Ten years ago both Tokyo and Yokohama were beginning to spread beyond their ancient boundaries.

The line of least resistance was along the Tokyo Bay shore between Tokyo and Yokohama, because along that line there were :

(1) A Government railway with several stations at important centres of population between the two cities; (2) an inter-urban electric railway; (3) a national road which furnished the main artery for vehicles.

Homes were slowly pushed out into the country, and when the great boom in manufacturing industries came, it was only natural that promoters should turn for building sites to localities where the population was greatest. The land between Tokyo and Yokohama also offered convenient transportation to an open port of regular call. As factories sprang up between Tokyo and Yokohama the population of the towns and villages grew by leaps and bounds, and land prices soared. This drove farmers to sell their ancestral holdings, and eventually practically all the land between Tokyo and Yokohama along the main lines of traffic was owned by factories, house builders, or by land companies.

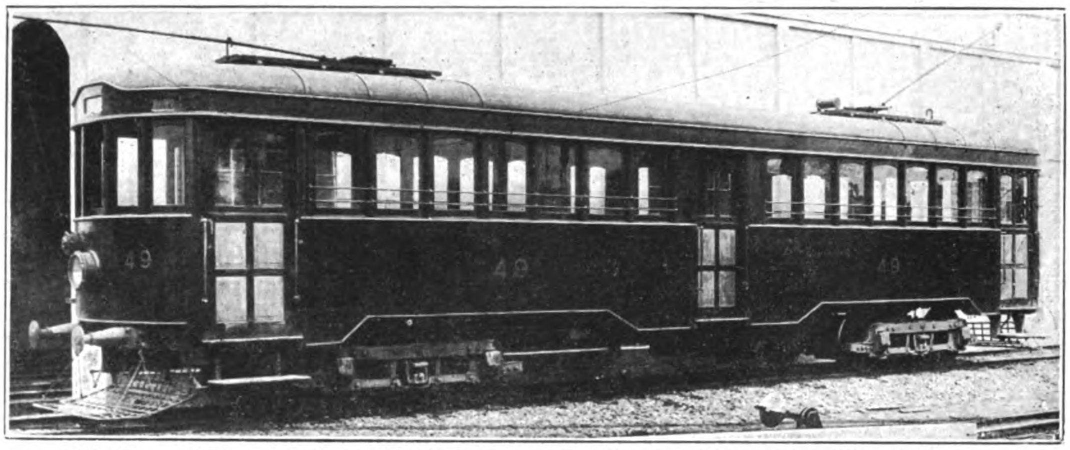
Much of the growth of this district was primarily helped by transportation facilities. One of the most important of these is furnished by the lines of the Keihin Denki Tetsudo (Yokohama-Tokyo Electric Railway), established in 1897 to operate a short excursion line from Kawasaki Station to Rokugo Bridge, near the popular shrine called Kawasaki Daishi, a distance of 1½ miles. The Company was capitalized at Y.89,000 and was called the Daishi Denki Tetsudo. Its usefulness was unquestioned and its success immediate. It was not until January 1903 that the present



Keihin Electric Railway. Tachibana Transformer Station

Kawasaki - Kanagawa (Yokohama) section was opened for commerical business, to be extended to Shinagawa (Tokyo) by the end of December 1905.

The Keihin Electric Railway Co. undertakes the supply of light and electric power in Omori, Iriarai, Oimachi, Kawasaki, Haneda, and Tsurumi.



New Type of Passenger Car on the Yokohama-Tokyo Service of the Keihin Electric Railway

A new line is to run between Tsurumi station on the Government railways to Daishi station on the Keihin line. The line will be built and operated under the name of another company, but the Keihin Electric Company owns all the shares. This is a common expedient, because new electric railway companies are not required to pay taxes for two years after the opening of business. After these two years have been passed it will be annexed to the Keihin. The authorized capital of the Company is Y.2,000,000, which will probably all be paid up before the amalgamation takes place. It will run through a district very well suited for factory sites, and it is the intention of this Company to build a canal to Kawasaki, cutting through the district covered by the Kaigan Kido, and with this end in view it has been buying up land on both sides of its projected canal route, and the railway line as well. This land is owned by a " Home Building Company," a subsidiary of the Electric Railway Company.

The national highway running through Kamata will greatly affect the economic growth of this district, as the road will be widened and bettered. The present line of the Keihin Railway is built on the national road for a distance of two miles between Umeyashiki and Minamizoshi. When the road is rebuilt the Keihin will change its present rail equipment to 100-lb. rails, in place of the 61-lb. rails now in use. The change will cost Y.280,000, it is estimated.

A great amount of money will be required to complete the projected canal which is to open the district between Kawasaki and Tsurumi to the sea through a port at Kawasaki on Tokyo Bay. Running south from Kawasaki Station, the Asano Shipbuilding Yards and the other Asano enterprises at Tsurumi have built an accommodation line generally known as the Asano freight line. Along the bay shore south of this line, and to the east of the Keihin line, great efforts are now being made to boost the land for use as factory and home sites. The projected canal from Kawasaki will run from Haccho Nawate along the main line of the Keihin Railway through Noda Mura, and along the Ushioda seashore, past the Asano Steel Works. It will be 8,100 feet long and 120 feet wide. Each bank will be 72 feet wide and especially built up for factory sites. The building work will give the Company some 260,000 *tsubo* of land along the canal which can be sold at a profit over and above all costs of original purchase and construction. In June 1919 it was decided to invest Y.2,300,000 in this scheme.

In June 1920 Y.1,230,000, in December Y.1,420,000, and in 1921 another Y.1,770,000 was expended, the original appropriation having proved insufficient. It was estimated that building the banks and the canal would cost about Y.10 a *tsubo* of land obtained from the construction work. The Company is finishing a new line between Omori seashore, passing through Morigasaki to Anamori, and thence to Daishi, Kawasaki. From Daishi to Tsurumi the newly-planned Kaigan Kido will connect up this whole territory. The districts traversed by this line are densely populated around Omori, but in other places not so well developed. There are no factories in this district, and it is hoped to keep them out, so this territory ought to prove attractive to prospective home builders. Morigasaki is a very fine place. This scheme plans for residential districts between Omori and Daishi, with the factory district south of Daishi extending to Tsurumi.

To complete the connection of the line from Anamori to Daishi it is necessary to bridge the Rokugo river. As the line is now built it is necessary to go to the main line, which has a bridge across this river, for through connections. The main line bridge when built cost only Y.260,000, but to build the one needed by the new line will cost, it is estimated, about Y.2,000.000. However, Rokugo river is now being banked up, and along the embankments factories will be built. If the factory belt is realized, then the expense of the bridge can be met from the increased earning the Company's line will make by serving it.

With respect to the operation of this railway after the earthquake, the system was not badly damaged, so that service was resumed within one week. Increase and extension of the Company's service later made it necessary to add twenty new cars to the rolling stock equipment. These cars are each equipped with four General Electric 263-A motors, maintaining a schedule of 42 minutes between terminals.

The new Yokohama-Tokyo highway lies, for a large part of its length, nearer to the line of the Keihin Electric Railway than that of the Government Railway, so that in the future it is quite possible that the business of the former company will increase, due to building up along the line of this highway.

Tokyo Electric Loan

Negotiations have been concluded for the flotation of debentures in the United States by the Tokyo Electric Light Company with the Guaranty Trust Company of New York. The negotiations were effected through Sale, Frazar & Company, who acted as agents for the Tokyo Electric Light Company.

The debentures to be floated total $20,000,000, with the issue price $98.50 for $100 face value. The debentures bear a 6 per cent. interest rate, with the term of redemption fixed at three years. The Electric Light Company offers no security for this debenture, unelik those secured by the Daido Electric Power Company from Dillon, Read & Company, of New York, and also by the Ujikawa Electric Company from Lee Higginson & Company, also of New York.

Mr. Walker, Vice-president of the Guaranty Trust, had been visiting in Tokyo during the past several months in connection with loan negotiations with both the Tokyo Electric Light Company and the Toho Electric Power Company. Shortly after his return to New York, in June, formal announcement of the second Toho debenture issue was made through the Guaranty Trust.

While he was in Tokyo Mr. Walker made a close survey of the property of the Tokyo Electric Light Company, which claims to be the largest business corporation under Japanese management, with the sole exception of the South Manchuria Railway. It is supposed that he determined then that no other security was necessary.

Most of this fund will be devoted to the extension of business of the company, and the rest to the conversion of old debentures which are to mature shortly.

At first the company contemplated the floating of loans in London, but with England's reluctance to send specie abroad the negotiations were dropped.

In connection with the proposed extension work it is said part of the money will be used for the Shinanogawa Hydro-Electric Company, a subsidiary organization. Upon the merger with the Keihin Electric Power Company next fall, the Light Company will increase its capitalization to Y. 300,000,000, it is reported.

Operator Pushes Buttons; Elevator Does the Rest

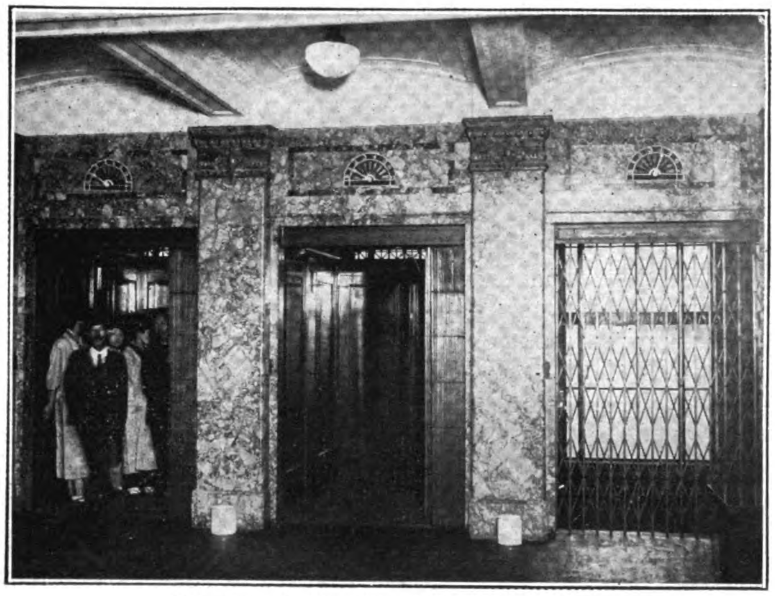
Buildings Equipped With Automatic Elevators Arouse the Wonder of Passengers

"IT is absolutely human!" is the comment of persons who have inspected a recently-developed Automatic Elevator, which is the latest type of high-speed intensive-service passenger elevator put on the market.

At a slight motion of the operator's hand on a lever at his side, the car gate and the landing doors close, and as if by magic the elevator starts up without any other apparent motion on his part. A tablet on the side of the car has two rows of buttons, bearing numbers corresponding to the floors.

As the passenger steps in and calls out his "six," „ eight," "ten," or "twelve," the operator presses the button bearing the corresponding number. Wondrously the car stops and the doors open—the operator has not stirred a muscle. The passenger steps out, the doors close automatically, and the steel cage resumes its upward journey until it reaches the next floor for which a button has been pressed.

So it continues merrily on its way until its round trip has been completed, unless an intending passenger outside of the car has registered his desire to have it stop. In this case, too, as if with human understanding, the car stops and takes on its passenger and resumes its course. No flash of lights notifies the operator that a passenger is waiting. The car halts, apparently of its own accord, quickly opens its doors, closes them again with equal rapidity, and, without the loss of a second, once more starts in motion.



Elevators in the Chiyoda Building, Tokyo

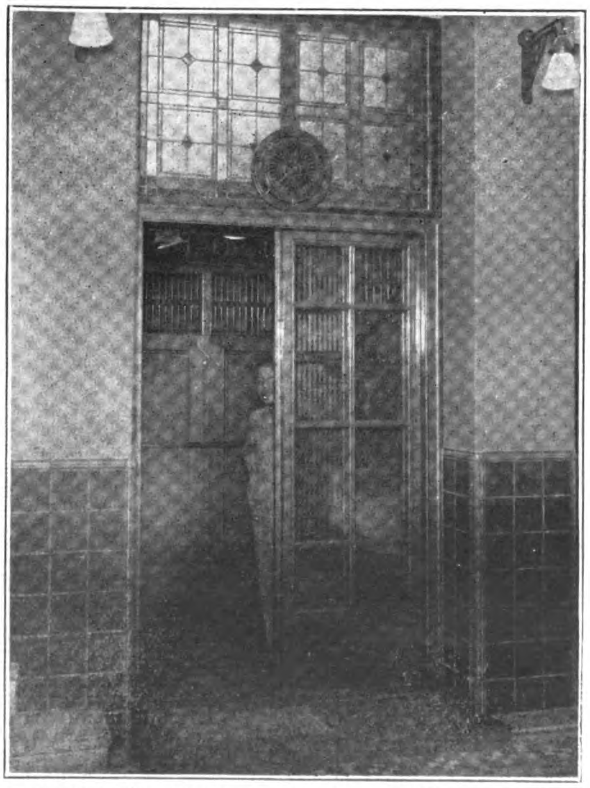
There is no shooting several feet beyond the landing, no waste of time in leveling the elevator with the landing, nor is the impatient man who signals the approaching car forgotten and left to kick his heels until an obliging operator chooses to pick him up. His pressure of the button, indicating his desire to enter an ascending or descending car, instantly registers his call on the controller and the elevator stops automatically without any action on the part of the operator; in fact, without his knowledge.

These elevators, which are built by the Otis Elevator Company, are equipped with what is known as "signal control" and with the "micro-drive," or self-leveling feature, combined with "multi-voltage control." The entire operation of the elevators, as far as stopping at floors is concerned, is accomplished automatically by the elevator controller, irrespective of the operator of the car. The car starts when he closes the gate and stops automatically at the first of the floors for which a button has been pressed.

As the elevator reaches the micro-zone the main operation is automatically cut off, the micro-drive brings the car exactly to the floor level, and the doors are opened automatically. Thus "inching," or starting and stopping two or three times to make an exact landing, which causes so much delay in the operation of elevators, is avoided. This type of control, the micro-drive feature, and the multi-voltage operation, produce the greatest possible speed, and the cars are accelerated and decelerated with a degree of speed calculated not to disturb the comfort of passengers.

This improvement in elevator service is another example of the strides made in the elevator industry. Whenever it becomes feasible to increase the size of business structures or build new ones the elevator problem has already been solved, thus providing suitable transportation for buildings of any size with safety, comfort and speed.

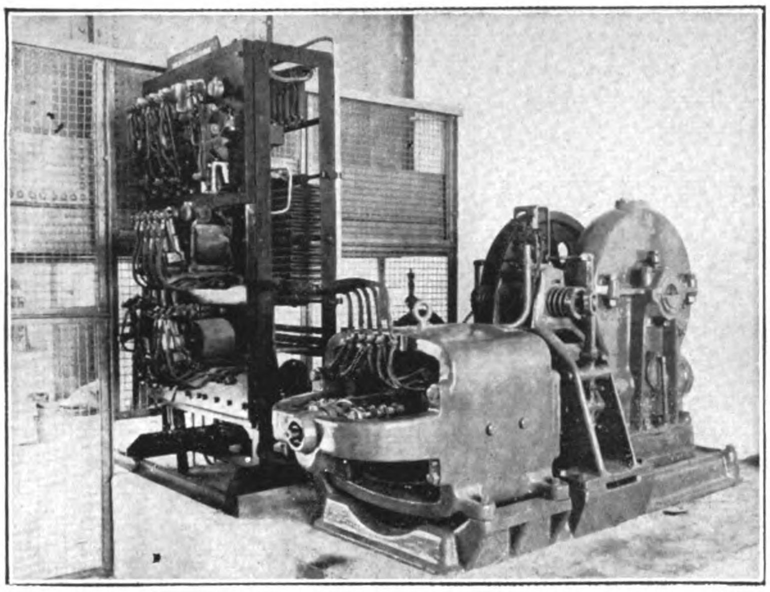
The most important factor in the erection of buildings is that of adequate and suitable means of vertical transportation, which occupies the attention of the elevator engineer in the same way that the president of a railroad studies the problem of rail transportation. Reduction of the round-trip time is one solution of this problem. There is no insuperable mechanical or safety reason why any limitation should be placed on velocity, and many elevator experts see no reason why any arbitrary limit should be placed on speed. In fact, elevators having the signal control device described above have been run in trial tests at a speed of 1,100-ft. per minute with perfect comfort and safety to passengers.



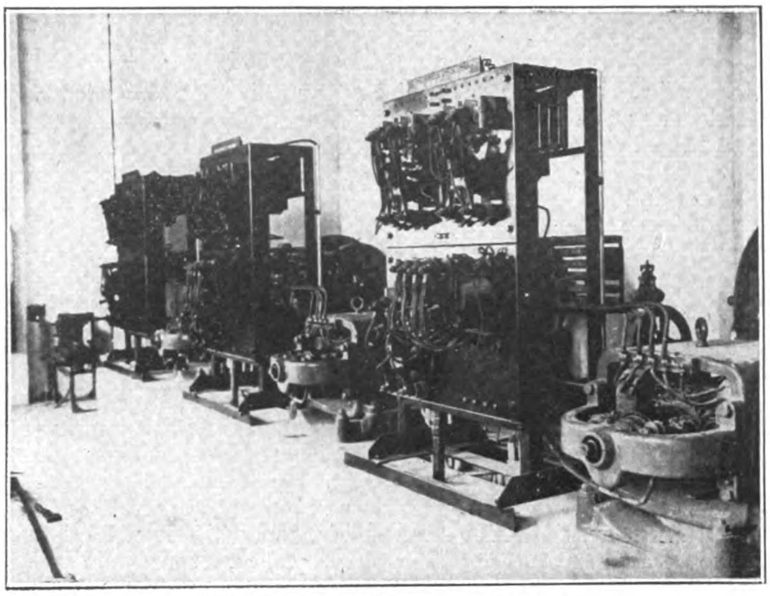
Micro-Drive Elevator in the Imperial Government Railway Club, Tokyo

It takes time for a thought to make its way from the mind of an operator to his hand. And, too, his memory is not always accurate. Hence the automatically operated elevator. Experiment has shown that no stops can be made accurately by car switch at high speeds. Stops must be automatic, and so the time consumed by false stops made at ordinary velocities with manual car switch operation is eliminated. Such false stops ordinarily exceed 50 per cent. of the normal stops.

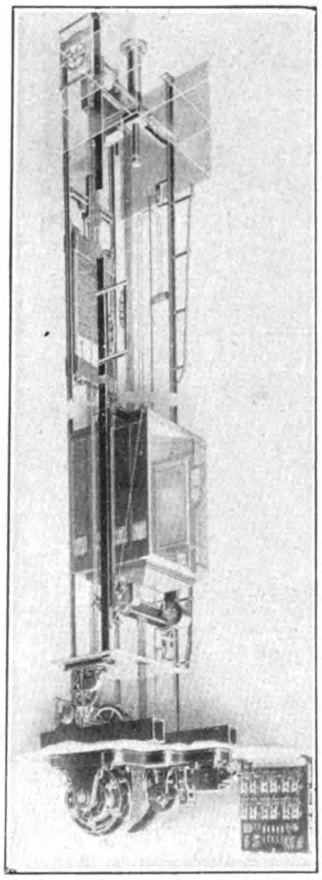
The next time-saver is the matter of opening and closing doors. Again the human element is removed. The operation, which when performed by hand took at least four or five seconds,



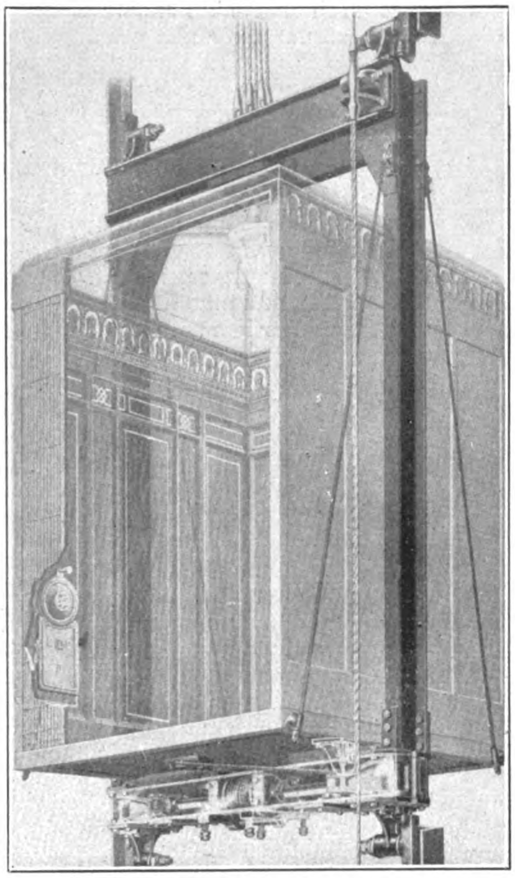
Modern Elevator Machine and Controller



Typical Elevator Machine Installation



Micro-Drive Elevator Installation with Multi-Voltage Control



Typical Elevator Frame and Car

has been reduced to two seconds for the "opening and closing cycle." Gates and doors are interlocked with the car operation and the levelling devices so that the gates and doors are operated automatically, and fully open when the car reaches the landing.

The elevator cannot leave the landing until both are closed, and locked. More than 80 per cent. of accidents to passengers arise from the fact that elevators are not equipped with car gates and interlocks.

No elevators of the signal control type have been installed in Japan, but there is no reason why the new buildings to be erected in the Tokyo district may not use this up-to-date system. Certain features involved therein are, however, at present used on some elevator installations in this district, particularly the micro-drive feature. This may be seen on the Otis elevators in the Imperial Railway Club in Marunouchi and in the Sankyo Drug Company building on the Ginza. Others are in operation in the Mitsukoshi Department Store, and several more are now being installed. Of these latter, two will utilize the unit multi-voltage system, by means of which alternating current power generates direct current for the elevator motors, and results in unparalleled smoothness in starting and stopping.

Included in the same installation is complete automatically operated door equipment, as described in a previous paragraph. As further indicative of the way in which this company considers the interests of its patrons, four escalators are being installed, each capable of handling four thousand persons per hour, and several more are now under consideration. An escalator of this same capacity is installed in the new Ginza building in Tokyo, designed by the prominent Japanese architect, Dr. Kida, seven floors of which are occupied by the Matsuya Department Store. This building is also equipped with modern American elevators and enclosure fronts of the highest quality, as are many other large buildings in the Tokyo district.

The best is none too good for the new Tokyo. It is to be hoped that as the plans for the reconstructed city materialize the elevator equipment, enclosure fronts, and other architectural features in connection therewith, as well as the buildings themselves, will keep pace with the most modern methods used elsewhere; and judging by the past, it is believed that enterprising Japanese architects and engineers will be satisfied with nothing else.

Large Turbine for Japan

ANOTHER 35,000 k.w. turbine-generator, the third so far this year, has been ordered by the Toho Electric Power Company of Japan from the International Electric Company. The last is for installation in the Nagoya station and duplicates the one ordered last year, giving that station a capacity of 70,000 k.w. The rating is 35,000 k.w. (43,750 kva., 80 per cent. per ft.), 11,000 volt, 3-phase, 60-cycle, 17-stage.

The stator will be shipped minus punchings. These, together with the windings, will be assembled at the destination. This same procedure was carried out with each of the other three units. Also, as in the case of the other three, a General Electric surface cooler has been ordered.

The two generators ordered earlier this year are for the Tokyo Electric Power Company, a subsidiary of the Toho Company, and will be installed at Tsurumi. They have similar ratings, except that they are for 50-cycle generation. The order was received by the I.G.E. Co. through Mitsui & Co., Tokyo.

MITSUI

(*Continued from page 505*).

two or three new concerns projected by influential financiers with head offices in Osaka. The Mitsui Trust has as chairman of the board the director-general of all the Mitsui enterprises, Dr. Takuma Dan, the president being Mr. Umekichi Yoneyama, one of the most popular and gifted financiers in Japan.

The Mitsui Mining Co., Ltd.

It would require a special article to do justice to the many activities of the Mitsui Mining Company, that branch of the Mitsui activities that has made the trade-mark of the family known throughout the metallurgical world as the stamp of quality on many products. The Miike coal mines at Omuta, in Kyushu, with the splendid Miike coal harbor for the rapid loading of steamers, is one of the most interesting and important engineering developments in the continent of Asia. Starting with the mining of coal and the subsequent building of a modern harbor, the Mitsui transformed this corner of Kyushu into an up-to-date industrial center. The Miike Metal Refinery, the Miike Dye Works, the Miike Iron Works, the Miike Coal Mines and the Miike Harbor Office, all great enterprises, are located at this point and operated under one general supervision. On the same island are located the Tagawa, Yamano and the Kushikino coal mines. The Yumoto mine in Fukushima, the Kamioka mine in Gifu, the Sunagawa mine in Hokkaido and the Kawakami mine in Karafuto (Saghalien) are also owned and operated by the Mitsui Mining Company.

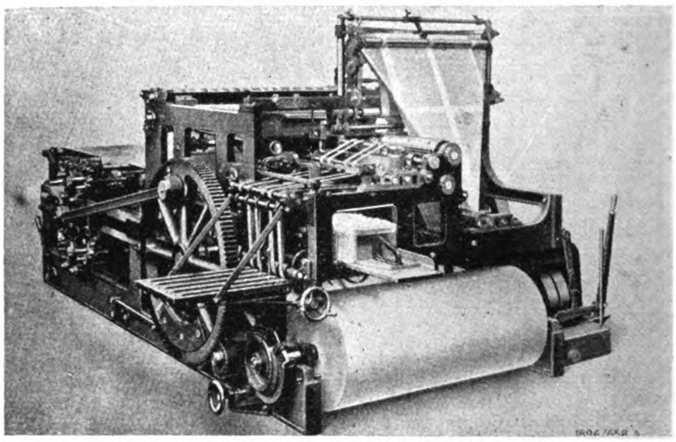
Rebuilding after the earthquake created an enormous demand for zinc plate, much of which was being imported from abroad. The Miike Refinery, however, came into the market with a large supply of the best quality plate and materially helped to keep down the adverse trade balance. This refinery, established in September 1914, smelts the zinc ores from the Mitsui Kamioka mine, in addition to imported ores, and is capable of producing annually 13,000 tons of zinc, 1,000 tons of zinc white and 30,000 tons of sulphuric acid. The Kamioka mine, one of the oldest silver, lead and zinc deposits in Japan, came into possession of the the Mitsuis in 1888.

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 Employees abt. 2,000



Duplex Press with one Paper Roll, Delivery Side

SPECIALITIES:

Portland Cement Works
Crushing and Breaking Machinery
Brick and Tile Making Plants
Silico-Calcareous Brick Works
Chocolate and Cocoa Factories
Paste-Goods Factories
Breweries and Malteries
Briquetting Plants
Powder and Celluloid Presses
Rice-Mills
Roller Mills for Soap and Paint Manufacture
"Duplex" Newspaper Printing Presses
Conveying Plants of every kind

For particulars apply to the

Far Eastern Office: BUHLER BROTHERS

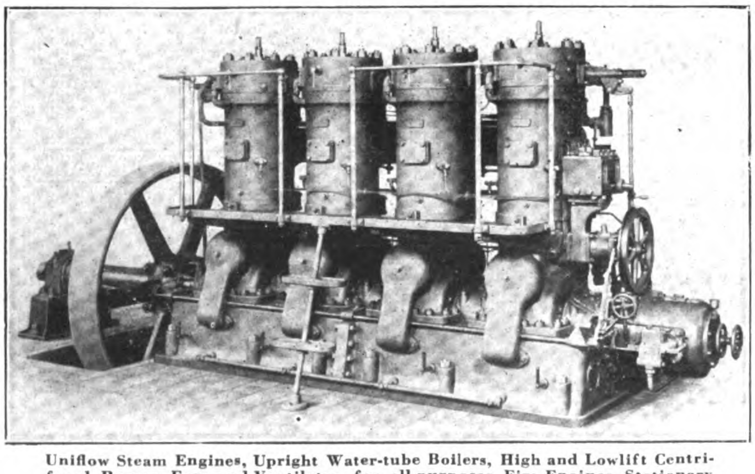
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE

4 AVENUE EDWARD VII.

蘇爾壽工程事務所
上海愛多亞路四號
本公司常備目錄供給各界
垂詢工程事務亦易誠酬答



Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, Stationary and Marine Diesel Engines, AIRLESS INJECTION DIESEL ENGINES, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

4-CYLINDER AIRLESS INJECTION DIESEL ENGINE

SIMPLE DESIGN; SIMPLE ATTENDANCE; RELIABILITY AND ECONOMY

WINTERTHUR. SWITZERLAND.

OCT 15 1925
PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

上海仁記路拾六號

遠東時報

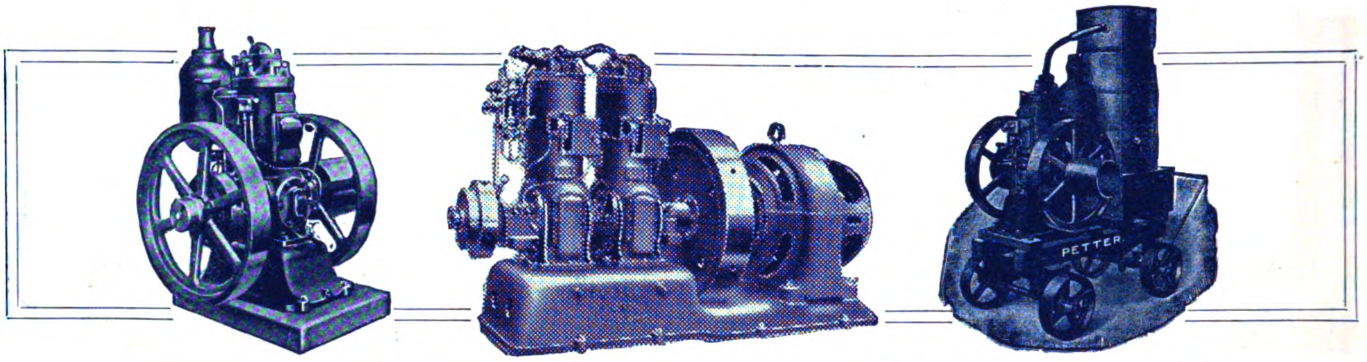
MAY 30

MANCHURIA—A SURVEY
RED JOURNALISM
STRIKE ECONOMIC, THEN POLITICAL, NOW ECONOMIC AGAIN
HOKKAIDO, THE DIFFIDENT
A STUDY IN EXTRATERRITORIALITY
COAL IN THE PHILIPPINES
JAPAN'S PLACE IN THE RACE FOR AIR SUPREMACY
JAPAN'S CONTRIBUTION TO NAVAL ARCHITECTURE
ZINC METALLURGY IN TONKIN
EASTERN STEEL MARKETS
DIRECT-CURRENT LOCOMOTIVES FOR YOSHINO RAILWAY
CAPITAL DAM OF THE CHENGTU PLAIN IRRIGATION

Vol. XXI August, 1925 No. 8

SHANGHAI, PEKING, TOKYO AND MANILA

Petter Oil Engines for all Purposes



PETTER 'S' TYPE ENGINES

Start and work on Crude Fuel Oil.
Self-contained. No Steam Boiler or Gas Plant. Great Saving in floor space and cost of foundations.
START FROM COLD without pre-heating.
Always ready for work.
For Factories, Electric Lighting, etc.
Sizes 5, 8, 12, 18, 24 and 36 H.P.

PETTER 'M' TYPE ENGINES

Start on Petrol—Work on Kerosene with Magneto Ignition.
Sizes 1½, 3 and 5 H.P. For Agricultural and general purposes.

THE PETTER-LIGHT ELECTRIC LIGHTING PLANTS

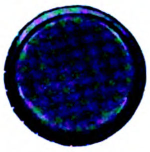
with Petter 'M' Type Engines are in use all over the World for Home, Shop, and Factory.

The Petter 'S' Type Marine Engines (Cold Starting) are Unrivalled for Fishing Boats and Small Vessels

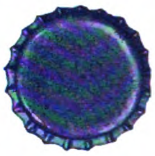
For particulars of the larger size Engines up to 500 h.p. please write to Messrs Vickers-Petters Ltd., Ipswich

PETTERS LIMITED, OIL ENGINE WORKS, YEOVIL, ENGLAND

Information may be obtained from Rear-Admiral Yutani, c/o Mitsubishi Shoji Kaisha, Ltd., Marunouchi, Tokyo



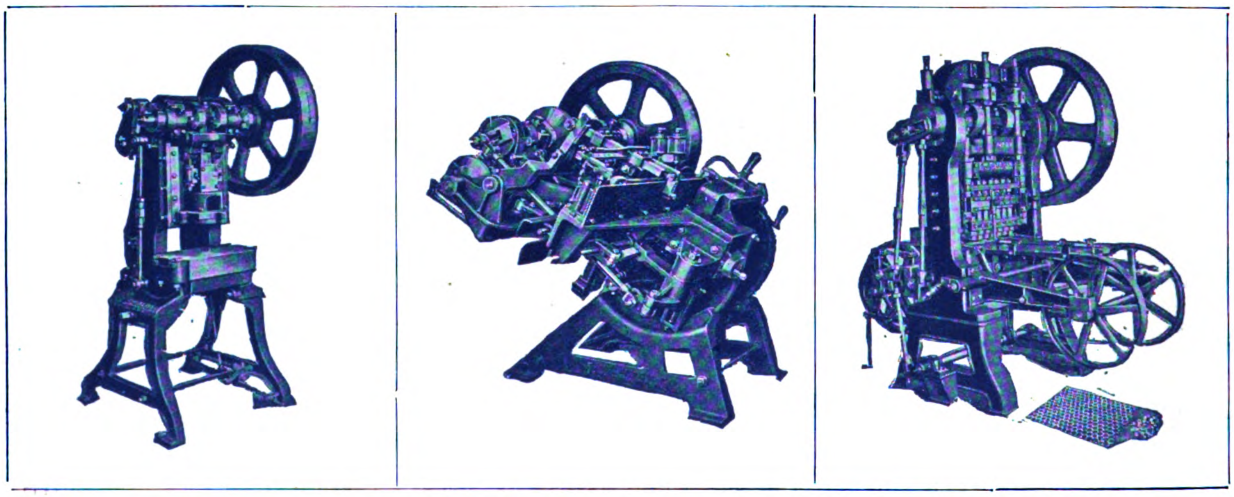
ONE OF THE MANY OUTFITS BUILT BY THE E. W. BLISS CO.



Crown Bottle Caps and Presses for their manufacture

From left to right, the Presses illustrated below will give the following productions per eight hour day: 10,000—100,000 and 500,000 respectively.

Send us Samples and state daily production required and we will be glad to give you prices and full particulars



E. W. BLISS CO., 53rd Street and 2nd Avenue, Brooklyn, N.Y., U.S.A.

Presses, Dies and Machinery for the Sheet Metal Industry in general. Complete plants for the manufacture of Metal Boxes, Sanitary Cans of all shapes and sizes, Kitchen Utensils, Petroleum Cans, etc. Complete automatic equipment for making tin cans from tin plate in one continuous operation.

BLISS

London, England—Pocock St., Blackfriars Road **Italy—345 Via Nizza, Turin.** **Paris, France—54 Blvd. Victor Hugo, St. Ouen, Paris**

FOREIGN REPRESENTATIVES:

India—Duff Engineering Co., Ltd., D. S. Clive Building, Calcutta

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum

VOL. XXI AUGUST, 1925 NO. 8

CONTENTS:

	PAGE
MAY 30	535
MANCHURIA—A SURVEY	537
RED JOURNALISM	538
STRIKES ECONOMIC, THEN POLITICAL, NOW ECONOMIC AGAIN	540
BANKING IN JAPAN	542
THE PROBLEMS OF PROFESSIONAL STATUS	544
PURIFICATION OF SWIMMING BATH WATER	545
A STUDY IN EXTRATERRITORIALITY	*546
HOKKAIDO—THE DIFFIDENT	*548
JAPAN'S PLACE IN THE RACE FOR AIR SUPREMACY	*554
COAL IN THE PHILIPPINES	*558
MODERN TENDENCIES IN EASTERN STEEL MARKETS	*564
ZINC METALLURGY IN TONKIN	*566
CAPITAL DAM OF THE CHENGTU PLAIN IRRIGATION	*571
GRAHAM BROTHERS IN FIRST PLACE	*574
HANDLING BALES OF COTTON	*575
JAPAN'S CONTRIBUTION TO NAVAL ARCHITECTURE	*577
DIRECT-CURRENT LOCOMOTIVES FOR THE YOSHINO RAILWAY, JAPAN	*579
THE OPENING OF JAPAN'S FIRST HOME ELECTRIC	*581

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allan, Whyte & Co., Ltd. 27
Allen & Co., Ltd., Edgar 11
American La France Fire Engine Co., Inc. 50
American Locomotive Sales Corp. .. 25
American Tool Works Co. 1
Armstrong, Whitworth & Co., Ltd., Sir W. G. 18, 19
Associated British Locomotive Manufacturers for China .. 49
Attwater & Sons 48
Avery, Ltd. W. & T... 11

Babcock & Wilcox, Ltd. 36
Baldwin Locomotive Works .. 65
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 2
Bethlehem Steel Export Corp. .. 31
Bliss Co., E. W. .. .. Cover
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Brown & Sons, Ltd. David 3
Browning Co., The 63
Bucyrus Company 73
Buhler Brothers 582
Butterfield & Swire 44

Canada Carbide Co., Ltd. 70
Chambers Scott & Co., Ltd. .. 14
Chartered Bank of India, Australia & China 48
Columbia Ribbon & Carbon Mfg. Co. 70

Daido Electric Power Co., Ltd. .. 28
Dai-Ichi Ginko Ltd. 62
Dai Nippon Brewery Co. 34

Diamond State Fibre Co. 75
Dixon Crucible Co., Joseph .. 70
Dodge Brothers 5
Drewry Car Co., Ltd. 15

Electricity Department, S. M. C. .. 6
Escher Wyss & Cie 16
Evans & Sons (Wolverhampton) Ltd., Joseph 2
Exchange Bank of China 61

Fairbanks Co. 21
Fairbanks Morse & Co. 75
Fuji Gassed Spinning Co. 10

Gaspary & Co., Dr. 14
Gleniffer Motors, Ltd. 15
Goodell Pratt Co. .. Under Index
Goulds Manufacturing Co. .. 14
Graham Brothers 4
Green Island Cement Co., Ltd., The 20

Hennef Engineering Works .. 74
Hongkong Rope Manufacturing Co. 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co., Ltd. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. .. 58
International Banking Corporation 55
International General Electric Co., Inc. 51

Japan Sugar Co., Ltd. 6
Jardine Engineering Corp., Ltd., The 12
Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. .. 10
Kawasaki Dockyard Co., Ltd. .. 33
Kokusai Kisen Kaisha 45

Link-Belt Co. 63
London Directory Co., Ltd. .. 74

Mather & Platt, Ltd. 17
McConway & Torley Co. 14
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd... 38
Mitsubishi Marine & Fire Ins. Co., Ltd. 38
Mitsubishi Shoji Kaisha 72
Mitsubishi Warehouse Co., Ltd. .. 38
Mitsubishi Zosen Kaisha, Ltd. .. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. 72
Mitsui Bussan Kaisha 26
Mustard & Co. 14

Nippon Menkwa Kabushiki Kaisha 52
Nippon Yusen Kaisha .. 46, 47
Nipponophone Co., Ltd. 34
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. .. 24
One Hundredth Bank, Ltd., The .. 59
Osaka Shosen Kaisha 42
Oster Manufacturing Co. 75

Petters, Ltd... .. .. Cover

Redpath Brown & Co., Ltd. .. 15
Reuther & Reisert, C. 74
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 73

Sale & Frazer, Ltd... 8
Shanghai Dock & Engr. Co., Ltd. .. 32

Shanghai Municipal Council 6
Shibaura Engineering Works, Ltd. .. 7
Siemens China Co. 36
Simons & Co., Ltd., Wm. 13
Smidth & Co., F. L. 41
Smith Major & Stevens, Ltd.. .. 16
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. 17
Standard Oil Co., of N. Y. 29
Standard Underground Cable Co. .. 14
Sturtevant Co., B. F. 63
Sulzer Bros. 582
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd... 60
Superheater Co., The 27

Thornycroft & Co., Ltd., John I. .. 1
Toshiu Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 74

Ujigawa Electric Power Co., Ltd. .. 74
United States Steel Products Company .. ..23, 37, Back Cover

Waggon-und Maschinenbau Aktiengesellschaft Gorlitz 71
Wallace & Tiernan Co., Inc. 27
Walworth International Co. 50
Westinghouse Electric International Co. 78
Williams & Co., J. H. 3
Wotan Werke, A.-G. 35

Yarrow & Co., Ltd. 21
Yasuda Bank, Ltd. 62
Yokohama Dock Co., Ltd. 34
Yokohama Specie Bank, Ltd. Cover
York Manufacturing Co. 73

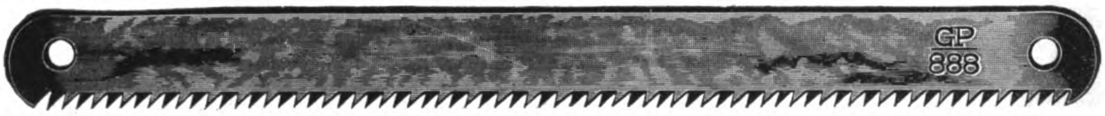
Zwickauer-Maschinenfabrik, ... 71

GOODELL-PRATT

1500 GOOD TOOLS

GP
888

This mark identifies the Goodell-Pratt *all hard* Hack Saw Blades.



DEPENDABLE HACK-SAW BLADES

Goodell-Pratt offers a variety of dependable Hack-Saw Blades, the two most popular styles being illustrated here.

GP-777 is a flexible blade with a soft center, and hardened back and teeth. Desirable for work which subjects the blade to severe twists and side strains.

GP-888 is an all hard blade, made from a special high grade of hot-rolled sheet steel, .025 inch thick, cut so that the length of the blade runs with the grain. For speed and endurance GP-888 is in a class by itself.

Export Orders are given especial attention, shipments being carefully packed in new and strongly re-enforced wooden cases.

Free catalogues may be obtained direct or from importers of American tools, most of whom carry the Goodell-Pratt line of tools.

GOODELL-PRATT COMPANY, Toolsmiths, Greenfield, Mass., U.S.A.

Representatives:

Muller, Phipps & Sellers, Ltd., Room No. 758, Marunouchi Building, Tokyo (Central P.O. Box No. 98)

Muller & Phipps (China), Ltd., N.K.K. Building, 2 Canton Road, Shanghai, China

Muller, Phipps & Sellers, Ltd., Dojima Building, Osaka (Central P.O. Box No. 63)

GP
777

Goodell-Pratt *flexible* Hack-Saw Blades carry this mark

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, AUGUST, 1925 No. 8

MAY 30

A FULL JUDGEMENT on the events of May 30 and the widespread popular antagonism to foreigners is not altogether possible even three months after the event. Until a judicial inquiry has definitely established responsibility and has determined the cause of the rioting and subsequent shooting, it is only a mark of partizanship to blame one side or the other. That such an inquiry has not been held is an error of judgement on the part of the officials in Peking, both Chinese and foreign. The Shanghai Consular Body and the Shanghai Municipal Council both declared for such an inquiry within a few days after the trouble started, and only the interference of the diplomats in Peking prevented what would undoubtedly have been a palliative from taking place.

Two immediate causes of the general anti-foreign movement was the strike in the Japanese cotton mills in Shanghai and the anti-foreign ultra-nationalistic propaganda conducted by the Soviet Russian representatives in Shanghai.

Japanese Pre-Eminence

Japanese capital dominates the textile industry of China. According to figures issued by the *Government Bureau of Economic Information*, the following was the ownership of cotton mills at the beginning of 1924:

	Chinese	British	Japanese
No. of Mills	73	5	41
Spindles	2,112,154	250,516	1,215,544
Looms	13,689	2,863	5,925

In 1922 there were 64 Chinese-owned mills in China; in 1923 this number was decreased to 54. It is reasonable to assume that the ten mills have passed to Japanese ownership. One British-owned mill in Shanghai passed to Japanese ownership in 1924-5. In Shanghai the Japanese now own 33 mills, representing an investment of more than Y.200,000,000.

From the above figures it will easily be seen that the Japanese influence in the textile industry is pre-eminent, and that a stoppage of work in those mills means a period of inactivity for the whole industry. The strike, then, which broke out in the Shanghai Japanese mills during the Spring crippled the industry, causing damage to Chinese and foreigners alike. In the course of the strike Russian agitators and Chinese Bolsheviks from Shanghai University intimidated the workers and conducted a propaganda which was not to be a class struggle between Capital and Labor, but a national struggle between Chinese and Japanese. This had nothing at all to do with the strike. This was not at all the opinion of the workers. It was an extra issue created by the agitators and fomented in the hope of prolonging the strike and spreading it to other industries. *The Chinese people are not anti-Japanese. They are not anti-foreign. Whenever such an issue is invoked in China it is the result of outside interference, of outside forces seeking to utilize the Chinese people as tools in a selfish game of international politics.* Russia utilized the strike in Japanese mills to foment an anti-Japanese movement in China. Russia sought an opportunity to conduct her own propaganda among the Chinese laborers and found it.

THE FAR EASTERN REVIEW has always sympathized with China's nationalistic aspirations. We always realized that the day will come when the Chinese people will organize a firm Government, will stabilize internal conditions, will devote their energies to public services, such as the development of means of communication and of great industries. We have held that when that day comes China will ask that the treaties which are now so objectionable be rewritten, and that China will then be able to take her place as an equal among the nations of the world. We have viewed with regret the carelessness, the negligence, the selfishness of China's militarists, who have permitted the country to suffer disunion and indignity that their own private fortunes might be increased.

Russian Intrigue

It is not, therefore, because we do not favor nationalism in China that we connect the present movement with Russian propaganda, but it is because we regard ourselves as friends of China that we view with the deepest regret the misfortune of a great nation on the eve of a diplomatic victory suffering herself to become a tool of Russia, which seeks to utilize the annoyance of the weak and small among the nations to embarrass the great and important Powers.

What was China's position on May 30 ?

China had won a signal victory at the Washington Conference. Her position of inequality was recognized and a definite promise of redress was made. China was without enemies. Great Britain, the United States and Japan had adopted policies which were favorable to China and which, in many respects, were more satisfactory than China could have anticipated at the time of the Versailles Conference. These favorable policies were possible because the United States and Great Britain were acting together with Japan, so that these three nations were almost a unit in their attitude of helpfulness toward China. France alone prevented the fulfilment of the terms of the Washington Agreements by failing to ratify the treaties because of the gold franc question. Had Great Britain, the United States and Japan not been hampered by France's unwillingness to ratify the Washington Treaties, a Tariff Conference would by this time have been held in Peking, and China's international situation would have been improved, in spite of the fact that almost never in her history has the Government been so impotent or internal conditions so disturbed.

Even without the holding of the Tariff Conference, China's position *vis-a-vis* the nations registered an improvement. For Japan was doing everything possible to win the friendship of the Chinese people, and no European nation was aggressive. The general viewpoint seemed to be to allow China to work out her own salvation and to help her along if possible. Russia, the policy of which since 1919 has been to establish a series of buffer states between herself and the Powers, was displeased with the recurrence of relationships of friendship between China and Japan and between China and the Western Powers. Russia's buffer state policy had produced curious results in China, for in one place, such as Mongolia, the Russians are bitterly anti-Chinese, while in Peking they attempt to appear to be exceedingly pro-Chinese and on good terms with the Central Government, and in Canton the Red Government is bitterly anti-Peking and is working for separatism in China.

The Shanghai Bund—The Heart of Economic China

It is remarkable that Russia, which had already destroyed China's position in Mongolia by fomenting an anti-Chinese nationalistic movement there, which has been stirring up an anti-Chinese nationalistic movement among the Mohammedans of Sinkiang and Kansu, and which has attempted to revive the spheres of influence in Manchuria, became interested in nationalism in China. Therein lay the greatest danger to a genuine nationalistic movement in China. For anything smeared with Russian gold, anything mellowed by Russian approval becomes so odious to the rest of the world, as no matter how righteous the movement, its connection with Russia makes it a menace and a danger to the peace of nations.

The Unequal Treaties

Russia utilized the natural and known annoyance of the Chinese with the "unequal treaties," a poor and un-Chinese term for the unilateral treaties which were signed under the Manchu *régime* as a result of wars in which China was the loser, just as other nations in other parts of the world have been forced to sign humiliating treaties when they lost a war or were unable to defend their integrity. The Russians utilized the quarrel among the provinces in China and assisted the Canton Government, which naturally made for further disorders in the land. The Russians financed agitational organizations through the Red University at Irkutsk, and later at Whampoa, near Canton, to create disorders in China. The plan was simple: It was that when Chinese "cells" of the Communistic movement rose against either the Chinese Government or against foreigners in China the confusion and disorder already existent in the country would make resistance difficult, if not impossible. In the full realization of their plan the Russians have been unsuccessful, for the natural sobriety of the Chinese people made outrages, as visualized by a Russian when he thinks of revolution, impossible.

Russia's influence is under-estimated by well-meaning, ardent Chinese nationalists, who believe that the foreigners are utilizing the general dislike and distrust of the Bolshevik to ridicule and minimize a Chinese nationalist movement. Their error lies in the lack of an international viewpoint on the part of the Chinese nationalists. They have failed to grasp the significance of the Third Internationale and its methods of work. They have not watched the course of events in Europe between 1919 and 1923, when Russia fomented similar movements in every European country, only to fail. When the world revolution, which is a religious ideal with a Communist, failed in Europe, the Soviet Government concentrated on Asia. Efforts were made in every Asiatic country to establish a point of contact, a "cell," as the Bolsheviks call it. In Afghanistan, Turkestan, Mongolia, China, Korea and Japan, the Russians labored, everywhere adapting their propaganda to the local situation. In one place they were nationalistic, in another aggressive. In China, for instance, they attacked British and Japanese imperialism, and yet reasserted Russian imperialism in Manchuria. On the whole, the Russian effort in Asia met the same response as in Europe. The peasantry of Asiatic countries had no desire to leave their century-old ideals and principles for the uncertainties of a Bolshevik millenium. Only in Canton did the Bolsheviks gain a foothold, and there it was the result of a curious series of episodes.

The Bolshevik agent attached to the Kuomintang, Mr. Borodin, was the only Russian representative in China who really succeeded in his effort to gain control of a Chinese unit, largely because he was able to finance the Red Kuomintang Government in Canton, and because he was in a position to provide arms, munitions and Russian commanders. He established a military school at Whampoa, near Canton, where Russians drilled Chinese, mostly not Cantonese, in accordance with the Soviet drill books. He made it impossible for any opposing Chinese general to defeat the Red Army. He became the guide and paymaster of the Red Kuomintang, the controller of its political and military activities. Only, however, where the Red Kuomintang's influence extended, could Mr. Borodin be of service to Soviet Russia in China. Elsewhere he was unknown, and as the Chinese people more and more came to know of the destruction of trade, the poverty of the peasantry of Kwangtung, the richest of provinces, they cursed the man and the government which foisted him upon China. The White Kuomintang hold him in

contempt, but for the Chinese tools of Comrade Borodin, for Liao Chung-kai and Wang Ching-wei they retain a bitterness and hatred which is bound to express itself in still further bloodshed before long.* It is an amazing fact that wherever the White Kuomintang is most influential, particularly in the Upper Yangtze Valley, the disturbances have been fewer and of a less ferocious character.

The question often arises, What does Russia want ? In the course of the Soviet's effort to impose Bolshevik principles upon other nations and to extend the imperialistic sway of Russia in Europe and Asia, there have been three impediments, Great Britain, the United States and Japan. The Allied support of the Czechs in 1920 ended in a Soviet victory because the Allies withdrew, eventually forced Japan to withdraw from Siberia, and left the way open for the Bolsheviks, first through the Far Eastern Republic and now through official Soviet agencies, to conduct their anti-British, anti-Japanese, anti-American campaign in China. Elsewhere, on the whole, the Soviet Government has not succeeded, and even in China it is but a seeming success, for the Bolsheviks know that on the whole the Chinese people find more value in the practical friendship of the three Great Powers than in the lip service of Russia.

At first the Russian idea was simply to create disorders in China with a view to imperilling the capital investments of Britishers, Americans and Japanese in this country. Labor troubles and disorders always reduce profits and discourage further investment of capital. Furthermore, in a period of constant disorder the people become discontented and nervous, and can then be utilized for the fomenting of still more trouble. The mass resistance is low. On the other hand, the three great Powers were interested only in constructive enterprises, from which they gained a certain kudos. New enterprises, new schools, cultural and industrial development plans serve to cement the friendship between China and the three great Powers which alone can serve in this direction. The Soviets then hit upon the scheme of utilizing Chinese nationalism in such a manner that the Chinese would reject the contributions of friendship. The students particularly were made to feel that these contributions of friendship were masked capitalistic bribes to keep them in permanent servility to the so-called Imperialistic Powers. Such an argument quite naturally appealed to the younger Chinese, who had already pledged themselves to tariff autonomy and the abolition of extraterritoriality. The aims of young China and the promptings of Bolshevik Russia dove-tailed, so that in China Mr. Karakhan apparently was successful in creating a bond of friendship between Soviet Russia and China. But Mr. Karakhan does not know, and his Government does not know, how the Chinese will react to Russia's imperialistic program—for Russia now wants something more positive in China than the mere weakening of British, American and Japanese influence. *Russia wants to utilize China to achieve Russian equality with the Powers. Russia wants to fight Japan on Chinese soil, to use Chinese soldiers and China's resources in such a war, to establish a Government in Peking managed and controlled by Russian Bolsheviks who will direct China's efforts in this war. Russia wants China to be a tool in her own war of revenge for the defeat in 1905, for the humiliation of the White Bear.* Russia believes that China will be foolish enough to agree to such a program; but it is safe to predict that when that day comes the nationalistic spirit of China, the consciousness of race, the good common sense of the Chinese people, the tradition of history will turn the wrath of China on the intriguers and betrayers, on Soviet Russia. Soviet Russia will reap in China what she has sown here—bitterness, hatred, disappointment.

*Liao Chung-kai was assassinated after this article was written.

Manchuria—A Survey

THE position of Manchuria within the Republic of China is seldom understood by those who believe that China is a unified, centralized country. Manchuria and Mongolia, outside the Great Wall, are altogether apart from China proper, in that they are sparsely populated and are peopled in part by alien races. Both Manchuria and Mongolia conquered and held China at one time, only to be absorbed by the Chinese people, not by conquest but by the assimilative genius of the Chinese. The Mongols, as a race, are decadent; but sufficiently active to be a problem to the Peking Government. The Manchus are moribund and are no longer a factor, but the Chinese in Manchuria are politically very active and competent, and under Marshal Chang Tso-lin are maintaining an administrative independence of Peking which seriously affects the status of the Peking Government, particularly as Manchuria's sway within China Proper extends from the Great Wall to the city of Shanghai.

In spite of the sparsity of population, Manchuria is undoubtedly the richest section of China. Consisting of the provinces of Fengtien, Kirin and Heilungkiang, it serves as a granary, producing beans, wheat and kaoliang in huge quantities, so that, for instance, Dairen, the port of South Manchuria, is the center of the soya bean trade of the world. The largest industrial enterprises in China, the only producing steel plants, are in Manchuria, which is now also developing a textile and large scale flour milling industry.

Much of Manchuria's progress is due to the progressive efforts of the South Manchuria Railway, the largest industrial organization in the Japanese Empire. Manchuria and the South Manchuria Railway have become so closely bound together by economic ties that it would be impossible to destroy the prosperity and integrity of one without altogether dislocating the other. It is fatuous for chauvinistic Chinese or anti-Japanese foreigners to attempt to under-estimate this relationship, for the realities of Manchuria are against them. The constructively-minded Chinese have never questioned the value of the South Manchuria Railway to China, for they have witnessed the transformation of a part of their country from an unproductive, poverty-stricken, backward area to a hive of industry, to a progressive center from which radiates commerce and wealth, bringing riches and importance to the whole country.

The Chinese have grown wealthy on the activities of the South Manchuria Railway, and in Manchuria, where the value of Japanese assistance has been most appreciated, there is no anti-Japanese movement, no boycotts, no strikes. The Chinese and Japanese there work together in harmony and friendship.

Russia Enters

Into this scene entered Russia—Soviet Russia, the disrupter of nations. During the old days of imperialism, after Portsmouth, Japan and Russia reached an agreement delineating their sphere of influence in Manchuria. An arbitrary line was drawn, south of which the Japanese regarded as their sphere, and north of which Russia regarded as her sphere. Japan owned the South Manchuria Railway, and Russia, in effect, owned the Chinese Eastern Railway. The Great War, however, wrought its changes. Russia, for a time, ceased to be a factor in China's affairs. China herself took over the management of the Chinese Eastern Railway under the capable administrator, Dr. C. C. Wang. Japan, in the meantime, had joined the Consortium and had attended the Washington Conference, and had given up all her claims to spheres of influence in China. Japan pooled her unworked interests in China with the other nations on the basis of the general interest of China.

Soviet Russia, which attacks imperialism in others but practices it herself, returned to the management of the Chinese Eastern Railway on an agreement with China which has never been kept either in spirit or letter. As soon as that was accomplished, Soviet Russia reasserted the sphere of influence in North Manchuria and sought to obtain recognition of this by both China and Japan. Thus far neither nation has replied to Russia's efforts, which are in the form of protests against the building of the Taonan-Tsitsihar Railway by the Chinese Government. It so happens that the Construction Department of the South Manchuria Railway has been awarded the contract to build the road by the Chinese Government, but this is merely a construction contract and has no political

significance. The South Manchuria Railway is probably the only company in Manchuria equipped to undertake this work. Russia, however, protests, and seeks to make out a case so that peace between Russia and Japan depends upon the revivification of these spheres of influence. Russia is seeking for trouble with Japan in such a form that Japan will appear to be the aggressor.

What South Manchuria means to Japan, and the significance of the Russian attitude in international relations, forms an interesting preface to Mr. Adachi Kinnosuke's new book, "Manchuria—A Survey." We reproduce this preface in full because it is so clear a statement of the situation, and because it represents the point of view of so many Japanese who are thinking of the future of their country. Mr. Adachi knows his Manchuria and China; he knows his America. When Japanese of the calibre of Mr. Adachi and Count Soyeshima openly point to the inevitability of war between Russia and Japan, the nations of the world might well turn their eyes toward Manchuria.

Adachi's Preface

Mr. Adachi's preface follows:

This is a story of what Manchuria has and what she is making of it,—a story of her crops, her mines and of her forest wealth.

It is also a story of what all these mean to Nippon.

It is not an Economic History of Manchuria: it tries to have as little as possible to do with a mere record of dead facts. The book's aspirations are rather immodest, in fact—even heroic. It addresses itself to the task of stopping America to see Manchuria as she is—a big enough job even for the prophet who once commanded the sun to stand still.

With the general run of our American readers, Manchuria is a name pasted on that jumping-off edge of the world somewhere in the outer darkness of their school geography—a mere label, some 10,000 miles below their mental horizon. Knowing that, and without apology, without ceremony, this book essays to make Manchuria as intimate to our American friends as a Philadelphia-made locomotive or Milwaukee steam shovels, which, indeed, happen to be writing the present-day history of Manchurian industry out here.

Funshun and Anshan are quite as American as Pittsburgh or a coal-field of Illinois in their methods and mechanical equipments. This is quite as true as that a few steps from these coal mines and steel plants one will find the Chou Dynasty (born 1122 B.C.) a reality, alive and kicking. For in Manchuria the Twentieth Century walks arm in arm with the days of Noah. Along the side of the Through Express of the South Manchuria Railway—made up of the same American Pullman sleepers as the "Broadway Limited"—creaks a wheelbarrow which has not lost a single one of the classic lines, old when Confucius was a baby. All of which means that Industrial Manchuria is, this very day, clearing in a single jump more than two thousand years. It is a huge industrial laboratory in which the old and the new, the Oriental and the Occidental, experiences and experiments are being tested out in a feverish rush. It is not a melting-pot of races, but a crucible of economic theories.

There is another thing of interest about Manchuria:

The question of WAR or PEACE for Japan will be settled—not in Japan nor on the Pacific, as some of the navy people on both shores of that ocean dearly love to believe. But in Manchuria. The question of FOOD for Japan is being settled there to a considerable extent. And the question of FOOD is one of the aliases of the question of WAR or PEACE. This must be of some interest to the people of America, where every time money is needed for a warship the propagandists feel it a moral duty to drag forth the over-worked ghost of a Japanese menace.

In the past Japan has known Manchuria as a battlefield. She has fought over it twice—against China in 1894 and against Russia in 1904. She is about to find there the source of life and of national peace. For of all the thousand troubles Japan has, two are serious: the lack of FOOD and the lack of vital raw materials, such as iron and oil. And Manchuria seems to be the answer,—to a large extent.

Then there is still another thing:

Last year in my wanderings up and down the Homeland of the Sun I saw that the only path of salvation for our dearly-beloved Nippon lay through the industrialization of the country. Over every section of the Island Empire I saw industrialization going on feverishly, aggressively. It was no easy job all the same: every inch of the old country is encrusted with the vested interests of centuries. In Manchuria, building over the wreck of the Russian Dream, all is different. It affords an experimental ground for the Japanese which is hard to beat. At Dairen the Japanese have built a port and a city more modern, more sanitary, with better-built houses and better-paved streets than anything they have at home. In Manchuria, not in Japan, the Japanese brought into existence the South Manchuria Railway Company, absolutely the biggest Japanese company ever organized.

It should not surprise anyone to hear that the future captains of Japanese industries are coming out of Manchuria.

Red Journalism

ONE of the most remarkable feats in journalism is the reporting of Shanghai events and conditions by a reporter who remains in Kobe, Japan. From the standpoint of a visual knowledge of conditions in China, Kobe is as far as London. From the standpoint of atmosphere one might as well be in New York as in Kobe to understand China. The critics of J. O. P. Bland, for instance, complain of him that he does not know the current tendencies in China because he is away from the country too long. The same is just as true of a writer in Kobe. Yet, Mr. John A. Brailsford, Kobe correspondent of the London *Daily Herald* whose articles occasionally appear in the *New York City World*, undertakes to describe conditions in China and to write with the air of an expert and an authority on all subjects related to China.

The article in the *New York City World*, for instance, is an example of the sort of dangerous piffle this man sends abroad to convince his own countrymen and Americans that their nationals and his are brazen, hard-hearted devils. The article is headed: "Why China is Boiling Mad at the 'Foreign Devils.'" The sub-head is "Westerners Too Quickly Acquire the Bullying Habit—Justice is of Two Kinds, One for Foreigners, One for Natives." The article then proceeds to belabor the foreigners in China as though they were all pre-natal criminals. Mr. Brailsford gives two examples of the misdeeds of the foreigners in China, on both of which he is misinformed, and therefore with regard to which he gives an altogether false impression.

His first instance is as follows:—

> A few months ago a Chinese soldier, disarmed, was killed by an American marine at Shanghai. The victim was one of about 10,000 troops who, having been defeated in the civil war, had taken refuge in Shanghai and had been interned by the foreign authorities there. They were forbidden to leave the internment camp, though it was admitted that the conditions in the camp were vile in the extreme. Four Chinese were seen trying to escape. The American marine on guard fired and killed one.

The writer of this article personally investigated this particular instance on behalf of a daily newspaper in Shanghai immediately after it happened. The facts are as follows:

During the Kiangsu-Chekiang war a body of soldiers under General Chang Yuen-ming rebelled and held their headquarters against their commander, Marshal Chi Hsieh-yuan. This war endangered the whole of Shanghai and aroused the bitter opposition of Chinese and foreigners. In the course of the fighting these soldiers were defeated. They took refuge in the French and International Settlements and became a serious menace to the peace and health of Chinese and foreigners alike. A riding school was improvised into a detention camp, where they were provided with beds and food—far superior to anything they had in camp. It was in March, when Shanghai suffers from heavy rains, and the men were in a riding school with a dirt floor. Before they were given the riding school they were huddled together in the open air, not in the foreign settlements but in Chinese territory on the edge of a foul creek.

The real menace to the city was that some of the soldiers would break loose and loot the city. Landing parties were sent ashore to protect the city against this danger. In the course of the trouble

some soldiers attempted to escape, and one was shot by an American marine in the course of his duty. Consul-General Cunningham rushed to the spot and made an immediate investigation. Newspapermen also went to the spot. *It was the concensus of opinion on the spot that if the marine had not fired an attempt would have been made to break for liberty and to loot the city.*

The above is an eye-witness's account. Compare it with Mr. Brailsford's Kobe account in the *New York City World*.

Running Amok

In the same article Mr. Brailsford picks on a motor car accident and gives the impression that foreigners can run down Chinese and kill them with impunity. Now, any one who understands the operations of the Foreign Courts in China knows that they are much stricter in their administration than the Chinese courts. In the British Supreme Court in Shanghai and in the United States Court for China men have been very severely punished for motor-car accidents. One American in Shanghai has for years been paying a part of his monthly salary to the family of an injured person. The records of both these courts will bear scrutiny with regard to their conduct on this subject; yet Mr. Brailsford is willing to sign his name to an article, and the *New York World* is willing to publish an article, which gives an altogether unjust impression of conditions here.

In a decision rendered on July 2, 1916 by Judge Lobingier of the United States Court for China in an accident case he said:

> "The rights of pedestrians on public streets are equal to those of motorists and the latter must be on the lookout for the former. In this case while defendant says that he did not see plaintiff till just before the collision the policeman and the Chinese tailor had seen her while she was crossing the street. Plaintiff's credibility was questioned in argument but the main facts above reviewed do not depend on her testimony; they are established by other witnesses, and chiefly those called by defendant.
>
> In the Federal Courts the burden rests upon a defendant to prove contributory negligence on the part of plaintiff and we do not think that burden has been met in the case at bar."

This policy has always been followed by the court.

If a Chinese comes before the Mixed Court, he will be fined $50 or $100 according to what he could pay. In the foreign courts, the damages often run into thousands of dollars.

Hits at Japan

In the *London Daily Herald* Mr. Brailsford published an article on "Japan's Political Safety Valve: New Manhood Suffrage Act Covers System of Repression." Again Mr. Brailsford picks on a few facts to cover an attack on the Japanese Government. We quote:

> Radicals are thrown into prison without trial, subjected to the attentions of detectives who seek to induce them to implicate themselves, and others are brought to trial after months, or even years. In the present trial of Communists the Court refused to permit the defendants to call witnesses.
>
> However, it appears that the rulers of the land are gradually coming to realize the necessity for a safety-valve for the pressure of popular discontent.

The development of universal manhood suffrage has been a slow process in all countries. The revolutions of 1830 and 1848 in Europe, the Chartist Movement in England, and the various Reform Bills in England covered more than a century. One might almost say that the struggle for universal suffrage in Anglo-Saxon countries began at Magna Charta and lasted until the Great War, a matter of some seven centuries. In Japan the process has been of much shorter duration. It is little more that half a century since Japan has changed from a feudal state with an absolute to a constitutional monarchy. The process of evolution of the masses from one political system to another has been gradual, but speedy. Japan has had the advantage of western example and has not been required to go through all the testing stages of the Industrial and Social Revolutions of Europe. Yet human nature and the attitude of individuals *vis-a-vis* ancient institutions is more lasting than paper constitutions. *The reformers of Japan had not only to change the economic and political technique of the Japanese, but their habits and viewpoint.* This process has taken less than two generations. Some of the original reformers are still alive. Some of them are still active in the nation's affairs. They all knew that the only effective method of fundamentally changing the political viewpoint of the masses could be by popular education, which is a slow process in any country. Even Mr. Brailsford, who seems to be willing to live in a country he dislikes when the world is so large and broad that he can surely find a more congenial place, will have to admit that few countries can vie with Japan in the literacy of the people. The fruits of this work are just beginning to become evident, and universal manhood suffrage is immediately granted. What more could even a radical like Mr. Brailsford require?

Child Slaves

Again, in the *London Daily Herald* Mr. Brailsford (his name is not given, but "From Our Own Correspondent, Kobe, Japan" fixes the responsibility) publishes an article on "No Relief for Chinese Child Slaves." He says:

> A hideous outrage on child life is being perpetrated in the mills of Shanghai. Not only is there a moral responsibility on the Westerners who control the situation to put an end to the abuse. As long as it lasts, its rebound will be felt. You can't degrade other people without degrading yourself. You can't degrade other people's children but the influence will come back through unseen ways upon your own.

Now, it is a fact that the Westerners worked very hard to have the Child Labor Amendment passed. *The Chinese opposed its passage* on the ground that the Chinese Government had legislated on the subject and that the Municipal Council need pass no further legislation. The British Consul-General at the time devoted much of his energy to the passage of the Amendment. Mrs. Gull, the wife of the secretary of the British Chamber of Commerce, devoted herself to it. Mr. Brooke-Smith, the manager of Jardine's, delivered an address favoring the amendment and asked ratepayers to vote for it. All the foreign newspapers favored it. A special meeting was called to pass the amendment; then the event of May 30 intervened and spoiled this effort. On the morning of the strike big posters were placed throughout the city asking the ratepayers not to attend the meeting. These posters were put up by Chinese.

Now, as a matter of fact, the bulk of the factories are Chinese-owned. In Shanghai the British own five out of more than thirty cotton mills. The Chinese did not want the Child Labor Amendment because they were not ready for it. It will perhaps interest Mr. Brailsford to know that in the Nagai Wata Kaisha Cotton Mills (Japanese) and in the British-American Tobacco Company factories (British) the employers have worked out a system of measuring their workers in an effort to keep children out, the only method available, as there is no Government registration of births in China. With regard to the whole question of Child Labor, we quote from the *China Year Book* (1925):—

> "The problem of female and child labour in China is different from that of western countries. The earnings of the head of a family in China, either among farmers or artisans, are so small that it is necessary for the welfare of the family that all the members of it contribute some earnings as soon as possible. The average earning of adults throughout the country is inadequately known, no scientific survey ever having been made, but casual experience indicates that it is a correct statement of the condition to say that the earnings of the female and child members of the family are necessary for the maintenance of a bare living. Under the handicraft system, still largely in vogue throughout China, female and child labour went over to the factories from the handicraft system. On the farm, children work as soon as possible, the small boy taking care of the water-buffalo being a common sight in South China, while the child carrier is usual in North China.
>
> "As long, then, as wages are insufficient to provide for the care of a family, the adult head of the family has to permit his female members and children to work. All efforts at regulation of child labor thus far have met with more opposition from the laborers themselves than from the employers."

Mr. Brailsford's articles have been taken up in this way because it is necessary occasionally to call attention to the sort of stuff that is sent out from the Far East by radical correspondents. The Chinese never ask for these sort of articles. They are basing their case not upon statements which can easily be disproved, but upon a claim for justice. Why do Mr. Brailsford and similarly-minded persons embarrass their case?

Strikes Economic, Then Political, Now Economic Again

By George E. Sokolsky

An Article by the Editor of "The Far Eastern Review" in the "North China Daily News"

THE present phase of the strike was perhaps not altogether unexpected. It might be called the third phase of a general uprising of labor in Shanghai. The first phase was purely economic and was evidenced by the strikes in the Japanese cotton mills in Shanghai and Tsingtao. These strikes ushered in the end of 1924 and culminated in the riots of May 30, when the second phase of the movement made its appearance. This phase was largely political: an anti-British, anti-Japanese movement developed even among those who were not laborers. The leadership for a moment passed from labor groups to students and merchants. Without discussing any of the political questions of that phase, it is necessary to indicate that there were many factors other than economic which swelled the ranks of the strikers and which agitated all classes of the Chinese people. The third phase is again economic. It is a movement for the increase of wages and a betterment of conditions. It knows no nationality, and, as a matter of fact, is liable to attack Chinese rather than foreign institutions, in that conditions and wages are not as good in the former as in the latter.

The Post Office Demands

The Post Office strike was entirely economic. The strikers' demands looked like political propaganda, but these demands have more or less become stereotyped, each striking group copying what has appeared before. The actual demands were for wage increases, and the strike ended the moment the increase was assured. Had all the political demands been granted and the wages not increased, the strike would not have ended. That test will apply to all economic strikes, no matter what the ultimatum of the strikers says about foreigners and the treaties. After all, in this phase of the strike movement the workers have practically forgotten the wild urgings of the Chinese Bolsheviks and have again returned to what is becoming a purely economic struggle in an industrial centre, a struggle which is not different from similar movements in England and America and which seems to be an historical concomitant of the application of the method of the Industrial Revolution to production and distribution.

To the Chinese laborer good working conditions are apparently not as important as wage increases. This is understandable to the economist, although it must appear as ingratitude to such employers of labor as have provided their workers with modern social improvements. The three firms which have the most modern programme of social improvements are the Naigai Wata Kaisha Cotton Mills, the British-American Tobacco Company plants, and the Commercial Press. The present writer is not repeating company propaganda, but as editor of the chapter on labor for the "China Year Book," he each year makes an investigation of the whole field, and therefore is in a position to justify such a statement by continuous observation. These organizations provide benefits to their workers in the form of education, health protection, better wages within the particular field and a supervisory interest in the general welfare of their workers, which contrast favorably with similar efforts abroad. In the case of the B.A.T., wages are practically on a sliding scale, in that a rice allowance is provided which is in direct ratio to the cost of rice on the open market.

The Currency Evil

The difficulty with wages is that currency is uncertain in China. The currency of the laborer is the copper, which is constantly of a decreasing purchasing power. The ratio between the copper and the silver dollar, which itself is of uncertain purchasing power, is constantly fluctuating. The writer recently saw tables of copper fluctuation during the past two years covering important cities throughout the country, which clearly indicated that the copper is gradually reaching a position where its purchasing value for commodities not indigenous to the locality will be *nil*. The laborer may be paid in silver, but he converts his silver into coppers. Any surplus over his expenses has a diminished value due to the constant decreasing value of the coin. The bad money situation can in no way be improved by the employers of labor, as they cannot interfere with the authority of the Government to regulate coinage, an authority which the Chinese Government is unable to exercise.

Wages are further decreased in value by the uncertainty and excess of taxation. House-owners, who are forced to make contributions to militarists, do not take the money out of their own pockets. They quite naturally—and, from an economic standpoint, correctly—levy their additional expenditure on the tenant in the form of increased rents. It must be remembered that since August, 1924, Shanghai has been levied upon by Ho Feng-lin, Chi Hsieb-yuan, Sun Chuan-fang, Chang Yuen-ming and Chang Chung-chang. These levies or forced loans have had a tremendous bearing upon the local strike situation.

Rice Tells a Tale

The militarists have at the same time been levying excessive and illegal taxation on the agricultural districts from which Shanghai obtains its food supply. The wholesale index number for cereals, including rice, for Shanghai on the basis of 100 for February, 1913, indicates a constant rise. Beginning with August, 1924, the index numbers are as follows:

1924		December	148.1
August	144.6	1925	
September	148.1	January	147.9
October	145.6	February	145.7
November	151.8	March	152.9

—Bureau of Markets Reports.

As rice is the staple food of most of the laborers in this area, with a growing appetite for wheat foods, wages would have to move in some direct ratio with this fluctuation in price. Now, in western countries the price in staple food products such as bread or beef does not fluctuate except in periods of stress. The loaf of bread remains at the same price until some such catastrophes as a war, panic or famine brings an increase. In Shanghai, however, the cost of the staple is constantly fluctuating, so that the laborer or the employer cannot possibly know the exact purchasing value of the wage at any given moment. It is impossible to manage industry with a monthly fluctuating pay-roll, as it would be impossible to fix costs and prices under such a system; yet the laborer is bound to be dissatisfied and subject to the vilest agitation if his wages have an uncertain purchasing power. This situation, in other countries, is usually remedied by governmental action, such as the regulation of prices and distribution of food commodities, the appointment of food controllers, the distribution of doles or the punishment of profiteering. In China the Government takes no interest in the subject except to issue mandates complaining about the sufferings of the people and calling upon officials to put their minds to work on the problems, a call which is ignored as having no vital bearing upon the official's political activities.

Employer's Position Yet Worse

As difficult as is the problem of the laborer, the position of the employer is even more difficult. No employer wants strikes and labor troubles. The investment has been made in the particular industry on a basis of probable profits covering a continuous utiliza-

tion of the plant and an opportunity to meet competition in a free and open market. Strikes and boycotts destroy these two conditions, and, therefore, imperial capital investments in the industry. It is not to be expected that the laborers in China will be so far-sighted as to realize the effect of their strikes upon the industries of the country. Labor in other countries has not been as far-sighted as that. The Luddites, who broke the first steam machines in Manchester, were not far-sighted. Yet men who are willing to sacrifice themselves for a national movement might be influenced to consider the effects of their activities on the industrialization and modernization of their country. For unless China becomes industrialized she will ever be the economic slave of industrial countries. The history of political freedom in Europe and Asia has indicated what might almost be a law: that those nations which are possessed of a highly developed national industry, such as Great Britain, Germany, the United States and Japan, are also possessed of the greatest political independence, while such nations as are still in a primitive industrial condition possess the minimum of political freedom and importance. Among those nations might be included the Balkans, Russia, China, the South American republics, etc.

China's Industry Infantile

Industry in China is infantile. The basis of the modern capitalist system is a firm steel and iron industry and a textile industry. China's position in the former is negligible, and in the latter is at the beginning of a career. Of the 119 textile mills in the country there are not more than half a dozen Chinese-owned and managed mills which can show a profit. This condition is due to a faulty system of capitalization and inexperienced management. The cotton boom at the end of the war brought to the country more mills than could be managed by experienced Chinese. The lack of laws governing corporation investments led to extravagances and the assumption of prerogatives on the part of managing directors which led to chaos and failure. In western countries some of the managers would have been punished for fraud; in China, perhaps rightly, the matter has been written off against experience. It is impossible to get data on how many Chinese mills are heavily mortgaged to banks or to importing firms, but current information leads to the opinion that not more than five or six Chinese-owned companies are altogether free and solvent.

In the flour milling industry the same is true. The wonderful mills at Wusih and Tsinanfu are not flourishing, although there are indications of improvement in their conditions. There is not a single Chinese tobacco company which was in what would be regarded as a flourishing condition in western countries prior to May 30. Some companies were paying dividends and pottering along, but in view of the hugeness of the tobacco industry in other countries their efforts were picayune. What their condition is now it is difficult to say, but no judgment on the condition of an industry can be based upon the extraordinary situation now in effect. The printing industry, which is everywhere important, was flourishing, but upon the basis of static conditions. Any change in wages would upset the industry, and an increase in expenditures could not possibly be accompanied by a relative increase in the selling market. By that is meant: when in Europe and America wages increase because of strikes or other conditions, the manufacturers find efficiency methods for the lowering of costs and use advertising and salesmanship for the increase of markets. In China both these methods are unavailable at present.

Costs Irreducible

1.—The costs cannot be lowered. The largest part of the goods consumed in the manufacture of commodities in China has to be imported because of the undeveloped condition of the country. Chinese cotton is of short staple, and therefore Indian, American and sometimes Egyptian cotton has to be imported. This is true in spite of the fact that cotton is now a staple agricultural product of the country. The likin tax and excessive and illegal taxes often bring the cost of the native product beyond its commercial value and make it more profitable to export it to a country having a higher standard of living, and therefore a higher cost capacity, than China,—Japan, for instance. This condition obtains in every industry, including flour milling, although China is an important wheat-growing country. As long as the basic article in the process of manufacture has to be imported, the cost will naturally depend in a large measure upon altogether extraneous influences.

In western countries costs have been lowered by speeding up the laborer. This has thus far not been successful in China, although there is divided opinion on the subject. One manufacturer said that Chinese labor is as good as any he has had in other countries; another suggested that one American negro would do as much work as five Kiangsu-Chekiang Chinese. It is clear from the state of mills and factories here that it takes a larger number of workers to produce a given article, even when machinery is the main tool, than it does in England or America. The rice-cabbage diet of the Kiangsu-Chekiang laborer is probably too poor in calories to produce a powerful worker. If, then, it takes five times as many Chinese to produce an article as it does one Englishman, theoretically the Chinese should be paid a fifth as much on the basis of the differing currencies. Theoretically that is the condition. But actually, the Chinese laborer is paid more in the differing currency.

Roads and Buying Power

2.—It is impossible to improve the market in certain manufactured commodities because of lack of communications and lack of purchasing power of the people. It may not be generally known, but every firm pushing important commodities carries certain markets at a total loss at the present time in the hope of developments in the future. These losses cannot be added to the price of the commodity elsewhere, as the market will not bear the increase because of the general standard of living, which is determined not upon industrial but agricultural incomes. The loss has to be added to the cost of production and taken out of possible profits. In many cases the cost of transportation is so high as to vitiate any possible profits. The manufacturer has then to make his profits in limited areas and on the basis of a more or less static marketing price.

Under such conditions, strikes and sudden increases in the cost of production will tend to destroy industry. Capitalists will find it more safe and more advantageous to invest their money in real estate, foreign bonds and money-lending than in industry. Any country which exists on such an economic basis is not safe, as must be evident from the condition of the franc on the money markets of the world in spite of France's victory in the Great War. Such a country lacks the economic independence to cope with Powers which are possessed of great industries. Great Britain's political pre-eminence is not based upon politics, but upon steel and textiles. Germany's marvelous recovery is not due to German soldiers, but to German manufacturing abilities. The relationship between industry and political independence is becoming constantly clearer as the aftermath of the European war focusses attention on the essential characteristics of the different nations.

Where, Indeed?

If China, then, is to develop an industry, there must be a changed attitude toward both Capital and Labor, a change which can only be developed under government supervision. But where is the Government which would take an interest, where is the Government which realizes this relationship between industry and political independence, where is the Government which would even heed the warning in such a strike as that which has at present closed the leading educational institution of the country, the Commercial Press?

Japanese Westinghouse Company

The Westinghouse Electric Company of Japan is a newly-organized subsidiary of the Westinghouse Electric International Company, incorporated under the laws of the State of Delaware with a capital of $1,000,000.

The purposes of this company are to distribute Westinghouse products throughout Japan and to arrange for proper service to the many users of Westinghouse apparatus there. Adequate stocks will be carried. The staff in Japan will be almost entirely Japanese.

The officers of the new company are Guy E. Tripp, chairman; L. A. Osborne, president; E. D. Kilburn, vice-president; I. F. Banker, managing director at Tokyo.

Banking in Japan

Colonial and Foreign Banking Systems; by Keith le Cheminant, B. Com. (London); George Routledge & Sons, Ltd., 1924

IN a very interesting and compact form, Mr. le Cheminant describes the banking systems of Canada, the Union of South Africa, Australia, India and Ireland, as well as the systems of France, Germany, Italy, the United States, South America and Japan.

The expansion of banking from local to national and international interests followed the general development of trade and commerce. Asiatic countries except Japan have not kept pace with this progress because of political conditions in those countries. Japan, however, when she determined upon a program of modernization did a very thorough piece of reorganization. The chapter on Banking in Japan is here given in full because of its concise and careful statement of the subject:

The Empire of Japan has often been compared to the British Isles, and they have many features in common—geographical, climatic, and economic, but in one important respect the comparison does not hold good. Japan possesses an imporant part of the mainland—Chosen, formerly Korea, and the large southern island of Taiwan, formerly Formosa. These two outside possessions have some effect on the banking institutions of the country, and each of them has a specialized institution of its own which has attained a position of some international importance.

Japan was in the fortunate position of being able to profit by other nations' mistakes in her modernizing process, and in banking she modelled her system mainly on that of England, with one or two strong points from other nations. Modern banking in Japan may be said to date from 1872, when a national bank system modelled on the National Bank system of the United States was adopted. There were a few merchant bankers of good standing already in existence in the country, notably the Mitsui Bank, which was founded as far back as the seventeenth century, but modern banking had been little developed. The adoption of the American system produced the same multiplicity of independent banks as in that country, and at the present day there are over two thousand.

It was difficulties of note issue which were mainly responsible for the adoption of the Federal Reserve system in the United States, and the note issue was found to be an equal source of trouble in Japan.

The private banks issued notes in excess, and this, with a large amount of Government paper in circulation, caused the financial structure to become severely strained, with the result that Japan turned to other countries for a solution, and found it in the adoption of a system of central banking.

The Bank of Japan

In 1883 the Bank of Japan was founded on the model of the Bank of Belgium. It received a charter from the Government for thirty years, and this was renewed in 1912.

The right of note issue was taken from the private banks and given to the new central institution, with very happy results for the financial stability of the country. The present fiduciary issue amounts to 120 million yen, but the Bank is in such a strong position that at one period in 1920 the total note issue was covered by specie, and at the end of 1921, at the height of the depression in trade, three-quarters of the issue were so covered. At the end of 1922 the position had so far recovered that only 57 million yen remained uncovered—a very strong position when it is remembered that the fiduciary issue is double that amount.

The Bank of Japan has not followed the lead of the Bank of England and separated its issue department from the purely banking department, but, apart from this, it has many of the same features. Soon after its foundation the Government handed over to the Bank the care of its balances, together with the management of the national debt. Issue and redemption of the debt together with interest payments are managed by the Bank in the same way as the Bank of England manages the English National Debt. In the last war the Bank did very good work in financing the Government's requirements, and also helped considerably in floating loans in Japan on behalf of the Allies.

The Bank of Japan naturally carries out the duty of a Central Bank in holding the balances of the "other banks," for whom it has also performs the function of re-discount. Of late years the Bank introduced the system of "acceptances," a class of business from which Japaness banks were formerly precluded, and will now rediscount bankers' acceptances made for the purpose of assisting foreign trade or home industries. The short loan and discount market in Japan has, in these circumstances, tended to develop on European lines, its operators carrying discounted bills with short loan money from banks and using the central institution for re-discount purposes if necessary. The Bank is also open to make loans to the Exchange Banks against foreign bills, a provision which has aided the work of these banks in helping to finance Japan's foreign trade. Both the Hongkong and Shanghai Banking Corporation and the Chartered Bank of India, Australia and China have branches in Japan, and one or two essentially Japanese banks dealing mainly in exchange operations are to a great extent controlled from London—although their head offices are in Japan—a fact which bears additional witness to the supremacy of London as the financial centre of the world.

Japanese banking is curious, among other things, from the fact that there are two distinct types of bank in the Empire—"ordinary banks" established under the general banking laws, and "special banks" chartered by the Government to perform special functions, and consequently enjoying certain privileges for which the Government exacts the right to appoint supervisory Boards of Directors, and so largely to control their activities. Of these "special banks" one has already been discussed, namely, the Bank of Japan, established to take over the note issue of the country and generally to perform the functions of a central bank.

Whatever may be said about the Continental system of Industrial Banking, when Japan was establishing her banking institutions the Government apparently decided that, at any rate, for a time, ordinary banking and industrial banking should be kept apart. "Special" banks were, therefore, established under close Government supervision for the assistance of trade, agriculture, and industry.

The Yokohama Specie Bank

The Yokohama Specie Bank, Limited, was founded in 1880 for the purpose of aiding the foreign trade of the country, and was given special privileges. It has since then assumed a position of world-wide importance, and its operations now approximate very closely to an "ordinary" bank, as it deals in other than purely exchange business, although its chief interests are still in financing foreign trade. The quotations of this bank fix the foreign exchange rates for Japan, and the Bank of Japan is under agreement to rediscount approved foreign bills for it to an amount not exceeding 20 million yen per annum at the rate of two per cent.—a privilege of some value.

The Yokohama Specie Bank, apart from the foregoing, is in a privileged position, in that it is entrusted with the foreign business of the Government and also holds the foreign balances of the Bank of Japan. It also has the right of note issue in China and Manchuria, but the circulation is small, amounting at the end of 1922 to six million yen, or less than one per cent. of the total liabilities. The *liai on* between the Bank of Japan and the Yokohama Specie Bank, already strong, is made additionally so by the fact that the Governor of the Bank of Japan is usually the Deputy-Governor of the Yokohama Bank, and the Deputy-Governor of the Bank of Japan the Governor of the Yokohama Bank—a provision which obviously makes for very strong interests in common.

This leading Japanese Exchange Bank has branches all over the East, in Japan, China, Manchuria, and India, and, in addition, has offices in London, Lyons, Hamburg, four in the United States, Buenos Ayres, and in Sydney, New South Wales.

Hypothec Bank of Japan

The next class of "special bank" in Japan is that which deals with agriculture and which has been extended to industrial operations. The main bank of this class is the Hypothec Bank of Japan, which was founded in 1897 as a central financial institution for assisting agricultural and industrial undertakings throughout Japan. It makes long-term loans at low interest on mortgages of real property and, in this respect, is comparable to the *Crédit Foncier* of France. The Bank has done much to develop agriculture, stock-breeding, and fisheries, and other productive activities. In connection with this Central Industrial Bank there are forty-six smaller provincial institutions which perform the same functions on a smaller scale, and locally. They advance money at low rates of interest for periods not exceeding thirty years, and, being semi-official institutions, they have usually the sole right of this type of business in their own locality.

The Hypothec Banks just described have as their main business the granting of long loans on real property. The Industrial Bank of Japan, Limited, performs the allied function of making advances on the security of bonds, debentures, and shares, mostly of an industrial nature. It also finances shipping and shipbuilding. The peculiarity of the Industrial Bank is that it is authorized to issue debentures to the extent of ten times its paid-up capital, or at present to the extent of approximately 500 million yen. The amount issued at the end of 1922 was 360 million yen, which gives room for further expansion when required.

The remaining "special banks" are those which have been established to finance the requirements of Japan's outlying possessions. The least in importance but not in interest is the Hokkaido Colonization Bank. This institution was established to assist in the exploitation and colonization of the northerly and climatically ill-favoured island of Hokkaido, and of Karafuto, the southern and Japanese portion of Saghalien. The Bank was established in 1902 and has since made considerable progress in opening up the island's fisheries and agriculture by granting long-term loans. It is authorized to issue debentures to the extent of five times its paid-up capital.

Colonial Banks

Japan has now a strong footing on the continent of Asia. Korea, the principal part of Japan's continental possessions, was transferred to the Empire in 1910 and its name changed to Chosen. In the same year the Bank of Korea, formed the year before, was established by special Act as the Bank of Chosen, and has become a semi-official central bank for the province and for the remainder of Japan's possessions and interests on the mainland. The Bank possesses the right of note issue in Chosen to a maximum of 50 million yen, fully covered by gold, with an excess issue of 20 million. This excess issue has been temporarily extended to 40 million to deal with trade difficulties in the country.

An Imperial Ordinance of 1917 proclaimed Bank of Chosen notes the sole legal tender throughout Kwangtung Province and the South Manchurian Railway Zone, where Japan has been granted a sphere of influence. These provisions have increased the prestige of the Bank, which has of late years extended its operations.

The foreign trade of the areas mentioned, with that of Chosen, is largely financed by the Bank, which arranges to buy bills against exported produce or accept bills against imports. Under the protection and influence of the Bank foreign trade has greatly increased.

Japan's southerly possession, the island of Formosa, or Taiwan as it is now called, was in a very backward condition in 1893, when Japanese rule was established. Since then great strides have been made and a considerable foreign trade has been built up, notably in the island's world monopoly of camphor.

In 1895 the Bank of Formosa, now the Bank of Taiwan, was established, and it is largely owing to its efforts that this progress has been made. The Bank acts as a central bank for the province in the same way as the Bank of Chosen does in the north, and has the right of note issue fully covered by gold with the exception of a fiduciary issue of 20 million yen uncovered by gold. Uncovered circulation in excess of this amount is subject to a tax of five per cent.

In addition to a number of branches throughout Taiwan the Bank also has branches in Japan, China, Java, Hongkong, Singapore, Bombay, London, and New York, and has risen to a place in international banking.

The ordinary banks of Japan conduct an ordinary banking business, and are subject to the general banking laws of the Empire. The Minister of Finance is in general control of their activities and can at any time order an inquiry into their financial position. In addition, they must submit a half-yearly balance sheet and report.

Private Banks

Of these "ordinary" banks the best known is probably the Mitsui Bank, which, although not incorporated as a joint stock company until 1908, can claim to be the oldest bank in the Empire. The bank in its early years was intimately connected with the famous merchant family whose name it bears and whose heads were its proprietors.

Since its incorporation the Bank has made great strides, its paid-up capital amounting to 60 million yen, and its offices numbering 16 in Japan, one in New York, and one in China. The character of the banking carried on by the company can be seen from the latest balance sheet, which shows deposits at 75 per cent. of the total liabilities, and advances, loans, and discounts at some 60 per cent. of the total assets.

The Mitsubishi Bank, Limited, was organized in it spresent form in 1919, but can trace its origin to a private bank connected with the famous merchant firm of the same name and with which was amalgamated the 119th National Bank. The Bank carries on a general deposit banking business and has extensive dealings in the foreign exchanges. There are several branches in Japan, and one in London and New York.

The Sumitomo Bank, Limited, another well-known Japanese "ordinary" bank, can also trace its descent from a private concern, having been registered in its present form as late as 1912. Considerable expansion has recently been shown by this Bank and a number of branches have been established, notably in Japan itself and abroad—in London, the United States, India, and China. Subsidiary banks have also been established in Seattle, U.S.A., and in Hawaii at Honolulu, an unusual development for a Japanese bank—which usually works not through affiliated concerns but through establishing its own branches and retaining them as such.

In conclusion it may be said that banking in Japan is on a very sound footing. During the late war Japan was able to keep its note issue always convertible into gold on demand—a fact which bears witness to the able manner in which the financial affairs of the country were conducted.

Westinghouse Forms Japan Company

Organization of the Westinghouse Electric Company of Japan, incorporated under the laws of the State of Delaware and capitalized at $1,000,000, to provide facilities for the distribution of Westinghouse products directly to Japan, has beeen announced by Mr. I. F. Baker, head of the agency in Tokyo, who becomes managing director of the new corporation.

The formation of the new company to operate exclusively in Japan is interpreted in business circles as an assurance that the Westinghouse intends to maintain permanently its independent Tokyo agency, which was established after the failure of Takata & Company. The Westinghouse Company will thus be one of the first large foreign corporations to sell its products direct on the market in Japan, rather than dealing through a Japanese or foreign agency.

The new firm has in its employ a large number of electrical engineers who were formerly on the staff of Takata Shokai, and since the suspension of the Takata agreement the Westinghouse agency in Tokyo has been regaining its full volume of trade.

The officers of the company, besides Mr. Baker, are Mr. L. A. Osborne, president; Mr. Guy E. Tripp and Mr. E. D. Kibourne, vice-president and general manager respectively. All of the stock in the Westinghouse Electric Company of Japan is owned by the Westinghouse International Electric Company.

The Problems of Professional Status

(By a Contributor in China of "The Engineer")

THE newspaper mail arrived last evening and the eagerly-looked-for technical journals have been carefully studied. You must live thousands of miles away from England really to appreciate the technical journals. In remote parts of the world you can discover very little of what is happening in the way of new developments in engineering except by the good offices of these most valuable and silent friends. In England you do meet the men who are making the improvements or who have recently witnessed experiments. You often learn a great deal outside of the lecture room when you attend a meeting of a technical society. A large number of engineers abroad miss that sort of thing very much indeed. "Books are all very well in their way," said the immortal R. L. Stevenson, "but they are a mighty bloodless substitute for life." Technical books are invaluable, especially for reference purposes, but they do not give the news. It is, of course, much nicer to discuss a problem than to read about it. The technical journals are more human than books. They are more alive. One would rather attend a meeting of a technical society than read about it, but it is a great boon to read about it instead of remaining in entire ignorance of what is taking place in the engineering world. And if we wait until all the current controversies are put into books we miss a great deal and are out of date.

The Status Problem

These are the days of democracy, and nobody is supposed to care a button about social status. That may be so in Great Britain; it certainly does not obtain in a Crown Colony. There is an official list of ranks, in which the Navy, the Army, the Civil Service and civilians figure. At any public function you are graded off according to the official list arranged by Government House. It avoids confusion, but it surprises and sometimes amuses newcomers. Every one has an official status usually dependent on his work.

There were great dicussions about the status of engineers in the Royal Navy about thirty years ago, and it is not improbable that the subject will be again revived at no very distant date. Status is, of course, a matter of social ambition. The writer has always remembered the main ideas expounded in a brilliant address given to engineering students, many years ago, by Mr. Swinburne. It was entitled "Some Difficulties in Getting On." The ambitious young men were politely told by the experienced, successful and clever Mr. Swinburne that, in nearly all cases, engineers are hired, and it is seldom that the man on a salary makes a fortune. He is dependent for a living on his employer. In this age of democracy status does depend to no small extent on money. You can buy status by spending money—but not always ; status in a profession is entirely different from social status.

The issue of *The Engineer* which has just arrived, has a leading article on this subject of "Status of Engineers." It causes the reader to arrive at rather depressing conclusions. One is that the status of engineers is not what it ought to be. The other is that the technical colleges are turning out too many engineering graduates. There is even the suggestion that "our universities and technical colleges" are persuading young men, who should seek other roads to fortune, to enter the engineering laboratories of the colleges. This is a sort of reaction against academic training, which is not unnatural. It may be that the colleges are turning out more engineering graduates than can be absorbed, or it may be that those who do not receive a training in an engineering college are able to undersell those who do spend three or four years of their lives and a good deal of money on a college training. If, however, the problem of the status of the engineer is to be worth consideration, then this college training is an important matter. For whether we like it or not, the social status of a young man is affected by the name of his school and whether he has attended a University. At any rate, those things count abroad, if not in democratic Britain. The lawyer, the doctor and the civil servant consider that a univeristy education does make a difference to a man's social status. They may be wrong, but there it is.

The Problem of China

There is another aspect of the matter which was not discussed in *The Engineer's* leader, but which is worth exploring. It is one which the writer ventures to believe is of supreme importance in China, and probably also in other countries. It is mixed up with the eternal problem of "the sinews of war." The new world politics is something that has to be reckoned with. There is a very intense national feeling in the various countries of Asia. The only people who are now likely to make possible the development of the vast natural resources of China are the Chinese. That is not to say that British engineers and manufacturing firms need no longer be interested in the matter. Far from it. They must inevitably benefit when China builds proper roads, extends her railways and uses machinery. They will co-operate with the Chinese. They will, however, be unable to do anything without the good will and even enthusiastic support of the Chinese. How, then, are we to obtain this enthusiasm for development work unless the intellectual Chinese have some knowledge of what engineering science can do in China ?

Perhaps too much is made of the fact that many young men who are trained as engineers in colleges drift into some other kind of work. They have probably benefited by their training, even although they cannot produce the dividends on the time and money spent at college. It would not cause the writer any great grief if he were privileged to take part in the training of 300 Chinese engineering graduates per annum for the next ten years. These young men might find it impossible to obtain the lucrative posts that they would desire, but they would act as missionaries of applied science in China. Of course, their influence would be much greater if they were all drawn from wealthy families. And the wealthy Chinese, rightly or wrongly, are determined to send their sons to universities. It is an advantage to have some of them trained as engineers.

An example may be of some interest. Eight years ago one of the engineering graduates of the University of Hongkong left to serve under a British engineer on one of the Chinese railways. Despite the initial prejudice of his technical superiors he managed to get along quite well. After a few years he came to the conclusion that, on account of his family connections, he would make more money in official life than as an engineer on a railway. He was probably quite right. We have had many casual meetings since he became an official. He has always, in his political position, kept in mind two very important things. One is the great advantages that must come to China by the use of engineering knowledge and appliances. The other is that this Colony of Hongkong presents an object lesson, not only of the results of applied science, but of the benefits to both nations which follow out of the co-operation between Chinese and British. Although he has not practised his profession of engineering for some years, there can be no doubt that it was a fine thing for himself and China that he was trained as an engineer.

If we could persuade the wealthy Chinese that it would pay them to introduce, let us say, roads, water supply systems, or motor omnibuses or tramcars in the cities of the interior, they would be quite keen about it. Europeans cannot hope to convince them. Only their own sons, or brothers, or nephews can do that. They may not be very practical young engineers, but they can point out the possibilities. My Chinese friend, who is a prominent official and an engineering graduate, is always urging on his colleagues to carry out this or that public work. Twelve years ago Canton, the biggest city in China, was a city without a wheel. It was worse than the London of 300 years ago, for the streets were so narrow that two sedan chairs could scarcely pass. Now the old city walls have been pulled down and there is a "bund" or water-front crowded with wheeled vehicles, as well as wide roads on the foundations of the old city wall. There are rickshaws and motor-cars in Canton to-day. Instead of shops with walls of mud bricks, there are five and six-storied buildings of reinforced concrete. Steel, electrical machinery and other products from factories in Europe or America have been used for these innovations. These changes have been brought about by young Chinese who have received a technical training in a University.

It must be remembered that the Chinese have still a very great respect for learning. The intellectual side of engineering admittedly appeals to the official classes much more naturally than does the practical work. Yet if you can only arouse their

intellectual enthusiasm they will gladly take a definite interest in the workshops and machines.

It must be admitted that, so far as the acquisition of wealth is concerned, engineering is a disappointing profession for many who enter it with high hopes. There are big prizes, but there is great difficulty in the early years. For the same expenditure of energy a man at about thirty years of age probably would be better paid in some other line of life. It would be difficult, if desirable, to make engineering a closed profession, like medicine and the law. There has been, however, a definite movement in that direction. The word " Chartered " reminds us of the success which has come to those who wish to emphasize their professional status of engineers.

One great difficulty is that there are so many branches and sub-divisions of engineering. There are also so many grades in the industrial army. Moreover, engineers are usually so engrossed in their work that they have very little time to consider questions of status; yet it is an important matter, for many engineering prospects are put forward that require sympathy and assistance from men in influential positions if they are to succeed. It may be true that during a University career a young man does not obtain the discipline or the practical experience that is so good for him. There are a good many other things that he learns. He has the opportunity, at a most malleable time of his life, to form friendships that may be very useful to him in after life.

We have the following state of affairs so far as Chinese engineers are concerned. A large number of young men, of influential families, are passing through colleges in different parts of the world with the object of studying applied science. Almost any experienced British resident in China will say that these young Chinese ought not to go abroad until they are at least twenty-three or twenty-five years of age. Therefore they should receive their academic training in applied science in the Far East. Some of those who do well at college should be encouraged to visit Great Britain in order to establish friendly and personal relations with British engineering firms. It is a fact that these young men will not go direct from school through the ordinary routine of apprenticeship in workshops in the Far East. They will not " lose face "—*i.e.*, social status—by doing the work of coolies; after a college training they will go into the workshops.

From the Chinese working classes there are drawn men who make good mechanics. These men can find work only if the initiative in developing the nautral resources of China is taken by men of a higher social status. It is, therefore, practically certain that the rapidity of the development of the natural resources of China depends on the number of young Chinese who are attending academic instruction in technology.

It also seems to be not improbable that if the status of professional engineers all over the world is to be improved, the idea underlying the use of the word " chartered " must become general. In that case it will become the universal practice for young men with ambition to graduate at a University as the first step in a professional career as an engineer.

Mitsukoshi Department Store

The Mitsukoshi Department Store, one of the largest in Japan, has decided to build a new and modern branch store opposite the new Matsuzaka-ya Department Store on the Ginza at a cost of Y.7,500,000, according to a report printed in the Japanese papers. The site, for which a contract has been signed between Count Ito, the owner of the land. and the Mitsukoshi Company, is now occupied by Brett's Hospital Pharmacy, the Café Tiger, the Matsuda Lamp Store, and other shops. It covers a total area of 700 *tsubo.*

The decision to have a large branch store on the Ginza is considered to have been prompted by the realization by the Mituskoshi Company that the center of the shopping district, like the migration up Broadway, New York, is beginning to move up the Ginza, as seems to have been indicated by the recent construction of the Matsuzayaka and Matsuya stores. A Mitsukoshi branch in the locality is expected to be a profitable undertaking.

Construction work on the new building is expected to start early in 1928, because the leases of the present occupants of the site expire in 1927. The new building, while it will not be as large as the main store, is to be at least four floors, and is to carry as complete a stock as the parent store.

Purification of Swimming Bath Water

(From Our London Correspondent.)

AN article appeared in the November issue of THE FAR EASTERN REVIEW on sterilization by chlorine. This has now been carried a step further, and the success achieved in sterilizing drinking water, and what may be termed semi-sterilization in preventing the growth of living organisms in the condenser tubes of steam boilers, has induced tests in other directions.

Normally, these organisms are apt to form a slimy and tenacious layer, which reduces the heat transmission efficiency and lowers the vacuum obtainable for given conditions as regards temperature and volume of cooling water. The good effects of chlorine gas in such cases is now generally admitted, but it has now been put to a new use in which it is proving itself equally effective.

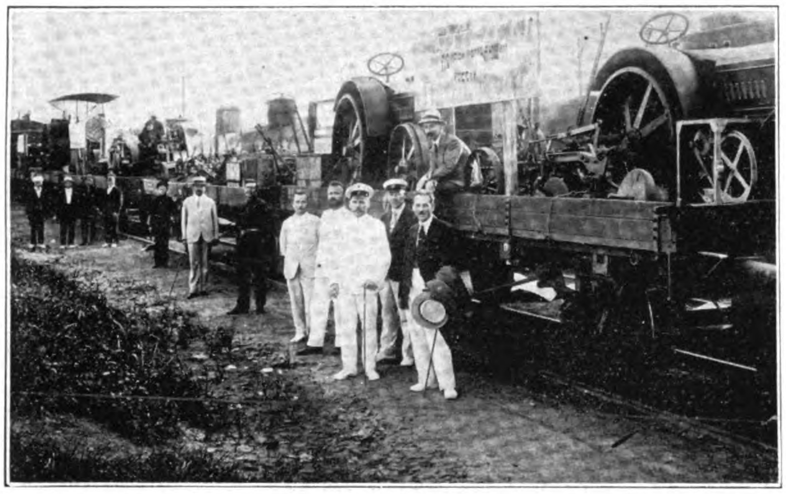
The latest and perhaps the most interesting application of the sterilizing properties of chlorine is for the purification of swimming bath water, so as to obtain a clear and sparkling water continuously for many months without emptying out the bath. As is well known, the present general method is the unscientific, unhealthy, and in many cases costly one of entirely filling the bath once or twice a week with clean water, so that the contents become dirty and discolored in a day or two, resulting in a rush of custom on " clean water days," and then very naturally a rapid falling-off in attendance.

The new method consists of circulating the bath water continuously by means of a steam or motor-driven pump, passing it through, first, a rough gauze filter, to remove any large objects, such as towels or costumes, followed by treatment with a coagulent, such as alumino-ferris, so as to separate all the coloring matter and impurities. Next, there is a passage through a pressure sand filter of efficient type, and the resulting clean water is then aerated to maintain the sparkling condition of fresh water, aeration being generally carried out by air under pressure, on the trap principle, the water being showered down through a vertical container. Finally a treatment with a measured trace of chlorine gas, about one part per 2,000,000 parts of water, follows, to destroy all obnoxious bacteria, the water being returned to the bath through a steam-heated calorifier, to maintain a constant temperature, about 72 degrees F. in the summer, and 78 degrees F. in the winter. In this way the same water may be used for at least six to twelve months, and maintained in a perfectly clean, healthy and sparkling condition, equal to fresh water, obviously a huge improvement in comparison with the present more generally accepted methods.

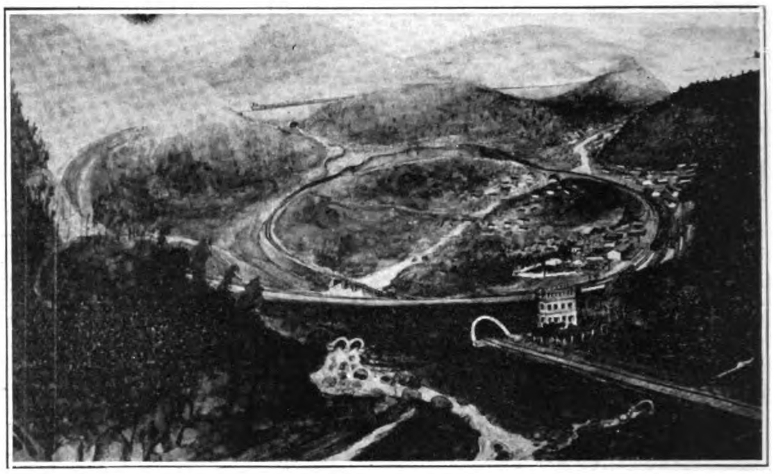
Under this new method the Paterson Engineering Company are using their chloronome apparatus, which uses gas in cylinders, on the same general lines as are now being applied very widely for both drinking and circulating water. The method of using chlorine itself has the advantage of being cheap, and at the same time of giving an easy and positive control of the amount of chlorine, which is adjusted in supply by merely altering a valve, and it is quite independent of the troubles inherent in the use of bleaching powder, or other hypochlorites, which are unstable, so that the chlorine content cannot be relied upon, while also adding soluble salts to the water.

A typical installation on these lines at the public baths of St. Helen's (England) is operating a men's bath of 84,000 gallons capacity (100-ft. by 30-ft.) and a woman's bath of 28,000 gallons (48-ft. by 24-ft.). The rate of circulation is equivalent to one complete replacement of the contents of the bath in ten hours, two 8-ft. pressure sand filters with compressed air cleaning mechanism being used for filtering the water from precipitated impurities. This has now been in operation six months without changing the water, representing the saving of several million gallons, and a detailed bacteriological examination and analysis after four months' running showed the water to be actually purer than many drinking waters in Great Britain.

In many Oriental countries where water is notoriously impure and frequently scarce the new system should prove a god-send, and it is particularly applicable for the fresh-water swimming tanks now so largely used in many of the great liners.



American Tractors Loaded on C.E.R. Flat Car for Direct Shipment to Russia



Looping the Loop on the Western Section of the Chinese Eastern Railway

A Study in Extraterritoriality

By E. Lennox Simpson

THERE was something dramatic about Boris Ostroumoff's arrest at the Chinese Eastern Railway's offices on October 3, 1924, the day the Soviet took over the management of the railway, and there is certainly something more tragic in his illegal solitary confinement in a Chinese prison for eight long months. This is undoubtedly the most important case in which foreigners are the defendants that has ever been brought before the Chinese Courts of Justice.

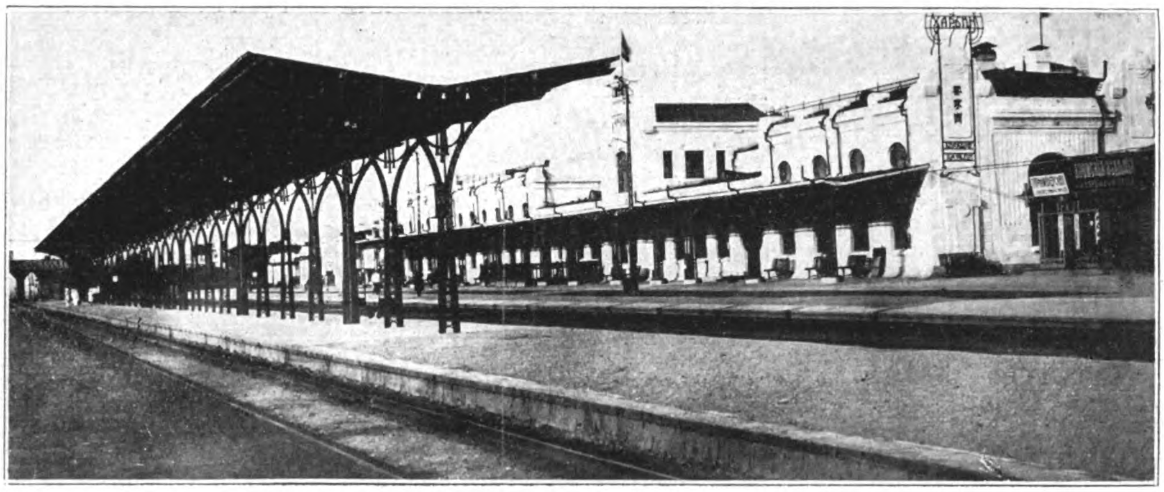
Ostroumoff, the selection of the Russo-Asiatic Bank, held the position of General Manager of the Chinese Eastern Railway for close on four years, whilst his co-defendants are Gondatti, ex-chief of the Chinese Eastern Railway Land Department and formerly Governor-General of the Priamur, Mihailoff, ex-chief of the Economic Department and formerly Minister of Finance at Omsk under the Koltchak Government, and Stepunin, ex-chief accountant, formerly chief book-keeper of the Russo-Asiatic Bank.

Before touching on other matters it is necessary first to explain about the Courts of Justice in the Special Railway Area. They are directly under the Ministry of Justice at Peking, and it is Peking who has to look after their maintenance, as with other courts of justice throughout China. Nominally they are quite independent of the local provincial government. Actually, Peking is unable to supply the funds that are needed, so that salaries are in arrears for months, and the officials badly paid, causing not only the dignity of the court to suffer, but also irregular and illegal practices on the part of the court officers, who charge imaginary fees for any little thing done for the public. It is the system and not the officials which must be blamed. In the second place, the provincial authorities have a great deal to say, insisting that the higher court official appointments be approved by them first, which means to say that these officials become morally subservient to the provincial authorities. These are two fundamental defects in the Chinese judicial system at present.

Administration Offices of the Chinese Eastern Railway, Harbin

In the Ostroumoff case we find that the Investigating Judge, as soon as he was appointed to preside over the trial, obtained ten days' leave to go to Peking to see his sick mother, and never returned, no doubt shirking the responsibility. He was succeeded by a Peking judge, who never took up his post, two local judges succeeding each other but never getting further than wading partly through the nine volumes of material and documents, the case being finally turned over to the present judge. The latter is a very

young man, not yet thirty years of age, and therefore without much experience.



Harbin Railway Station

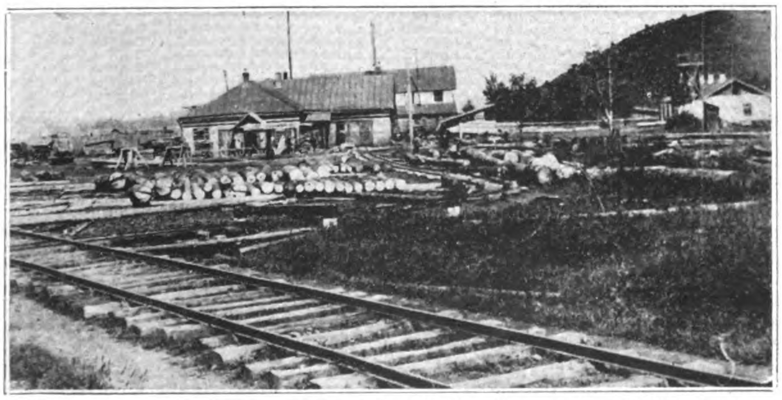
At the opening hearing of the trial, which was on June 3, exactly eight months from the date of arrest, all the lawyers for the defence—five of the leading Russian lawyers and all men of experience—protested against the hearing of the case, asking that the accused should be discharged by virtue of the Amnesty Mandate of the Chief Executive. This was over-ruled owing to the order of Marshal Chang Tso-lin, who decreed that three classes of prisoners in the Special Area should not benefit by the Amnesty, and Ostroumoff and his colleagues were included in the third classification. Counsel then proceeded to show the Court that none of the accused were Government officials, and that Marshal Chang's order only applied to Government officials. Documentary evidence was furnished that Ostroumoff received his appointment from the Russo-Asiatic Bank, which was confirmed by the Directors of the Railway, and had nothing to do with the Chinese Government; also that the Chinese Eastern Railway was purely a Government enterprise. This had no effect on the judge, who stated he would proceed with the case. Another point brought up was that, according to Chinese law, the court may keep prisoners in custody without presenting an accusation for six months only. If in six months no indictment is drawn against the person in question he should be released. In the case of Ostroumoff this law has been transgressed, and, however peculiar it may be, the judicial authorities, when making up the total of the term, left out the time they spent in clearing up the question whether the amnesty was to be applied to Ostroumoff or not. Thus it has come about that the accused had spent eight months in prison instead of the prescribed six months before the trial came on.

Boris Ostroumoff, ex-General Manager, C.E.R.

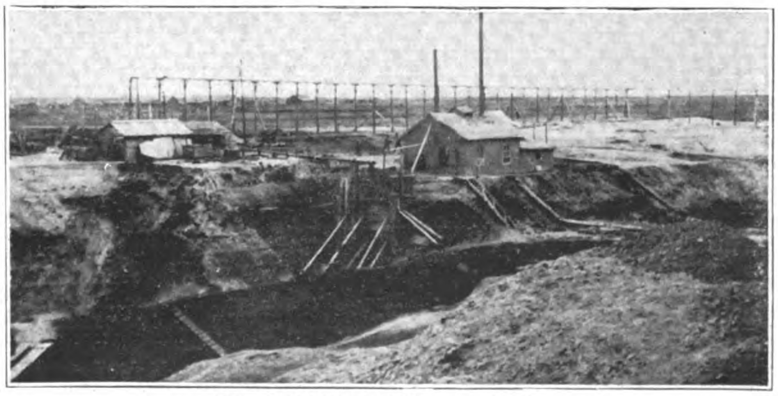
From a foreign point of view, the discharging of the accused is so incontestable that the non-performance of it may become tantamount to a denial in principle of all the bases of the forms of law proceedings, so far as these constitute guarantees of rights. Then, again, the question of formalities in the case is of great significance in judging of the nature of judicial activity itself. Though the trial is a long, long way from being over at the time of publishing this article (the begining of Aug.) one cannot fail to see that the executive authorities in Manchuria are imparting a quality of pressure to the decisions of the court.

On the second day of the hearing Ostroumoff read a telegram which had been sent by the President of the Chinese Eastern Railway to the Administrator of the Special Railway Area, General Chu, stating that the arrest of the accused was based on the request of the Russian (Soviet) authorities, and goes on to say that the Chinese Eastern Railway Directors should present documentary evidence against the accused in order to observe the law, urging the receiver of the telegram to see that what was necessary was carried out in order that there should be no protests from diplomatic circles. This telegram produced a sensation in court when read, and much surprise was evinced that it should be among the documents that the prosecuting attorney has attached to the accusatory act. The producing of this telegram in court has strengthened the conviction that many people hold, that the case against Ostroumoff is more of a political than a criminal nature. This conviction becomes stronger and stronger as the case proceeds, on account of the attitude taken by the presiding judge and the arbitrary actions he resorts to. Times out of number the counsel for the defence rise and protest against one and another thing, but without success. The prosecutor has presented no direct evidence against the accused from the Board of Directors; therefore Ostroumoff rightly argued he should be discharged, seeing that his employers were the Directors and that the vague accusations by other people, some actually not in railway employ, cannot be taken seriously by the court.

(Continued on page 557.)



General View of the Saw Mills at the Timber Concession at Shitahotze



The C.E.R. Coal Mines at Jelainor

Hokkaido—The Diffident

By Frederic de Garis, F.R.G.S.

The writer of the following article is the editor-in-chief of the guide-books published by the Japanese Government Railways, and as such can be depended on to present only the exact and detailed facts about such places as he visits. He gives an illuminating survey of the conditions in this comparatively unknown island of Japan, which is in reality the third largest of the group composing the Japanese Empire proper.

HOKKAIDO (literally "North Sea Districts"), the large island north of Japan Proper, is best reached from Aomori, near the northern tip of the main island. To its nearest principal port, Hakodate, 60 nautical miles distant, two express steamers of the Japanese Government Railways make the run daily in about five hours.

In company with Mr. Torao Oita, the distinguished traffic manager of the Japanese Government Railways, the writer made an official visit to Karafuto (Japanese Saghalien) for the purpose of learning something about the resources, conditions, climate, etc. of this northernmost colony of Japan, which is about 1,000 miles north of Tokyo. Upon returning to Hokkaido it was decided to make an extensive tour of the island, so that the actual conditions existing there could be seen and considered from a foreign viewpoint, and also to determine the truth or falsity of the statement, so often loosely made, "that there is plenty of room in Hokkaido for the Japanese, but they will not go there because it is too cold—they will only settle in warm countries."

Hokkaido proper has an area of 31,825 square miles; with the outlying islands, the Kuriles and others, 36,810 square miles. Its geographical features are quite different from the mainland of Japan. The island's extensive plains, wooded hills and other features are similar in many respects to parts of America, though much of its surface is mountainous and rugged, which, even when cleared of timber, is unfit for farming purposes.

From the latest available official figures, Hokkaido had 101,052 acres under cultivation, 75,039 acres in stock farms, and 14,424,291 acres, or 22,574 square miles, of timber lands, of which about 48,800 acres are opened yearly for settlement. Thus, it will be noted, the island's area roughly is divided in about the proportion of three-quarters of mountainous and timber land and one-quarter now in use for farms and grazing lands. From which it appears that the greater part of the area of the island is not available for settlement, and, taking into consideration the table of population that follows, the above figures show that emigrants have taken up the land as fast as it has been cleared.

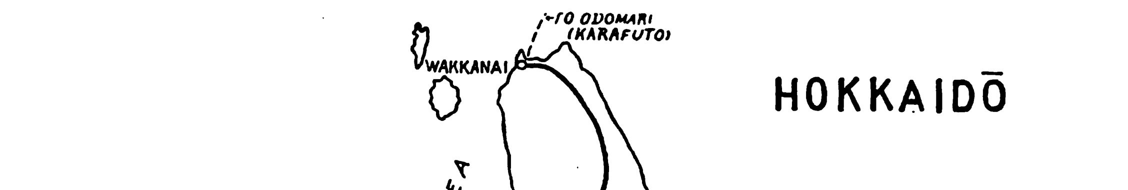
Hokkaido has a population of nearly 2,500,000. Its steady growth is shown in the following table:

Year	*Population*
1877	191,172
1887	321,118
1897	786,211
1907	1,390,079
1917	2,088,455
1921 (National Census)	2,359,097
1923	2,500,000

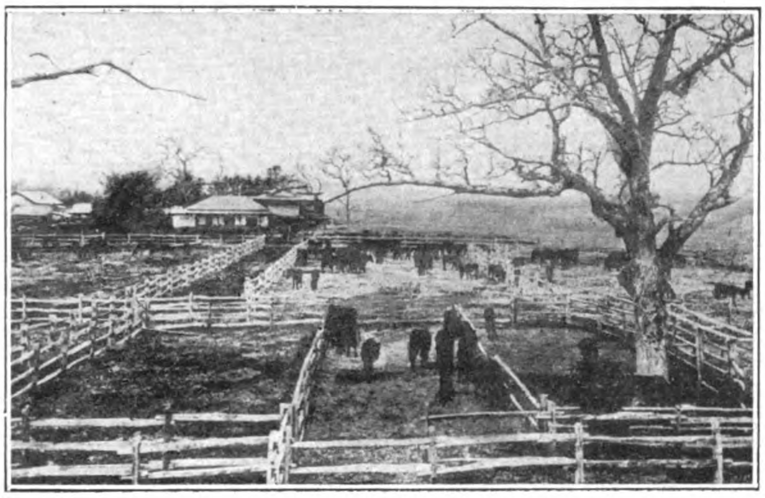
The 1923 total is estimated; it is a little less than 2,500,000, but roughly it about equals the population of Tokyo.

There are now 1,259.1 miles of Government railways on the island and 118.4 miles of private railways. New lines and extensions of existing lines are being constructed by the Government, and railway construction will be continued until all important parts of the island are provided with transportation facilities; but far in advance of prospective railway facilities the writer saw large farms with a wealth of diversified crops which appeared to have been long established, and this is true also of places without any prospect of direct railway service—a fact learned on a 15½ mile walking trip to Sounkyo, a noted canyon at the head waters of the Ishikari river, in the center of Hokkaido. There, along the roads and trails, primitive farm-houses are tillable, and beans, corn and other crops are being grown. These facts seem to belie the statement that the Japanese will not settle in Hokkaido.

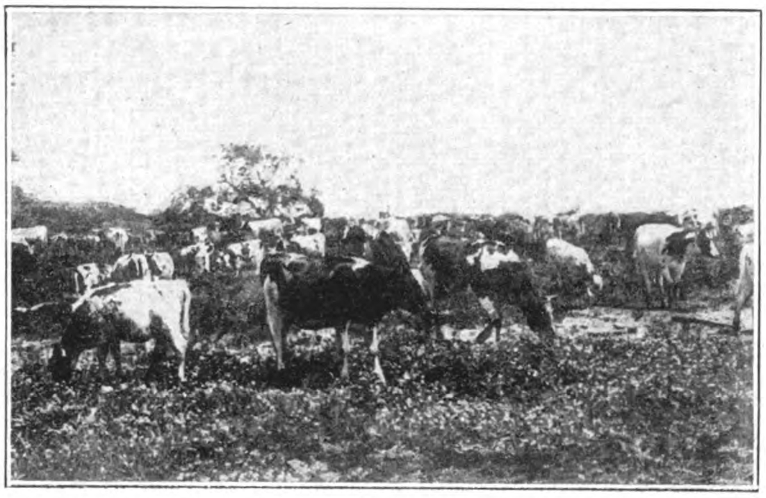
Although the island is in the same latitude as the northern tier of States in the United States, its winter climate is more severe, being similar to that of North Dakota, but much more humid—on account of the surrounding seas. Real winter



Sketch Map of the Island of Hokkaido, the northernmost of the three main islands of the Empire. The shaded portions show the three large plains or valleys which are so ably described by Mr. de Garis. With an area of a little over 31,000 square miles, the island is served by about 1,300 miles of railroads as shown by the black lines on the sketch. Its principal city is Sapporo, and its two largest ports Hakodate and Otaru.



Imperial Pasture, Niicap, Nitake Province



Oxen Depastured, Sasaki Pasture, Shiramuka Mura, Kushiro Province

begins in mid-December and continues until mid-March, but the season extends over five or six months, during which time the ground is covered with snow. The snowfall is heaviest in the western districts, where in the northern part it sometimes reaches a depth of six feet. On the Pacific side the snowfall is seldom over a foot in depth, and in this district many horses and cattle are bred and raised, but in other districts the long winter and the costly item of fodder is a deterrent to livestock farming. The principal dairy centers are, therefore, in the southern part of the island, and large quantities of condensed milk, butter and cheese are exported annually from them.

In Hokkaido there are four great plains or valleys—every inch of which, and often the adjacent hills, is under cultivation. All are well provided with railway facilities. These plains are given here in their importance with relation to their products :

(1) The *Ishikari Val'ey*, which, beginning close to Sapporo, extends north-east for seventy miles, and is ten miles wide at its widest part. On this plain 70 per cent. of the rice grown in Hokkaido is produced, besides diversified crops : beans, corn, potatoes, wheat, oats, barley, hay, rape-seed, etc.

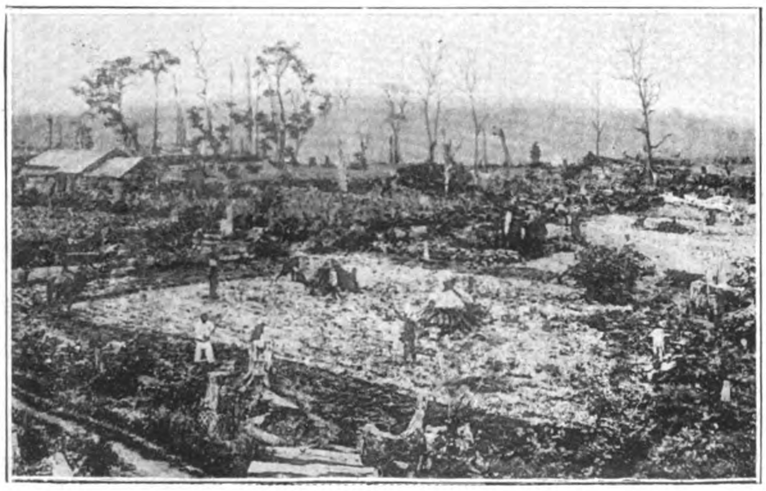
(2) The *Tokachi Plain* is the large agricultural district extending out from Ikeda, in the southern part of the island, on which is grown great crops, and recently sugar beets to supply the mill of the Hokkaido Co., at Obihiro and that of the Meiji Sugar Co. at Shimizu, not far distant. Both these mills, operated under the supervision of American experts, are equipped with modern machinery. They expect to handle 70,000 tons of beets this year, these facts being mentioned to show the present extent of this infant industry. The farmers are supplied with the best qualities of seed and are given a guarantee for the pruchase of their beets at a fixed price per ton.

(3) The *Kitami Valley*, between Nayoro and Okoppe, in the northern part, is a plain which produces abundant crops of many kinds, and between the last two districts named there is an extensive area, of which Engaru is the center, on which is produced a superior quality of peppermint, well known in international trade. About 250 tons of this are harvested yearly, almost all of which is exported. The lumber out of this district is an important factor in domestic trade.

(4) The *Kamikawa district*, west of the Kitami Valley, has, besides rice fields, large areas planted to diversified crops. In all four sections, and elsewhere on the island, the land given over to bean cultivation is amazing. It was learned that the bulk of the crop is exported to America, where it is used as the base for talcum and other toilet preparations. Besides these great plains there are three large areas embracing small valleys and hills, all the former being under cultivation, the latter being used for stock raising. These areas are in the Nemuro section (588 square miles), the Kushiro section (2,274 square miles), and the Hidaka section (354 square miles). The latter includes the Niikappu stud farm of the Imperial household.

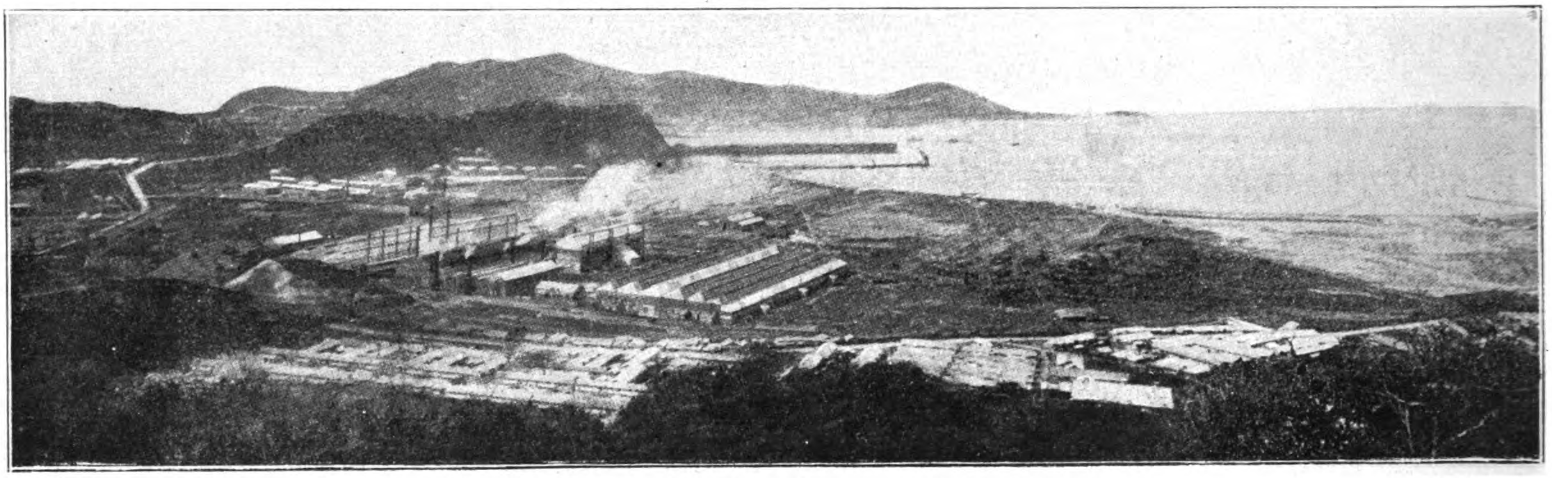
Hoddaido produces approximately 6,000,000 bushels of rice annually, valued at Yen 30,000,000, but as this is not enough for its needs, considerable additional quantities are imported. The important crops are those mentioned above—the usual crops of other countries in the same latitude, with the exception that wheat is not so extensively grown. The Sapporo Agricultural College is noted for the high standing of its graduates, who come there from every part of the Empire. This college, together with its experimental farm, has done much to improve and increase the agricultural products of Hokkaido. Besides the field crops, apples and other orchard products are grown in many parts of the island.

The fishing industry has had the greatest development, its annual value averaging Yen 96,000,000 in fresh and cured fish and fertilizer, the principal items of which are herrings, sardines, salmon, cod—besides seaweed. Travelers who have made approach to Hakodate on a clear evening will not soon forget the impressive sight of the fishing fleet through which the steamer passes. On every side are hundreds of lights, each boat showing a lantern, some in groups, some in long lines, the whole appearing like a well-

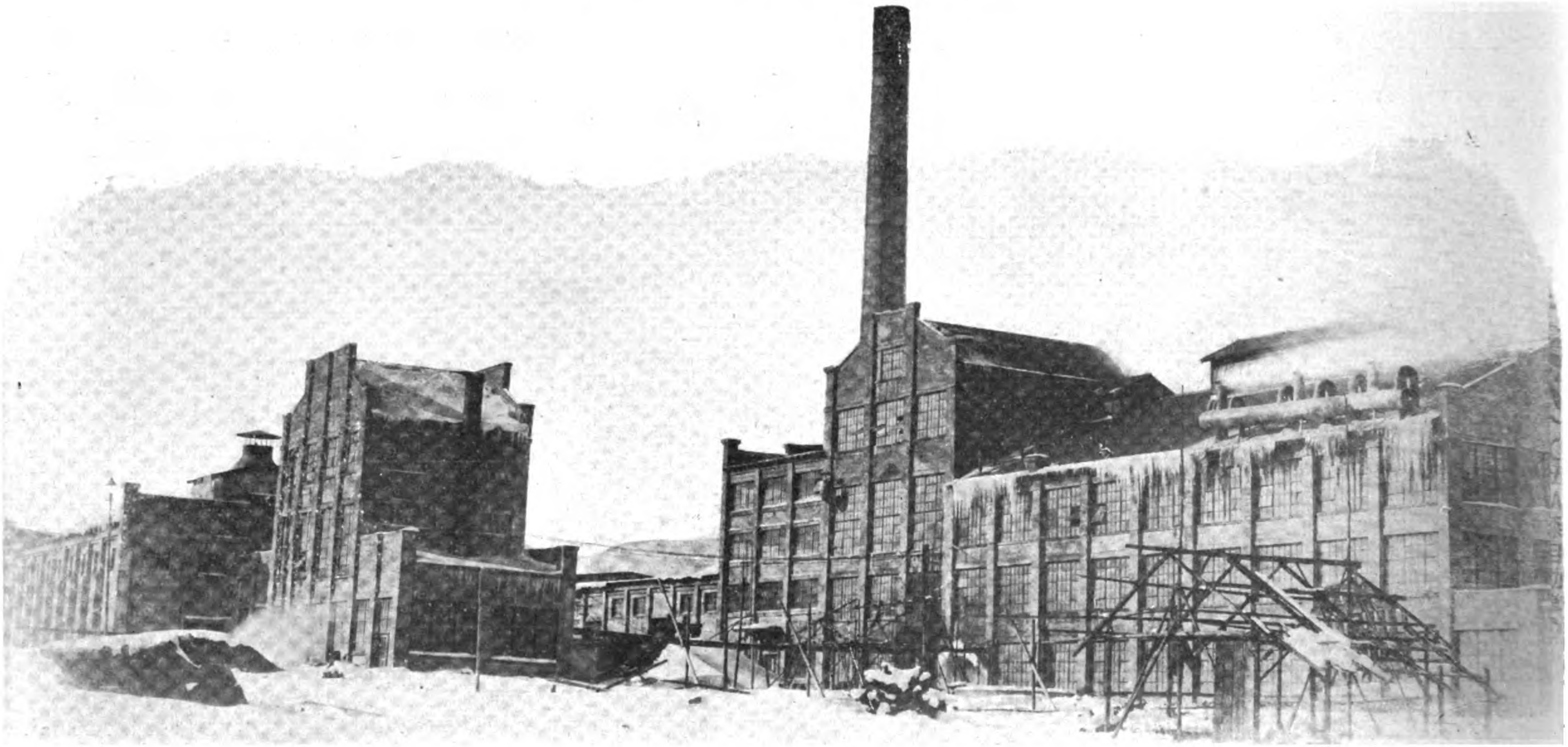


Field brought under Cultivation, Shimo Furano Mura, Ishikari Province

Cultivated Field under Plow, Shimo Furano Mura, Ishikari Province

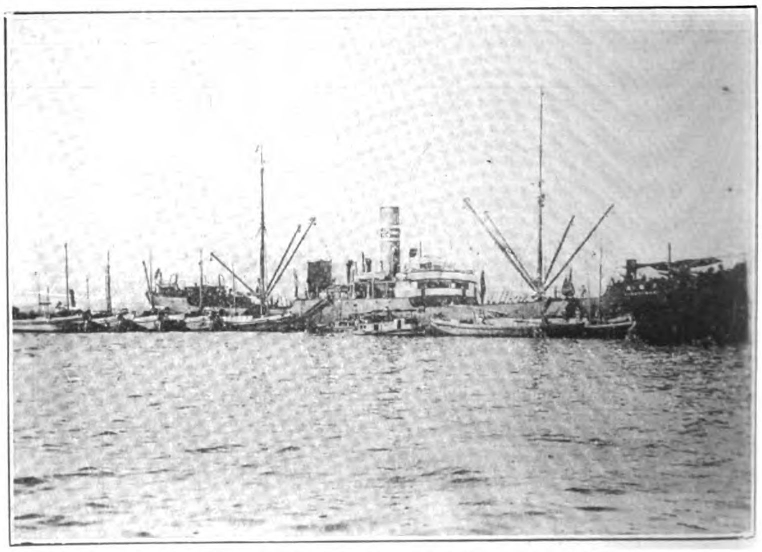


The Japan Steel Works at Muroran, in Hokkaido

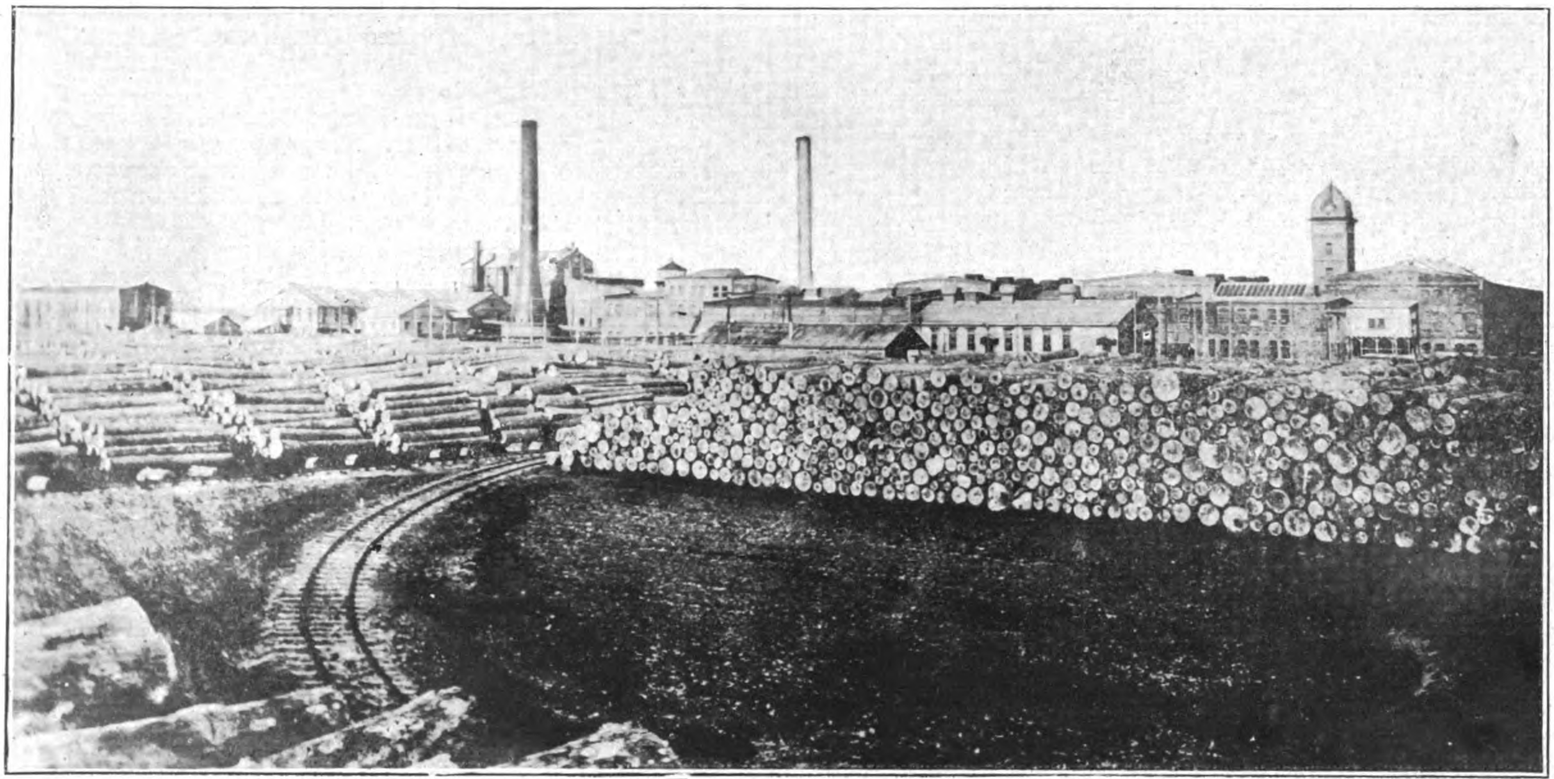


Shimizu Beet Sugar Factory

Hokkaido Fisheries



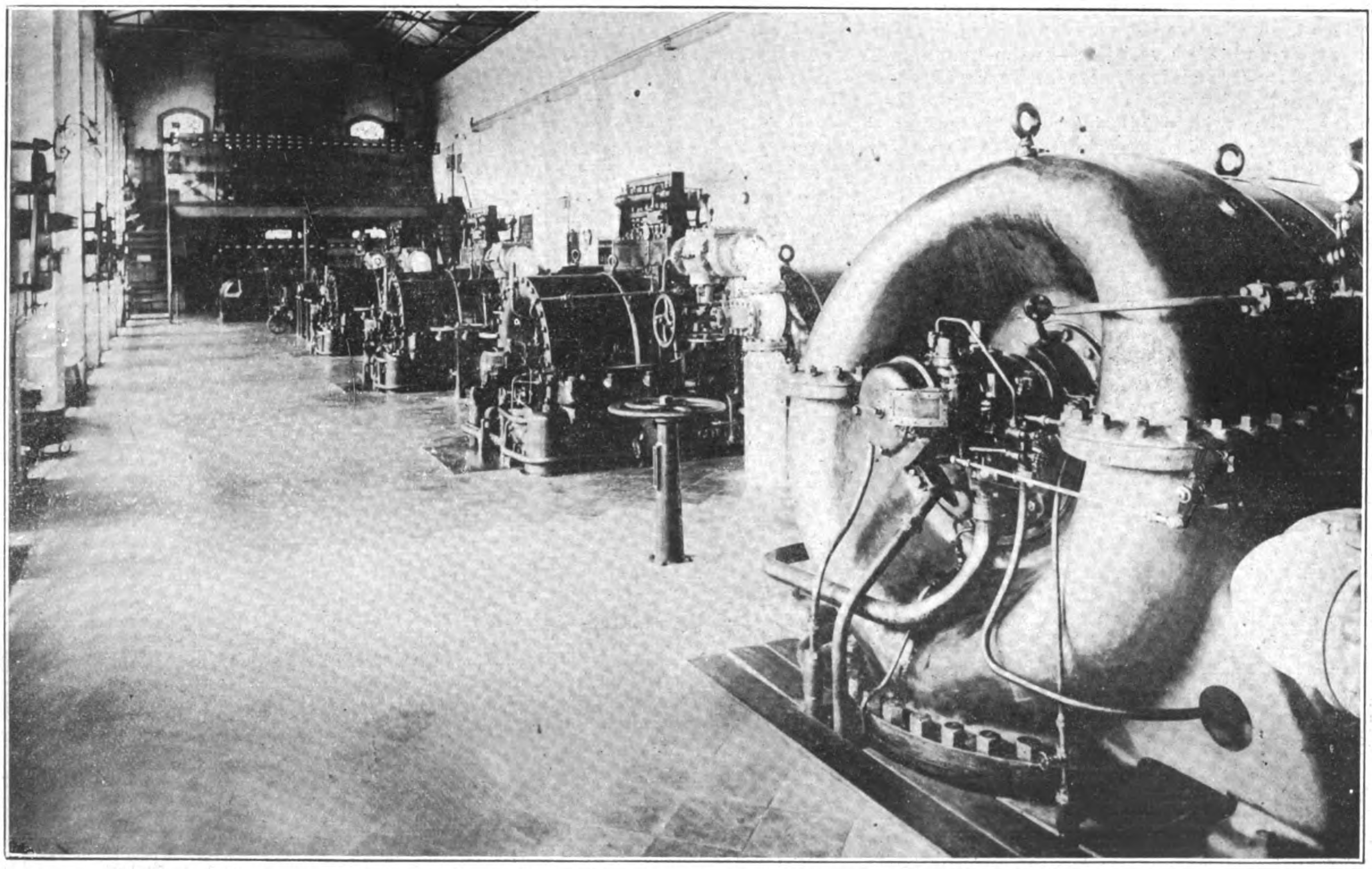
The "Yubari Maru," 6,200 tons, one of the Coal Fleet of the Hokkaido Tanko Kisen Kaisha



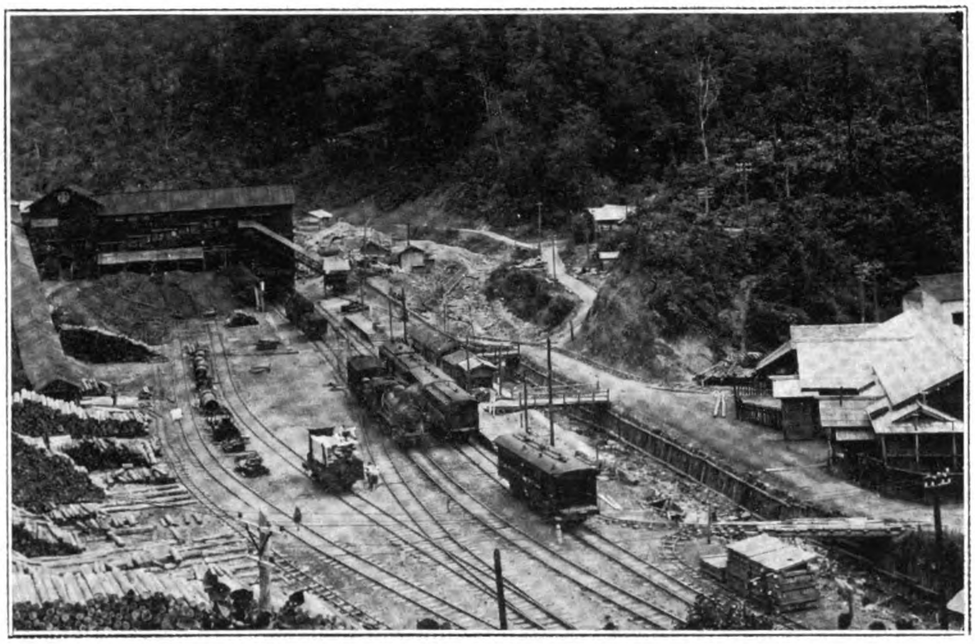
Oji Paper Company's Mill at Tomakomai, Hokkaido, where 85,000 tons of news print paper is produced annually

lighted city on the sea—and just beyond is Hakodate, on the hill-side, sparkling with electric lights—a miniature Hongkong.

Hokkaido has a wealth of forests, the wooded area amounting, as before mentioned, to 14,489,203 acres. The principal varieties of trees are the *Ezomatsu* and *Todomatsu* (the former similar to the spruce, the latter to the balsam fir used in the manufacture of pulp in America), oak, alder, maple, etc. The output of the forests was valued at Yen 45,751,012, of which timber, logs and boards totaled Yen 22,331,574; pulp, Yen 6,740,883; matchsticks, Yen 464,907; railway ties, Yen 953,996; fuel, Yen 9,871,676; and



The Central Power Plant of the Hokkaido Tanko Kisen Kaisha, supplying power to all mines of the company, equipped with 12 B. & W. Boilers; 4—1,000 k.w. General Electric-Curtis turbo-alternating sets of 3,300 volts, 3 phase, 3,000 r.p.m; and two 1,500 k.w. G. E.-Curtis sets of 1,500 k.w.



The Noborigawa Colliery

charcoal, Yen 5,387,976. The largest paper mill in Japan is located at Tomakomai, on the Muroran line. It is owned by the Oji Paper Manufacturing Co., of Tokyo, whose modern plant, representing an investment of Yen 35,000,000, has a daily output of 250 tons of finished paper ready for the printing presses. This company has three mills in Karafuto and mills at other places. Its paid-up capital is Yen 51,000,000. At Ikeda is the large pulp mill of the Fuji Paper Manufacturing Co., and other mills are located at various places. Reforestation is being made to recoup the annual timber cut.

At Yamuwakka, near Ikeda, is the veneer mill—the largest in Japan—of the Nitta Belting & Veneer Co., of Osaka, which, besides the native woods, uses wood from the South Sea Islands—mahogany and other varieties—in the manufacture of veneer. It now produces five million square feet yearly (50 per cent. of capacity), 20 per cent. of which is exported to China, Australia and Great Britain. The principal business of this concern, however, is that of extracting tannin for their Osaka leather-belting factory.

On the south coast, especially in its south-eastern swing from Muroran, stock farming is extensively carried on, both because of the pasture available and the climate. This industry centers around Niikappu, where the great field for horses owned by the Imperial household is located. This stud farm is 15 miles square, thus embracing 225 square miles. It is divided into large fenced fields, the fencing totaling about 187½ miles. An average of 1,000 horses range these fields, and as the snowfall is seldom over a foot in depth, the horses graze on the natural pasture the year round. Only the imported stock is fed—stallions of the best breeds: thoroughbred English racers, Arabians, hackneys, Percherons, and American trotting stock. Their feed is grown on the farm. The surplus stock not needed by the Imperial household is sold. The farm is reached from Tomakomai by a light railway (25.1 miles) to Sarufuto, thence 27½ miles over a splendid motor road to Shimo-Geho, a small town from which the farm is five miles distant. From its entrance it is five miles to the office.

Upon approaching Shimo-Geho we were surprised to see a horse market in full swing. Hundreds of admirable horses, principally two and three-year olds, were in the fields alongside the road and in the market pens ready to be auctioned. We thought it noteworthy that such a large market should exist so far away from the rail lines. Two markets are held annually, in August and October, the former being the more important. After visiting the Imperial farm we went back to the market, where all was bustle and activity —the center of interest being the auction booth, which was packed with buyers.

Not the least interesting feature of this particular trip were the many Ainus seen in this section, there being a number of their villages along the coast. They appear to be more thrifty and prosperous than Ainus seen elsewhere, some of them bringing colts of their own raising for sale at the market.

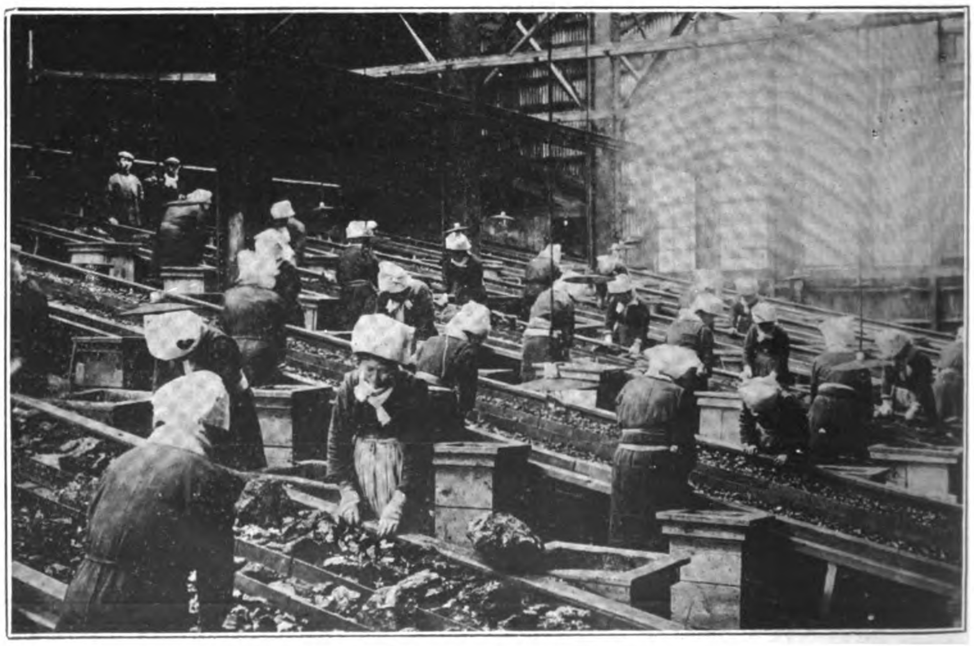
From the foregoing it appears that much of Hokkaido's tillable land is being intensively farmed, and that a steady stream of emigrants spreads out to sections of cleared land away from the railways. The statement that the Japanese are neglecting Hokkaido in favor of warmer climes is not well founded, judging from the writer's observations. They are even going farther north into Karafuto (Japanese Saghalien), where the winters are more severe. For a race whose life, customs, dress, dwellings, etc. are more in conformity with the people of warmer countries, it is much to their credit that so many have made the trek northward, and that the emigration still continues.

Since the above article appeared in "Japan," several new developments with regard to Hokkaido have taken place, an account of which supplements Mr. de Garis's article. The Chamber of Commerce of Hakodate addressed a petition to the Japanese Government requesting permission to enlarge the harbour at an early date.

Hakodate, it is pointed out, ranks with the ports of the main island, as well as those on the mainland of Asia, in its importance as a shipping center, especially since the recent accord between Russia and Japan and the continual development of the hinterland of Hokkaido. The petition asks that a greater percentage of the second Government allowance to ports and harbors be diverted to Hokkaido.

"It is gratifying," says the document, "to note that the Government plans to carry out a second series of development works in Hokkaido. It is almost needless to mention the urgent need for the building of harbors to keep pace with the growing traffic concomitant to the building up of the hinterland. It is our hope that this territory may become one of the most important industrial centers of Japan, as much for the sake of the entire Empire as for our own interests.

"Hakodate is at the entrance of this rapidly developing territory. It ranks first in Hokkaido in population and its trade aggregates no less than Y.400,000,000 annually, including its traffic with foreign ports as well as those on the main



Coal Sorting at the Yubari Mine

island. Exports of marine products to Siberia alone total Y. 35,000,000.

" Notwithstanding this, the port was given only 3 7 per cent. of the Y.38,471,000 appropriated for the reconstruction and improvement of ports and harbors in the first series of development works in Hokkaido. The harbor at Otaru was given Y.350,000 wherewith to construct the breakwater and put that harbor in the best of condition. The Government has thus been providing subsidies to other ports and harbors in Hokkaido, and the improvement of Hakkodate seems to have been allowed to fall behind that of the other ports in Hokkaido.

" The surface area in Hakodate harbor is at present only 570,000 *tsubo*. It is estimated that a steamer requires at least 10 *tsubo* in order to moor in the harbor. There being too little space, the port has been congested with vessels during the past several months, and the traffic is particularly heavy from May to November. An average of 173 ships of a total tonnage of 58,600 has been moored in the harbor daily. This number should be given an area of 580,000 *tsubo*, which is just 10,000 more *tsubo* than is available. The shortage of harbor space would be even greater if the number of lighters and motor boats is taken into consideration.

" The congestion inevitably leads to collisions and other accidents in the harbor, the loss from which is estimated at Y.350,000 annually. This is merely a part of the deficit that results from the lack of adequate mooring space. In addition, the lack of well-built piers is another source of inefficiency. The loading and unloading of cargo have been carried out by lighters and this ought to be improved immediately. All of this points to the immediate need for the reconstruction and improvement of the port at Hakodate."

The Port of Rumoye

The development of Rumoye, another port in Hokkaido, is attracting attention.

To make Rumoye the center for the coal shipping industry in Hokkaido plans are being formulated to establish a corporation to carry out harbor construction work that will cost approximately Y.3,000,000. The building of a breakwater has already been completed at a cost of Y.5,800,000, but considerable dredging must be done in the port to permit calls by vessels displacing more than 5,000 tons.

The port of Rumoye is located on the north-western coast of Hokkaido. It is the most proximitous port to the Uryu coal mines, which are only 30 miles distant. It is also a gateway to the Ishikiri plains, where much of the produce of Hokkaido originates.

The plan to fashion the harbor has been given the support of Mr. Soichiro Asano, president of the Tokyo Kisen Kaisha ; Mr. Korekiyo Takahashi, Minister of Commerce and Agriculture, and many other bankers and financiers in the country, including the Sumitomo interests. When the plans are completed the port will be capable of shipping coal amounting to more than 1,000,000 tons annually, and vessels displacing more than 8,000 tons will be able to call at the port with ease.

As originally drafted, the plan contains the following provisions :

The depth of the harbor is to be made not less than 30-ft. Since the sea outside the harbor is usually rough, the harbor is to be dredged outside the breakwater so that vessels in the roads may be provided safe anchorage in case of congestion inside the harbor. The area to be dredged in this manner will aggregate approximately 35,000 *tsubo*.

Reclamation work is to be done along the coast in the vicinity of Rumoye to the height of about five feet at high tide, and the area thus reclaimed will total about 27,000 *tsubo*. Piers will be constructed to a total length of about 100 *ken*, and other measures will be taken as needed for the protection of that part of the coast. Railway tracks are to be extended to the wharves, so that cargo may be loaded directly on the steamers. The distribution of the appropriation for the harbor is as follows :

Reclamation	Y.123,606
Coastal protection	232,500
Quays	200,000
Machinery	650,000
Other construction	43,894
Supervision in survey	50,000
Dredgign work	423,742
Civil engineering work	15,000
Equipment for coal shipment	35,000
Railway tracks	15,000
Land	57,000
Office	100,000
Reserves	50,000

The construction work is to be started in April and is to be completed in five years. Rumoye has recently celebrated the completion of its new post-office, middle school, and civil engineering works. When the harbor is constructed the coal export at the port is expected to increase greatly.

New Liner for D.E.I. Service

A new vessel, the *Pieter Cornelisz Hooft*, is now being built in France for the Netherlands Steamship Company. She is to be a first-class liner for the Dutch East India service, 540-ft. in length, with a beam of 67-ft. 9-in., and a gross tonnage of 14,000. There are two 4,000-s.h.p.-Sulzer engines, each of which has eight cylinders, with a bore and stroke of 680 and 960 mms. respectively. This is a cylinder size which has been built for many six and four-cylinder engines, but the output represents the highest power yet reached in a Sulzer engine. The power is developed at 100 revolutions per minute, and as is usual with large motors of the Sulzer design, the scavenging air is supplied from separately electrically-driven turbo blowers, the only auxiliaries driven by the main engines being the twin air injecting compressors. As in the case of most large motor liners now under construction, electrical auxiliaries are to be utilized throughout, and three 520-b.h.p. Diesel engines are to be fitted, each driving a generator, besides a 120-b.h.p. plant.

New System of Ship Ventilation for Oriental Voyages

The *Bianchi*, the second of two sister ships built for the P. & O. Company by Hawthorn, Leslie & Co., was launched at the firm's yard at Hebburn, England, toward the end of January. The vessels have seven decks and are luxuriously furnished. The engines develop 15,000 horsepower.

Mr. J. T. Batey, managing director of Hawthorn, Leslie & Co., said the *Bianchi* was one of four building for a special fleet to carry mails and passengers between England and Bombay. A new system of ventilation has been adopted, and all that is necessary is for a passenger to press a button, whether in bed or during the day, to ensure a supply of fresh air. The electric fan system has been done away with. The line purpose adopting this new ventilation system on all future vessels built for their Oriental services.

Oriental Contracts for Europe

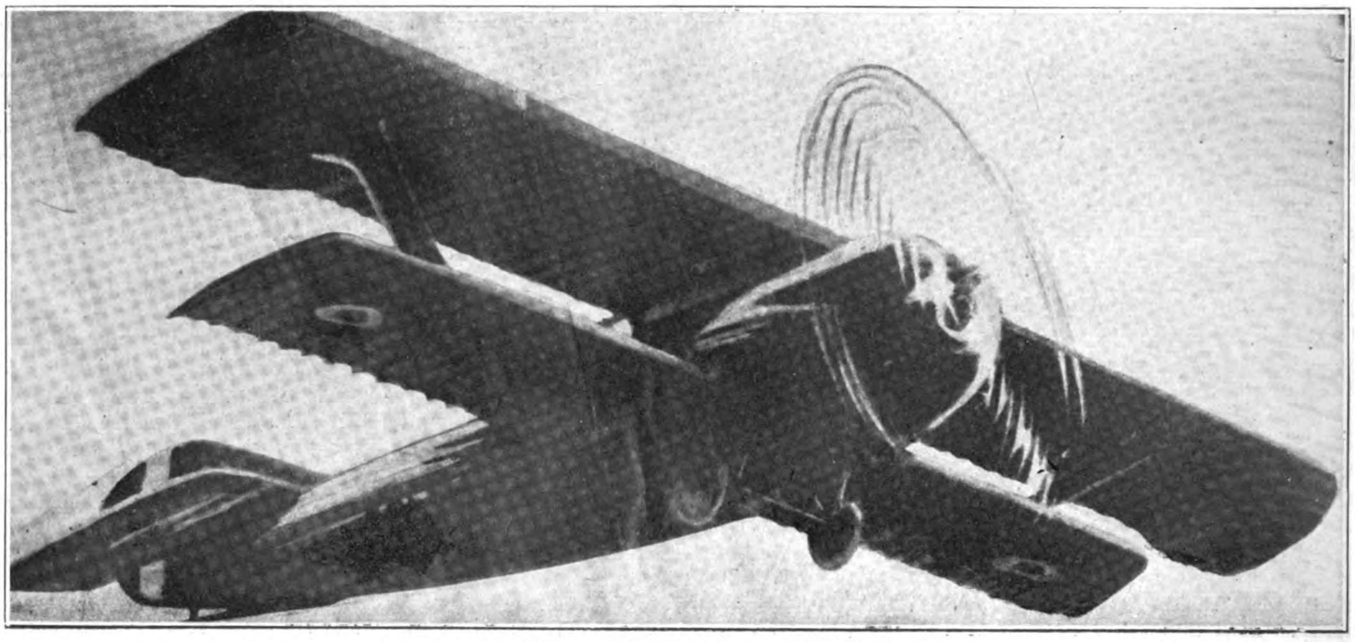
Plans have just been completed for the erection of a new pier at Kamal, Madura, for the Sourabaya Harbor Board, which it is estimated will cost approximately 61,000 guilders.

Sperry Gyroscope for N.Y.K.

The Sperry Gyroscope Company, of London, has just been given an order for a Sperry Gyro Pilot for the *Hakusan Maru*, belonging to the Nippon Yusen Kaisha. It is understood that a number more are to be installed on other vessels of the line. They have already been adopted for general use by the Anchor-Donaldson and Canadian Pacific Lines.

Anglo-Dutch East Indies Tin Syndicate

One of the most interesting of recent tin propositions (representing the introduction of British capital into the Dutch East Indies) has just been formed, with Sir Ernest Birch as Chairman and an influential board, to take up and prospect tin-bearing lands in the south-western portion of Borneo. This district (Matan), which has long been known to be tin-bearing and is said to be geologically continuous with the famous Banka and Billiton islands, was thrown open to private enterprise (by a reversal of policy operating for over seventy years) in 1923, and the concession held by the company covers prospecting rights on eleven contiguous blocks aggregating 238,723 acres. The company, which has a capital of £60,000, will act as the parent company for the flotation of subsidiary undertakings. Mr. A. W. Hooke, M.I.M.M., late manager of the Bisichi Tin Mining Co., and a technical staff are preparing to start for Matan, and a new chapter, the extent of which it is impossible to foresee, is now opening for British tin mining in the Far East.

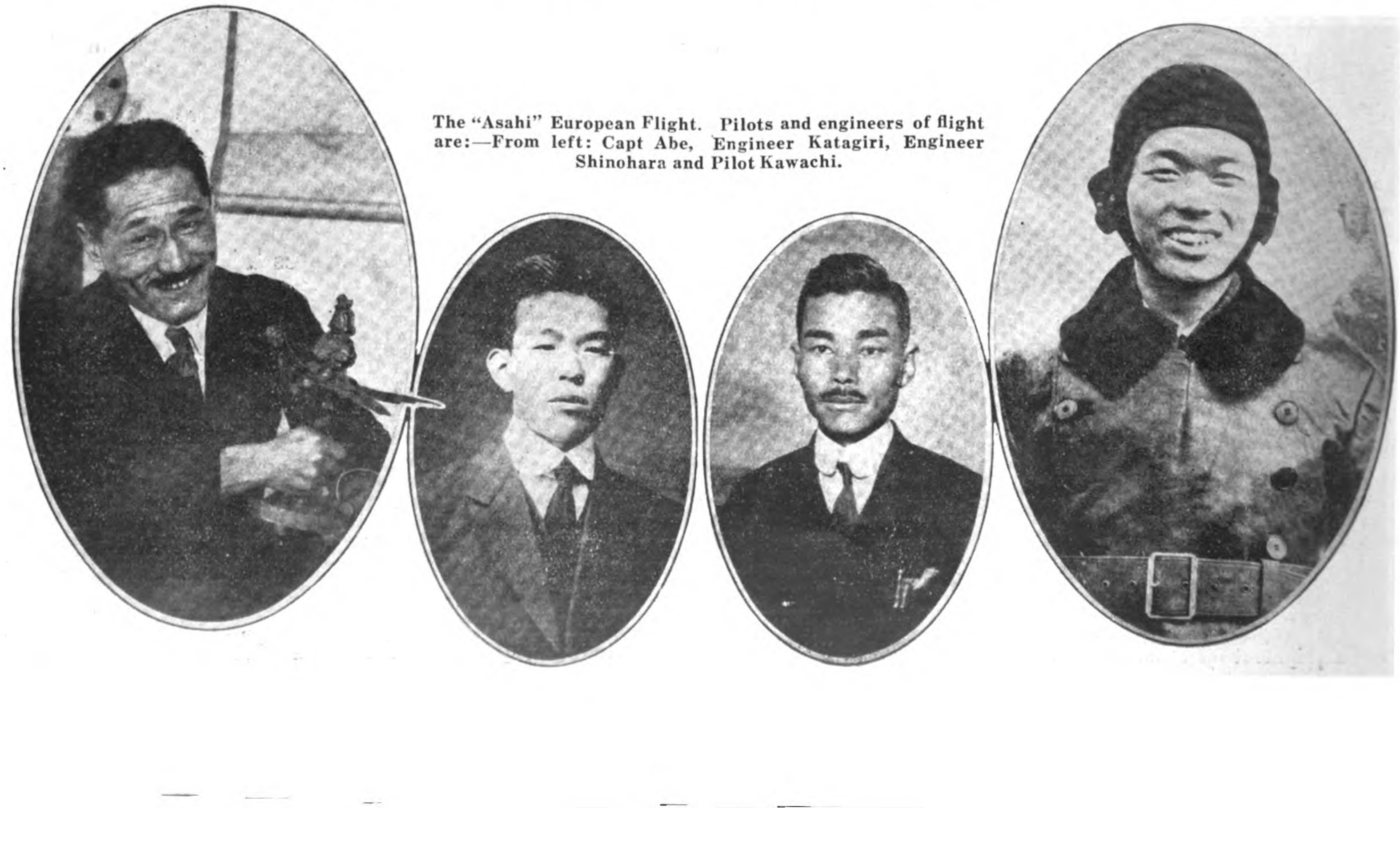


The machines employed in the "Asahi's" Tokyo-Europe flight are two Breguets, capable of an average speed of 180 kilometers an hour. The route over which the flight was made is Tokyo—Osaka—Heijo—Harbin—Chita—Irkutsk—Krasnoyarsk—Omsk—Chervyansk—Samara—Moscow—Warsaw—Prague—Paris

Japan's Place in the Race for Air Supremacy

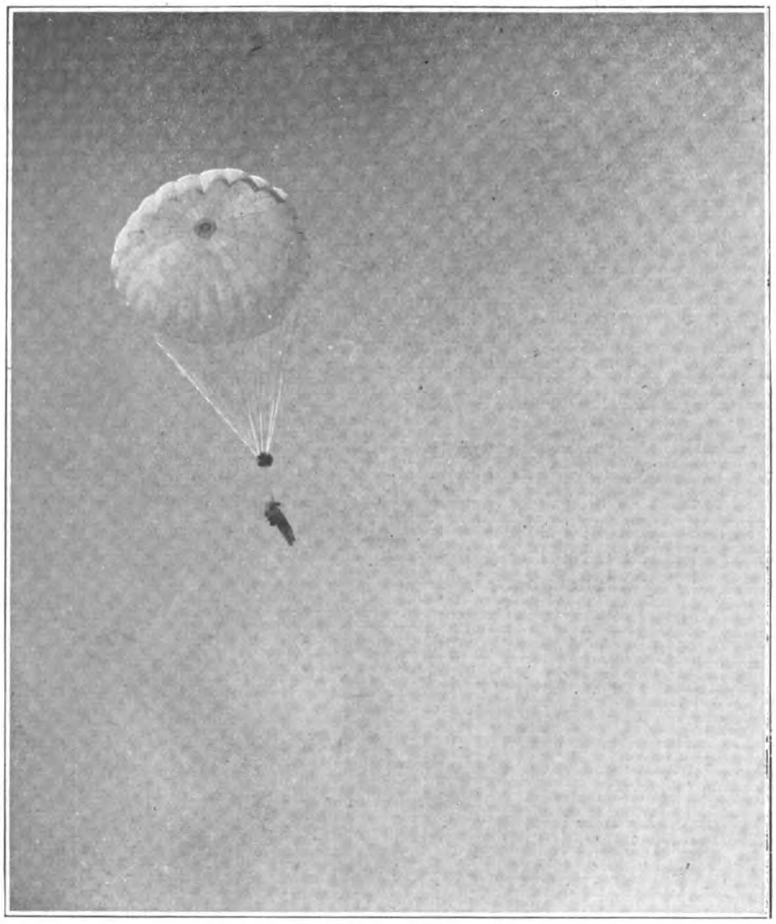
JAPANESE flyers have flown to Europe as this issue of THE FAR EASTERN REVIEW goes to press. Interest in this flight is naturally very keen throughout Asia, as this will be the first time that an Asiatic people have flown across the European continent.

Colonel the Master of Sempill, R.A.F., recently delivered an address before the members of the Japan Society, at the Central Hall, Westminster, on the "British Aviation Mission to Japan," of which he was the head. There was, said Colonel Sempill, every reason to believe that in the very near future an airship service between London and Tokyo would be inaugurated. The airship used would probably be about 700-ft. in length, with luxurious accommodation for fifty or even a hundred passengers. The ships would be capable of travelling about 70 miles an hour, and would probably make flights of from 2,500 to 3,000 miles without a stop. Rigid airships of this type leaving during the summer would travel by way of Scotland, the west coast of Norway and the northern coasts of Russia, and eventually across to Tokyo. The distance was something under 5,000 miles, and the journey would take about four days, during only one of which darkness would be experienced. The advantage of reaching Japan across the Arctic



The "Asahi" European Flight. Pilots and engineers of flight are:—From left: Capt Abe, Engineer Katagiri, Engineer Shinohara and Pilot Kawachi.

The Airship "Astra" Flying over Tokyo

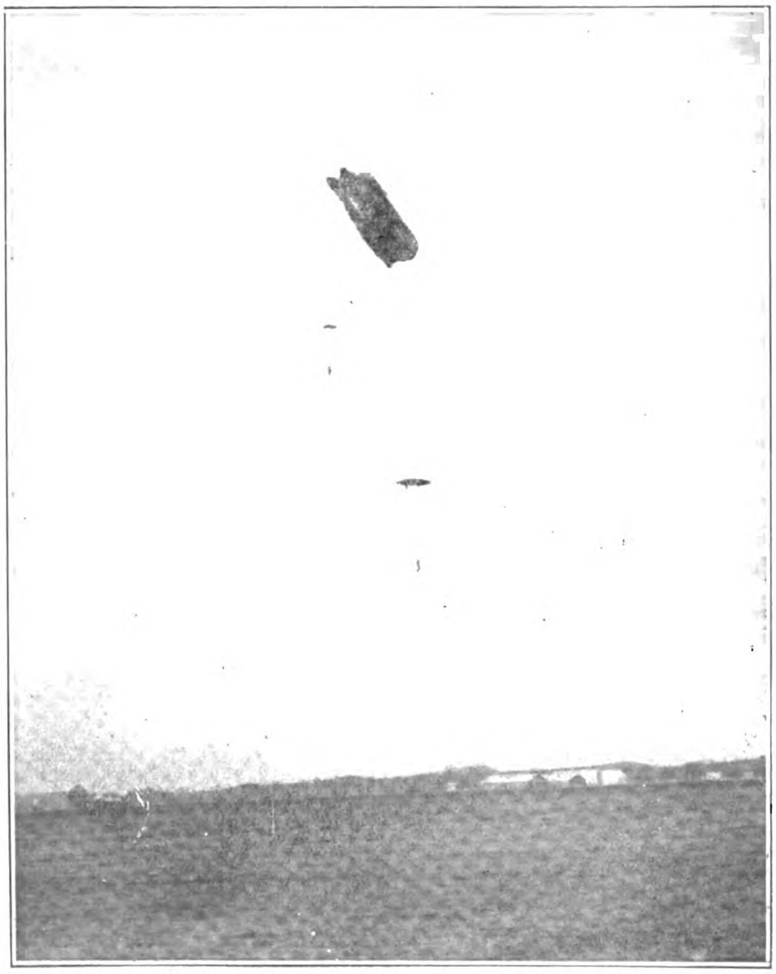


A Parachute Descent

were enormous, and so far as lighter-than-air ships were concerned, he was sure that would be the route eventually chosen for transportation to Japan.

Baron Hayashi said if in the future Japan was enabled to have an air service as a branch of its navy, the thanks would be due to the work of the British mission.

In view of the many alarmist reports that have been appearing in the press of the world with regard to the air preparedness and efficiency of the Japanese army and navy, the *Chicago Tribune* recently undertook to verify these stories, and as a result of its investigations announced that they were grossly exaggerated. This sane conclusion was subsequently corroborated by an excellent article by Alfred E. Pieres, Tokyo correspondent of the *Brooklyn Eagle* and other American papers. Mr. Pieres says that the truth is that Japan lags far and away behind Europe and America as regards aviation. The army and navy aeronautical bureaux are still in an experimental stage, and the best proof of this is that neither branch of Japan's defence forces has yet decided finally as to what type of machine to choose.



Double Parachute Release from the "Astra"

The army has to-day about 500 planes and the navy about 100 less. Japan to-day constructs her own planes—in addition to importing various types from Europe and America—in five plants. These are the Kawasaki Dockyard, Kobe; the Mitsubishi Dockyard, Nagoya; the Nakajima Airplane Works, Kobe; the Tokyo Gas and Electric Works, Tokyo; and the Aichi Watch Manufacturing Works, Tokyo. Another interesting fact about Japan's airplane industry is that all foreign instructors have been dismissed, and aviation, both in the army and navy, is being taught by Japanese.

Principal Types of Planes

The principal types of machine used by the army are the Nieuport 24 and Heriot 14 for training purposes. Some Farman 60 planes for bombing and Nieuport 24 and 29 for fighting purposes are also used. The type of motors principally used are the Le Rhone, 124 horse-power, and Salmson, 235 horse-power. The Hispano Suizo, 300 horse-power, has just been chosen as part of the standard equipment and will gradually replace the Le Rhone. At the moment, according to experts, there is not a single high-powered plane among the regular army equipment.

The navy has a larger variation of planes than the army. The lighter-than-air division of the navy is keenly interested in rigid

airships. The current year's appropriation for army aviation is 20,000,000 yen and for the navy 18,000,000 yen.

Plans for Air Mastery Guarded

There is a veil of secrecy drawn around Japan's efforts to master the air, but this secrecy is to hide the lack of air power rather than to conceal any degree of efficiency or preparedness.

The general public in Japan is sadly indifferent to aviation. Time and again efforts have been made to arouse them from this lethargy, the most recent being when crack machines of the army and navy joined with civilian airmen in treating Tokyo's millions to air stunts, nose-diving and an air raid on Tokyo. The public, however, regards aviation surely as the province of the army and the navy—and even in the army and navy aviation still stands for something yet in the experimental stage, something vague and undeveloped.

The first commercial air route in Japan was opened last week when private machines, backed by the Government, flew to Osaka, and then to Fukuoka, from Tokyo, carrying a small quantity of mail. It is hoped to make this air mail service first a bi-weekly one and then a regular daily affair. No night flying has yet been done in Japan except for very short distances.

Three Big Training Schools

There are three big aviation training schools in the country. One is at Tokorozawa, which teaches piloting and mechanical training. The course is an eleventh month one. Then there is the school at Shimoshizu, where a six-months' course for scouting and air tactics is provided for. Lastly, there is the school at Akeno, where bombing and firing is taught.

Japan has six aviation battalions, posted in various parts of the country (one in Korea). Each of these battalions possesses its own independent equipment. In addition, a special balloon corps is stationed at Tokorozawa.

The naval aviation department is made up of four naval flying corps, with a total of 3,000 men. Their training takes place at the Kasumigaura aviation station and varies but little from the army training. Foreign teachers were used also here during the first few years.

Cost of aeroplane production is extremely high in Japan, partly due to excessive cost of material and partly due to the high cost of skilled labor. Construction costs in several cases have turned out more than 100 per cent. in excess of the figure at which the same plane could have been purchased direct from the original manufacturer abroad. But in this instance national independence is placed above the thought of economic gain.

No " all-metal " machines are as yet built in Japan, but as plenty of aluminum can be found in the country it will only be a question of time before duraluminum planes will be constructed there.

No Record Flight Made

The Japanese aviation corps have no records to their credit, neither in regard to distance nor altitude. In fact, any attempt of record flying is strictly contrary to military rules. Only recently several attempts were made of an army flight from Tokyo to Seoul, a distance of about 900 miles. The flight did not succeed. The machines were forced down repeatedly, due to motor trouble. A special test of civil aviators also took place, during which successful candidates were to receive their diplomas, but not one succeeded in passing the simple tests prescribed. The courage and nerve of Japanese aviators is beyond criticism. Military strategics show that last year both army and navy men flew an aggregate of 35,029 hours, with accidents limited to one smash-up to 110 hours' flight, and one killed to every 2,000 hours' flight. These figures compare favorably with the fatalities of other nations.

The visits of the British, American, Italian, French and Argentine aviators to Japan in their round-the-world flights have aroused great enthusiasm in that country. With a desire to emulate these exploits, the *Osaka Asahi* and the *Tokyo Asahi*, who have contributed so much towards the advance of aviation in Japan, have determined to repay these visits and arouse further interest in aviation by organizing a flight by Japanese airmen to Europe. The two machines to be used for the flight are the Breguet 1922, the same machine Captain D'Oisy used in his visit to Japan. They are equipped with Lorraine-Dietrich 400-h.p. engines. The *Asahi* aviators are to fly from Tokyo to Paris, visiting the other capitals of Europe.

The *Asahi* newspapers are to be congratulated on their splendid work in encouraging the science of flying in Japan. These newspapers are the pioneers of civilian aviation in their country, and it is not too much to say that they have contributed largely to the present development of the science in Japan by inviting, as far back as 1911, an American aviator to come to that country and do exhibition stunts.

The next year the *Asahi* invited Atwater, another American birdman, to the shores of Japan and staged sea-plane exhibitions at Nishinomiya, near Osaka. In 1913 the *Osaka Asahi* invited to Osaka Koha Takeishi, who had studied the art of flying in the United States for many years, and he tried the first city-to-city flight in Japan. Although Takeishi met with an accident at Kyoto and was killed, his brilliant work greatly stimulated the interest of Japanese youth in aviation and brought many young aspirants into the profession. In 1914 and 1915 the *Tokyo Asahi* and *Osaka Asahi* gave strong support to the aviation tournaments held under the auspices of the Imperial Aviation Association. Both the *Tokyo Asahi* and the *Osaka Asahi* invited Niles, an American aviator, to Tokyo and Osaka in January 1916, and Art Smith, a star birdman from across the Pacific, in the spring of the same year. Both of them staged looping-the-loop and fancy night flights. Since then these two newspapers have done their best to promote the interests of the Japanese people in aerial enterprises by means of lectures and motion pictures, and presented condolence gifts to the relatives of those who have sacrificed themselves in flight, thus paying tribute to the daring aviators. The *Tokyo Asahi* and *Osaka Asahi* had the honour of being the first newspapers to use aeroplanes as conveyors of news matter, news photographs, extras, etc., beating their rivals many times. These two papers, realizing the vital relations existing between the newspaper business and aircraft, inaugurated in January 1923 regular bi-weekly flights between Tokyo and Osaka, a distance of 440 kilometres. At first they used Hall-Scotts of the Nakajima type, with 150 horse-power engines, but recently they purchased a half-dozen Salmsons, each equipped with an engine of 230 h.p. The aeroplanes with the mark of the *Asahi* have been seen between the two great cities of Japan so often that the distance covered by them up to this time amounts to about fifty thousand miles. The true value of the regular flights was amply proved during the great earthquake, when every other facility of transportation and communication was utterly disorganized by the quake. The *Asahi* aviators brought the first photographs of the *débris* and the first details of the great disaster out of the devastated areas, and the details of the calamity were cabled to the London *Times* and the Associated Press of America at their request. The *Tokyo Asahi* and the *Osaka Asahi*, besides running the regular flights and making air trips whenever there was an incident or accident worth reporting, have joined hands with the Japan Research Laboratory of Aerial Transportation, the Aviation Corporation and many other similar organizations, and have done their best to raise Japanese civilian aviation both on land and sea from the state of infancy to its present state. The *Asahi* sister papers, not satisfied with pioneering the conquest of the air in Japan, have now carried out the flight to Europe.

Another Proposal

Haakon H. Hammer, the Arctic explorer, who has been visiting in the Far East, recently wrote a description of the proposed northern flight. Mr. Hammer's article deals with the subject from the European standpoint:

The primary object of this flight is not, as many appear to believe, to reach the North Pole, but to fly over and explore the million square miles of unknown territory located between the North Pole and Alaska. The exploration of this territory will solve the last geographical problem the world has to offer, and as all previously attempted explorations of this area by ship or by dog sleighs have proven futile, it is believed that aeroplanes or airships are the only means with which this problem can be solved.

The flights made from Spitzbergen towards the North by the Hammer-Junkers expedition in the summer of 1923 definitely proved the practicability of aeroplanes for exploration work. This expedition might be called the " experimentary " or " preparatory " expedition as it was on the basis of the experiences of this expedition that the detail plans of the big Trans-Polar flight were laid.

Just what will be found in the unknown Arctic territory cannot possibly be foretold, but prominent scientists are of the opinion that a large continent is located there. Should this be true, the value of such a continent is problematical, but that it will have a tremendous value as an air base for a Trans-Arctic air route is a foregone conclusion.

When discussing the future of a Trans-Arctic air route, it must always be remembered that there is permanent daylight in the Arctic regions between May and September and that the temperature during that period averages from 40 to 44 degrees F. The supposed extreme cold exists only during the winter months, and during the summer the atmospheric conditions for flying are ideal.

While the plans of the expedition so far have been limited to a flight from Spitzbergen to Alaska, I am now endeavoring to make arrangements to secure the additional equipment necessary in order to make a flight from Spitzbergen to Japan with Alaska as the one and only stop for refueling.

The duration of such a flight would be about 36 flying hours and should be accomplished within a period of two or three days. Such an attempt should command the keenest interest in this country.

The distance to be flown would be about 3,400 miles, not much longer than the distance across the American continent from New York to San Francisco. The distance is no obstacle, and after the flight has been made once and the condition of the territory becomes known, it should be simple to operate a regular Trans-Arctic air route during the four or five summer months.

No other country will benefit nearly as much from such a Trans-Arctic air route as will Japan. Such a route will shorten the distance between Japan and Europe by several thousand miles. It would bring London to within a three-days' distance of Tokyo. A visit to Europe and return could comfortably be made in from one to two weeks. From this it will be seen that the opening of a Trans-Arctic air route would not only be of immense strategical but also commercial importance to Japan.

The Trans-Polar Flight expedition is not a national undertaking, but a strictly international effort for the purpose of geographic exploration. That its results, if successful, should develop into a regular Trans-Arctic air route would simply be a natural trend of the progress and development of the world.

A Study in Extraterritoriality

(Continued from page 547).

Ostroumoff and his colleagues, when giving their evidence, denied all the accusations brought against them, and handed the court numerous copies of documents to prove the statements they had made. And this, though so far they have been denied the right to have access to the archives of the Railway Administration to get hold of original documents that are most important for the defence.

The case is a long way from being over, though ten hearings have taken place, for apparently the presiding judge is bent on drawing the case out as long as possible. The sessions are short, never more than three hours, and often much less, whilst they do not take place daily, it taking exactly one month to hold the ten sessions. Another difficulty is that the prosecuting attorney may at any time make additions to his accusatory act. This means further delay, for the production of new documentary evidence on the part of the prosecution will mean that the defence will require time to study these in order to give an intelligent reply.

When Ostroumoff took over the railroad he founded the Economic Bureau to institute an organization for compiling the necessary basic information for the planning of the railway's work. He at once introduced a new tariff policy on the railway, reducing the former tariff rates, which were absurdly high, and enabling native carts to compete successfully with the railway on the southern section, and also to create new transportable commodities by taking advantage of the economic resources of the country.

The following figures show the growth of the commercial transportation :

1920	102,286,613 poods
1921	126,149,526 ,,
1922	151,605,404 ,,
1923	171,153,044 ,,

Extraordinary efforts were needed for getting the rolling stock in good order again. The following table shows the improvement brought about :

	Locomotives 1921	Locomotives 1924	Passenger Coaches 1921	Passenger Coaches 1924	Goods Cars 1921	Goods Cars 1924
In service and reserve ..	256	181	178	252	9,667	7,208
	97	280	57	206	—	4,348
In bad order ..	152	72	278	153	2,536	647
Percentage of bad order stock to effective number	30.3	13.5	54.00	25.00	20.8	5.3

In the Traffic Department the following improvements were made. The commercial speed of freight trains was increased from 12.78 versts an hour in 1920 to 17.10 versts in 1923, and the commercial speed of passenger trains from 21.75 versts an hour in 1920 to 33.36 versts in 1923, whilst passenger trains obtained a maximum speed of 77 versts an hour in 1923 against 65 versts in 1920. There was likewise a great increase of the make-up and weight of trains. The average make-up of 67.5 axles in 1920 was increased to 100 axles in 1923, whilst the maximum weight of trains of 60,000 poods in 1920 was raised to 115,000 poods in 1923. At the same time traffic department expenses were reduced from 4¾ millions in 1920 to 2½ millions in 1923.

The property of the Railway, which is looked after by the Maintenance of Way and Works Department and which includes the track, different buildings and construction, and open yards, fell into a state of complete decay during the war and civil commotion. The total length of the railway is 1618.4 versts of main line, and with inclusion of sidings 2,702.8 versts. A space more than 200,000 square sagens (a sq. sagen equals 49 sq. feet) is covered by civil constructions, representing 125 sq. sagens per one verst of track. No other railway in the world possesses such a number of civil constructions. During the three years 1921 to 1923 the Ways and Works Department has not only effected repairs and restored all essential elements of the track, whereby it has been possible to raise the speed of trains to 77-80 versts an hour, but it likewise repaired all damaged buildings and accomplished a number of new works involving a sum of over six millions; the signalling equipment has been improved, wooden bridges replaced by bridges of a permanent type, and car-sheds and other large-size buildings have been erected.

Japan Competes for India's Textile Trade

Indian trade statistics for the eleven months ended February 1925 have just been published. They show that the imports of cloth from the United Kingdom (grey, bleached, and colored) amounted to 1,449,000,000 yards, an increase on the corresponding eleven months of the previous year of 265,000,000 yards. During the same period the cloth imports from Japan were 138,000,000 yards, an increase of 26,000,000 yards. These figures show that the increased trade done by Great Britain with India in cloth was nearly twice as much as Japan's total cloth trade with that country. With regard to yarns, however, Japan has undoubtedly made a good deal of headway. She has exported to India over 30,000,000 lbs., in comparison with 19,000,000 lbs., whereas the United Kingdom has sent only 19,000,000 lbs., as against 20,000,000 lbs. in the corresponding period of last year. The main cause of this is Lancashire's higher cost of production.

New Shallow Draught Oil Tanker for Chinese Trade

A very interesting launching during the month was that of the *Tien Kwang*, which vessel Messrs. Yarrow & Co. have built for the Anglo-Saxon Petroleum Company, for service of that concern on one of the great rivers in China.

The vessel is a sister ship to the *Shu Kwang*, also built by Messrs. Yarrow for the same owners. They are shallow river oil tankers of about 206-ft. long and fitted with machinery of 3,500 horsepower. They are also fitted with the latest type of Yarrow oil-burning boilers. Formerly it was usual to send vessels of this type in sections to their destination to be re-erected there, but the *Shu Kwang* was sent to the Far East under her own steam, and the *Tien Kwang* will shortly be ready to leave the Clyde for China, and will also come out under her own steam.

Coal in the Philippines

By *Warren D. Smith*

COAL and coke are needed in the Philippines for making steam, for cooking, for smithing, and for the manufacture of cooking gas and producer gas. The annual domestic production of coal amounts to 60,000 tons, approximately, and a larger amount is being imported. In 1920 imports, from Japan, Australia, and China principally, amounted to 531,550 tons. Until the entrance of the United States into the World War, coal production in the Philippines had nowhere been conducted very successfully over any considerable period. War conditions gave coal mining in these Islands a great impetus, and under favorable conditions it may remain an established industry. With the manufacture of iron and steel from the large deposits of iron that are known to exist in the Philippines, which may be soon undertaken, there will be given an added stimulus to the coal business.

There is some coal on practically every large island of the Archipelago, but there are six localities of first importance, namely, Batan Island; Gotas-Butong, Dumanquilas Bay, Mindanao; Cebu Island; Polillo Island; Mindoro Island; and Masbate Island.

Batan

Batan Island is 15 kilometers almost due east from Legaspi, in Albay Province, which in turn is a part of the long irregular arm of south-eastern Luzon. The island is from 15 to 20 kilometers long and 8 to 10 wide. It has an irregular coast-line and, for its small size, is very mountainous; one peak attains an elevation of approximately 500 meters.

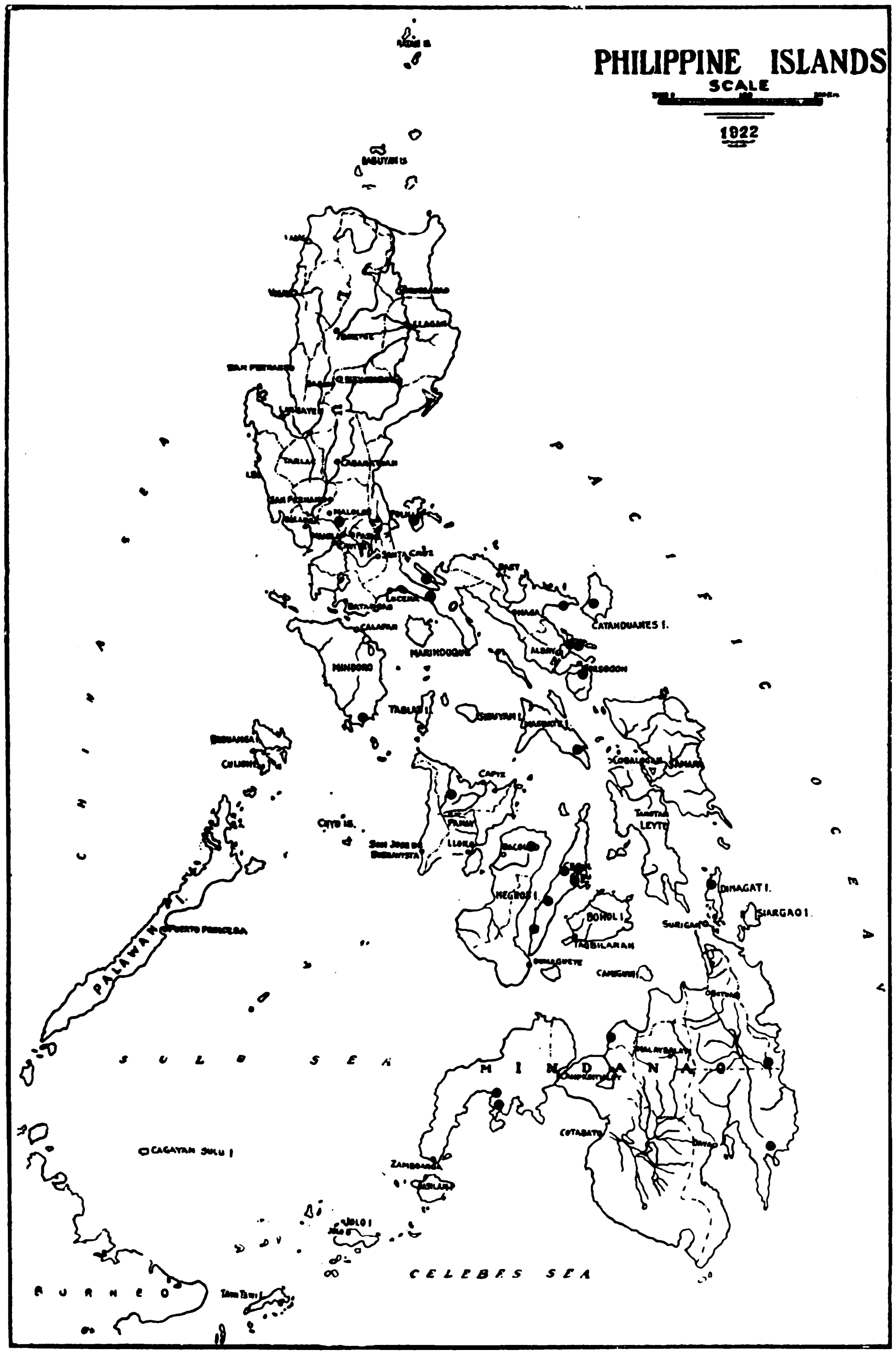
The formations are an igneous base of diorite; some serpentinized intrusives; the remnants of an iron formation; coal measures, including shales, sandstone, and coal seams; and at least two horizons of limestone, the upper one of which is rather coralliferous (Malumbang Pliocene)—in fact, it is quite probable that a coral limestone covered the entire island at an earlier time. The coal beds are inclined at various angles, often steep, and in some cases vertical. At the points where they can be most easily reached from the seashore the beds unfortunately dip into the island, thus necessitating hoisting and pumping. At eastern Batan there is a local down-faulted block of coal which has a slight dip to the sea. It is this block of coal that is being mined by the Philippine Coal Mining Company. There are at least two good seams of over 1.5 meters, and one or two more of uncertain thickness, which can be easily reached, almost at sea-level.

From 1904 to 1910 the United States Army attempted to open and operate a coal mine on the west end of this island, at the sitio of Liguan; but, owing to difficulties, partly geologic and partly of a business nature, success was not attained, and the then Secretary of War, Jacob M. Dickinson, closed the mine in 1910. A private enterprise has recently renewed operations in this locality. The coal at Liguan is, as will be seen from an inspection of Table 29, superior to most Philippine coals. It is greatly to be regretted that this mine did not prove a success in its initial undertaking.

The old Minas de Batan properties on the north-eastern portion of the island (Calanaga Bay) were abandoned years ago. For several years a Spanish company employing Japanese miners, who used rather crude and wasteful methods, operated these properties, but production never amounted to much.

On the east end of the island, near the old barrio of Batan, there have been several attempts at mining since 1907 with more or less success; and to-day, after several ups and downs, the Philippine Coal Mining Company is operating there successfully and producing between 200 and 400 tons per day, which is the largest production in the history of coal mining in the Philippines. The output is by no means steady, as it depends upon a fluctuating demand.

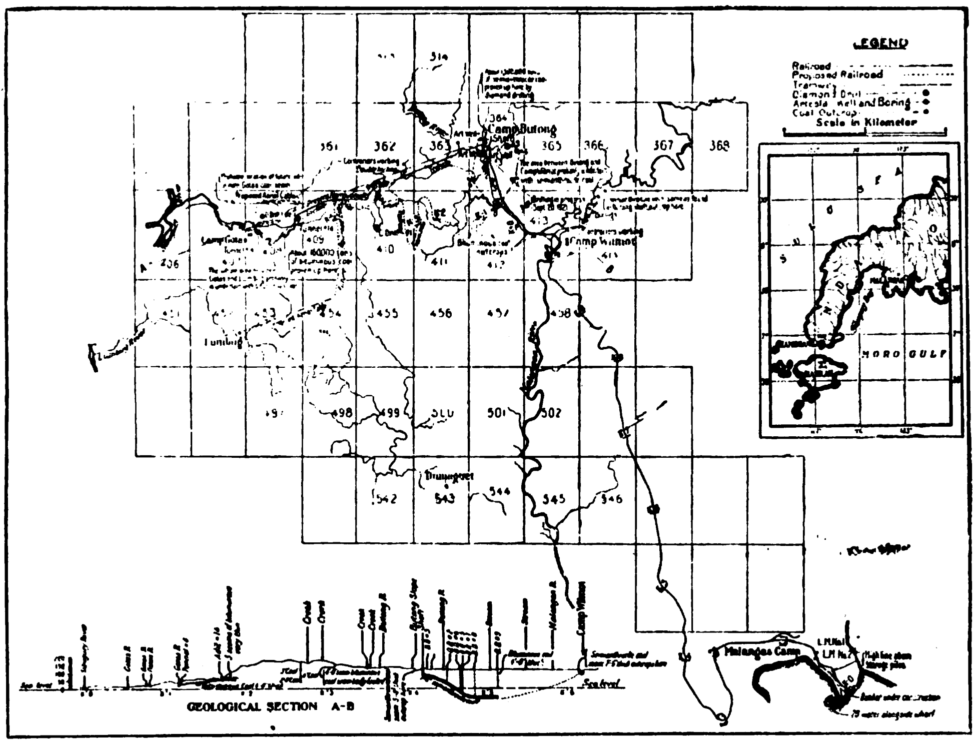
As yet not much trouble from gas in the mines has been



Coal in the Philippines

experienced, and naked lights can be used, in spite of the fact that the coal is rich in volatile matter. In places, especially in eastern Batan, the coal contains considerable resin and sulphur. There is also some iron pyrites in the shale just above and below the coal, which causes the coal to take fire if it is not thoroughly cleaned or if it is allowed to stay too long on the dump. In 1905 I visited the old Bilbao property, on the north side of Batan Island ; at that time the tunnels were abandoned because of spontaneous combustion in the workings. These points are mentioned in detail, not to present too discouraging an outlook, but so that investors and engineers may not enter the field with high expectations which experience with the facts will prove unfounded.

Batan Island is well situated, being directly in the track of steamers coming from San Francisco by way of Guam, the most direct route to Manila. A coaling station here would save the Army transports the long northward trip to Japan, where they now go to coal. On the other hand, it is off the track of many of the inter-island trading vessels and large European tramp ships that touch at Cebu, Iloilo, and Manila.



The Sibuguey Coal Field, Mindanao

Cebu

Coal in the Philippines was discovered in 1827 on Cebu. Cebu is the second district in importance in the coal industry ; although the mines located on this island are not the largest, there are more of them, and the coal reserve there is greater than on Batan. Cebu is a long, narrow, mountainous island, with no navigable rivers, few bays, and but little wide coastal plain.

Geologically, many of the formations on Cebu are similar to those on Batan ; there are also crystalline schists, volcanic flows, and old slates, all of which may yet be found on Batan, however. In two respects Cebu differs greatly from Batan. It is badly deforested, as compared with Batan, and there is over the greater portion of Cebu a thick mantle of coral limestone, which has been cut through here and there by erosion, revealing the coal measures below. The coal measures are of the same age as those of Batan. Structurally, the island is badly faulted and there is more or less intense folding of the rocks, which makes coal mining difficult.

Scores of outcrops are known in at least fifteen localities, which are distributed from one end of the island to the other. The chief localities to which attention was paid by the Spaniards are to-day receiving the attention of Americans. All but one of these localities are on the eastern side of the central cordillera.

In the early days a great many claims were staked out in this field, but only a few were ever patented. At the present time it is necessary to secure leases from the Government, as patents on freeholds are no longer issued.

Cebu is the headquarters of the National Coal Company, which has workings in the vicinity of Mount Licos, 15 kilometers west of Compostela, the site of rather extensive workings in Spanish times. To date this mine has not been particularly successful. In reality, the only property which approaches a real mine is that of the Mount Uling Coal Mining Company, situated about 12 kilometers west of Naga.

Cebu has the distinction of being the one island, in addition to Mindanao, where coking coal is known to exist. A seam about half a meter in thickness occurs at Guila-Guila, on Mananga River, about 5 kilometers west of the city of Cebu, on the property of Mr. Eugene Mitkievicz. There is also some coking coal at Mount Uling and on Toledo River.

Four principal coal seams which, more or less modified, can be identified in several localities, are known on this island and at Mount Licos ; they were given in Spanish times the following names :

4. Pilarica.—1.4 meters ; strike north 23° east ; dip 30° south-east ; 40-meter interval.
3. Enrique Abella.—1.2 to 1.5 meters ; strike north 23° east ; dip 40° south-east ; 9-meter interval.
2. Esperanza.—50 centimeters ; strike and dip same as No. 1 ; 40-meter interval.
1. Carmen.—1.6 meters thick ; strike north-east and south-west ; dip 30° south-east. This is the lowest.

Some small undertakings for the exploitation of coal at Mount Uling, Mount Licos, and Camansi were in progress prior to 1898, and a large project with Government backing was in process of formation just at the outbreak of the insurrection in 1896. This project was to have been under the supervision of Abella, the then Inspector de Minas of the Spanish Government, one of the ablest of the Spanish engineers in the Philippines and certainly the most competent geologist.

The property of the Danao Coal Mines, Limited, located at Camansi, Cebu, which mined several thousand tons in 1920, has recently been taken over by a large syndicate of foreigners in China, and it is expected that they will carry forward the work on a large scale. The seams in this field are continuations in part of those at Licos and of the field to the north.

In the field adjoining on the north known as Cajumay-jumayan, careful estimates by the late Benjamin Smith Lyman, a famous American coal engineer, who examined it in 1907, gave the workable coal reserve as at least 7,000,000 tons. In this field the coal seams lie in a syncline ; elsewhere in Cebu they are generally in a monoclinal attitude.

Sibuguey Peninsula, Mindanao

The Sibuguey Peninsula coal field is perhaps experiencing the greatest amount of development of any of those named, as the principal holdings of the National Coal Company are located there. Coal is known in many places on this peninsula. The principal sites are Gotas, on the head waters of Siay River, 4 kilometers west of Butong ; Butong, about 12 kilometers from the town of Malangas ; and Camp Wilmot, about halfway between Butong and Malangas, on Dumanquilas Bay. Along a line running across the peninsula from Malangas to Sibuguey Bay scores of coal outcrops can be seen.

The most extensive report on this region is a manuscript report by Dalburg. I recently made an investigation of the properties on this peninsula at the request of ex-Governor-General Harrison and, later, of Governor-General Wood, but my work covered principally the business aspects of the operations. Therefore, the following description is based in part upon Dalburg's report, and is supplemented by my recent observations.

The most important districts are Butong and Gotas. Butong is first on account of the railroad line nearing completion to that point, which will assure means of transportation ; Gotas is second in importance on account of having a fairly large body of coking

coal. There is a possibility that the best part of the coalfield lies just north of Gotas and Butong, which can only be proved by underground development.

The coal-bed sections show that there are at least three coal beds of sufficient thickness to be mined. At Butong, the main seam (semi-anthracite) is over 2 meters thick. The principal seam of coal at Butong is a semi-anthracite, which owes its high fixed-carbon content to local metamorphism by dikes and sills of andesite and basalt. A characteristic physical feature of this coal is the crystallization resulting in columnar jointing.

The physical and chemical properties of the coals are such as to make them suitable for fuel; they could be used instead of foreign coals and could compete favorably with them. The coal from the Butong seam is too hard to be used alone, without forced draft, and should be mixed with other coal.

Geologic conditions are such as to render mining somewhat difficult, but it is probable that some of the seams are of sufficient extent to allow of successful mining. Diamond drilling during the last year has proved that there is a fine body of coal in the vicinity of Butong. The main shaft for all the mines will be located in a basin to the east of the present exploratory shaft at Butong. The development of this field has not been altogether without mistakes, and some expenditures were made here before they were justified; but it is expected that the mining operations at present in progress will go forward now and produce better results.

At the time of my last visit to this mine (December, 1921) the work in the Butong district was progressing favorably, and a good thickness of coal, in excess of 2 meters, continues. The development work at Gotas has not been pushed, owing to lack of rail facilities, though this work may later be resumed. At Camp Wilmot there is a small production, and development work continues. The work in the Sibuguey field is under the very able superintendence of Mr. Caldwell, an English mining engineer, who had had five years of coal-mining experience at the Silompopum mine in British North Borneo before coming to the Philippines.

Polillo

Polillo lies off the east coast of Luzon, about due east of Manila, is about 50 kilometers long by 25 kilometers wide, and is separated from the mainland by a channel 30 kilometers in width. This coast of Luzon is very sparsely settled.

The principal coal-field lies a few kilometers inshore from the town of Burdeos in the eastern central part of the island, on Burdeos and Aloeon Creeks. The central part of the island is igneous, with granitic rocks resembling diorite, and on the flanks of the igneous complex are Tertiary sediments, with conglomerate, sandstone, shales, and limestone, in the order named, from below upward. Practically the same series of formations occurs here as in the other coal-fields of the Islands. Structurally, there is one well-marked anticline and syncline with two monoclines, with the general axis north 20° west. Moderate and perhaps major faulting is in evidence. The age of the coal is middle Miocene. There are three well-developed coal seams; respectively, 1.5 meters, 0.6 meter, and 1.2 meters in thickness; others are too small to be worked. The principal coal seam is the Wray seam. It was named after its discoverer, Captain Wray, formerly of the Philippine Scouts. There is no development or mining on Polillo at present (June, 1921). Formerly, there was some prospecting work at the so-called Wray mine, on Guinibauan Creek. The following is a copy of notes made by me while on the ground on my last visit in 1910. As there has been practically no work since, these notes are up to date:

"*Quality of Coal at the Wray Mine.*—Upper portion, shiny black, powder black, lower portion dull, brownish black, resembling 'bone'; fine, angular, shiny particles cemented in a coaly matrix. Fairly free from clay or sand; 2 to 2.5 centimeters sooty clay parting between the two portions. No sulphur visible, some gypsum. Fairly firm for outcrop coal, lower part of seam exceedingly hard and firm. It is reported that this coal does not air slack. A large lump that has been in the division of mines for five years has not slacked at all. (At present, seven or eight years later, it is still firm and solid). No well-defined cleats; slickensides or shear surfaces characteristic. Does not coke. Good steaming coal. The coal-field is bounded definitely on the west by volcanic rock. The coal-beds do not appear to be continuous in north and south direction; witness the almost entire absence of outcrops in the north branch of Guinibauan Creek. The seams are flattening toward the coast, and will be found there in all probability of inferior grade to the more highly inclined seams to the west."

The folding in this region was due to lateral thrust against an abutment of resistant rock, the igneous complex in the center of the island. There are no indications of intrusions.

Given continuous seams, which will have to be proved by more excavations, there is nothing prohibitive in the geology. Mining operations will, however, not be simple.

This coal, it can be seen, is of very fair grade. The chief factor that militates against it as a commercial proposition is the geographic situation of the island, as it is well off the track of inter-island steamers. Some years ago there was much talk about developing a port for Manila on the east coast of Luzon, just opposite Polillo Island. This, of course, would have boomed Polillo coal. The project, however, has never advanced beyond that stage. The field was examined some years ago by Mr. J. B. Dilworth, of Philadelphia, then in the employ of the well-known American coal expert, D'Invilliers; in an article on Phillippine coal fields in 1908, he had this to say on Polillo coal:

"All practical and laboratory tests of this coal show it to rank in quality with the best in the Philippines. It is the equal chemically of that from western Batan, and is but little inferior to the Japanese fuel now on the market. But in this field, as in western Batan, geologic disturbances have rendered the coal seams structurally difficult to mine economically on a large scale."

Masbate

At two places on Masbate fair coal seams have been found. These are near Cataingan and Dimas-Alang, near the lower end of the eastern prong of the island. The deposits have been known for a long time, and some attempts to mine coal there were made in Spanish times, particularly on the old Spanish concession containing two *pertenencias* known as the San José and the Santa Cruz.

There are practically no published data with reference to these deposits, but in 1910 Ferguson made a private report from which I have taken some very general notes. The reader will understand that this report was not meant for publication, and Mr. Ferguson has not since examined the region nor had a chance to make any changes in the report as originally submitted. Therefore, I alone am responsible for the following interpretation of his statements. Inasmuch as I later visited a portion of this field I am in a position to substantiate Ferguson's statements of fact and of opinion.

The principal deposits are located near the barrio of Nabangig. It was Ferguson's opinion that there are three main workable seams of coal in that locality. The three workable seams are each approximately a meter in thickness, and they dip very steeply to the north-east, though there are some local departures from this. The coal measures are comparatively closely folded, with one well-marked anticline and syncline. Some faulting was noted, but the most serious feature of the field in the places examined by me was the lack of persistence, the coal thickening and thinning within short distances, in some places disappearing entirely, due either to pinching or to faulting.

Ferguson considered the coal to be of good quality. Some coking coal was noted by him at Dimas-Alang, but for several reasons was considered valueless. No work has been done in that region since the propsecting work which called for the report made by Ferguson. An analysis of the coal from one of the best seams is given in Table 29.

Transportation to a shipping point might be provided by a tramline about 15 kilometers in length through country which, according to Ferguson, offers no considerable topographic difficulties. Port Cataingan, he thought, would be the natural outlet for this coal. Good timber in sufficient quantity is found in this region. Labor is moderately cheap when available, though the gold mines in the Aroroy district absorb most of the local supply. The geographic situation appears to be the chief favorable feature of this field.

Mindoro

At the southern end of Mindoro, near Bulalacao, are some deposits of coal of medium grade which have long been known and where some development work was done in Spanish times. I visited this locality in 1910, but was unfavorably impressed with both conditions and the quality of the coal.

The thickest seam of coal is 7 or 8 kilometers up Bulalacao river. It is 4 meters (approximately) in width. An analysis of coal from this field (not from this particular seam) is given in Table 29. Early reports mention at least six seams, but I doubt that there are more than three or four that are workable.

On Semirara, a small island directly south of Mindoro, there are also coal seams, undoubtedly the continuation of those near Bulalacao. About the year 1893 title was issued for a mine on Semiraral, but I know nothing of its development. The Recoletos Fathers also had some coal properties there, but apparently nothing was ever done to develop them.

Coal deposits of seemingly commercial possibilities, in the following five localities, have attracted attention from time to time; they will merely be listed here, but the interested reader can find some reference to practically all of them in Burritt's Coal Measures of the Philippines. These are Alabat Island, off the north coast of Tayabas, Luzon; Dinagat Island, off the north coast of Surigao, Mindanao; Escalante, on the north-east coast of Negros; Catanduanes, north of Batan Island, off the east coast of Luzon; and Gatbo, Sugod Bay, Sorsogon Province, south-eastern Luzon.

Chemical and Physical Characters of Philippine Coal

Philippine coal is of three chief classes; namely, semi-anthracite (hard coal), sub-bituminous (black coal), and lignite (black and brown coal). The following data with reference to the character of Philippine coal are taken from notes by Dalburg, with some revisions:

Much of the lignite coal is black and very seldom shows a woody structure or brown color. The coals that slack or crumble on exposure to the air break with an irregualr fracture, which as a rule does not conform to the bedding planes or cleats.

The lignites are found where the rocks are little disturbed and away from the lines of uplift. The sub-bituminous and bituminous coals occur near the bases of mountains or where the lateral disturbances and pressure which folded the formation have made a great change in the character of the coal.

Philippine coals are generally non-coking, although fair coking coals have been found at Gotas, Mindanao, and Guila-Guila, Mount Uling, and Toledo, Cebu.

The coal will generally stow about 48 cubic feet to the ton. It is friable, and a large percentage is small or broken. Unless carefully fired a portion only is consumed and the rest goes through the grate bars. In some cases the ashes may be fired twice and still contain a considerable amount of combustible. An important question is the proper spacing of the grate bars, which should not be over 0.75 inch apart. The coal is very gaseous, and it is almost impossible to insure complete combustion in an ordinary type of boiler furnace. Firing lightly and almost continuously insures the best results.

Recent tests on a German gas producer have shown the coal to be suitable for this purpose.

Considerable difficulty is experienced in storing the lignite coals, due to spontaneous combustion.

The fuel value of the best Philippine coals is from two-thirds to three-fourths that of the best Cardiff coals and very little short of that of the Borneo and Japanese coals.

Table 29 gives the analyses of representative Philippine coals.

These analyses were made by the "smoking off" method in which the coal is subjected to a low heat so as to expel the volatile matter with a very small flame and finally heated for seven minutes over a Bunsen burner.

The sampling was done according to the Bureau of Science method, which is practically the same as that of the United States Bureau of Mines.

The results are given on an air-dried basis, at laboratory temperature (30° C.).

Coal Seams and Inclosing Beds

In general, there are four workable seams in most of the fields, though in practically each only one seam is being mined. Some of the drill records show more than four present in some localities.

On the United States Army Mine Reservation near Liguan, Batan Island, drill hole 4A, beginning at about 200 feet elevation, gave the following record of the strata:

TABLE 30.—*Strata from Drill Hole 4A on Batan Island, from above downward.*

Material.	Feet.	Material.	Feet.
Shale..	20	4. Coal	6
Grit (coarse SS) ..	8	Shale	2
1. Coal	3	5. Coal	1
Shale..	10	Shale	1
Grit	10	6. Coal	1
Shale..	5	Coarse SS	10
Grit	24	7. Coal	4
Shale..		Shale	32
2. Coal	2.5	SS (?)	
Coarse SS	10	8. Coal	5
3. Coal	2	Shale	20
Shale..	30	Limestone, bottom of hole	15

An examination of these records, which, I regret to say, are not altogether accurate, reveals several important facts; namely, (*a*) that there are at least eight seams of coal on this part of Batan Island, four of which are workable; (*b*) that these beds are not persistent; and (*c*) that shale forms the floor and coarse gritty sandstone the roof.

Drill records from borings on the property of the National Coal Company at Butong, Sibuguey Peninsula, show the presence of sills of igneous rock intercalated with coal measures, which may account for the anthracitization of the coal in this locality. One of these sills is very persistent and is found in the same relation to the chief coal seam in several of the borings. The following is a copy of the record of bore hole 4:

TABLE 29.—ANALYSES OF PHILIPPINE COALS.

Analyses frm the Bureau of Science, Manila.

Air-dried basis.	East Batan.	Liguan.	Cala-naga.	Camuju-mayan.	Caman-si.	Mount Licos.	Uling.	Bula-lacao.	Cata-ingan.	Polillo.	Sibuguey. Butong.	Sibuguey. Gotas.
Proximate analysis:												
Moisture	18.32	5.81	13.28	12.49	7.49	8.10	14.90	17.57	4.87	3.76	2.05	1.25
Volatile matter	36.53	39.39	39.10	41.63	44.18	40.73	38.63	42.43	46.50	43.58	12.95	18.57
Fixed carbon	36.60	49.71	39.13	42.41	43.90	48.21	41.91	31.49	44.18	38.60	75.60	73.72
Ash	8.55	5.09	8.49	3.47	4.43	2.96	4.56	8.51	4.45	4.06	9.40	6.46
Ultimate analysis:												
Sulphur	1.03	0.12	1.93	0.65	2.40	0.42	0.35	2.54	—	0.32	0.71	0.71
Hydrogen	5.32	5.08	11	—	5.11	5.72	—	5.87	—	5.54	—	—
Carbon	51.55	68.14	—	—	66.18	66.46	—	52.60	—	70.47	—	—
Nitrogen	0.92	1.11	—	1.64	1.72	2.10	—	0.96	—	1.59	—	—
Oxygen	32.64	20.56	—	—	20.16	22.34	—	29.52	—	18.02	—	—
Calorific value determined:												
Calories	4,618	6,358	5,221	5,761	6,249	6.424	—	4,959	—	6,775	7.730	7,730
British thermal units ...	8,312	11,444	9,398	10,370	11,284	11,563	—	8,926	—	12,195	13,775	13,914
Calorific value calculated from ultimate analysis:			%									
Calories	4,603	6,386	5,266	—	6,294	6,389	—	5,058	—	6,840	—	—
British thermal units ...	8,285	11,495	9,479	—	11,329	11,500	—	9,104	—	12,312	—	—

TABLE 31.—*Record of Bore Hole 4, at Butong, Sibuguey Coalfield; from above downward.*

Material.	Meters.	Material.	Meters.
Clay		Shale	
Sandstone		2. Coal	0.15
Shale		Shale	
Compact limestone		3. Coal	0.15
Basalt		Shale	
Shale		Sandstone	
Sandstone		Shale	
Sandy shale		4. Coal	1.98
Shale		Shale	
Compact limestone		5. Coal	0.15
Shale		Shale	
Bone with coal parting		Bone	
Shale		Shale	
1. Coal	0.15	Sandstone, bottom of hole	

Hole began at an elevation of 108.5 meters.

A generalized section of the stratigraphy in the Cajumayjumayan field, Cebu Island, made by the late Benjamin Smith Lyman, an eminent coal engineer, is as follows:

TABLE 32.—*Stratigraphy of the Cajumay-Jumayan Coal-field, Cebu.*

Material.	Feet.	Inches.
Coralline limestone of unknown thickness, perhaps	500	
Unconformity		
Shales, sandrock and pebble rock ? poorly, if at all, exposed, perhaps	1,200	
G. Coal bed, including shales; average of the eight completest exposures	12	5
Shales, sand rock and pebble rock ? poorly exposed	215	0+—
F. Coal bed, including very little slate, average of ten exposures	4	0
Shales, sand rock and pebble rock, poorly exposed	125	0+
E. Coal bed, including little slate, average of 4 exposures	3	0
Pebble rock, sand rock and shales, much exposed at the Hogback; probably not far from	650	
D. Coal bed, unworkable, without slate or shale, average of 3 exposures	1	6
Shales, sand rock and pebble rock, poorly exposed	65	
C. Coal bed, including slate or shale, average of 6 exposures	7	5
Shales, sand rock and pebble rock, poorly exposed	70	
B. Coal bed, including little slate or shale, average of 7 exposures	11	
Shales, sand rock and pebble rock, partly exposed on Dunga Creek	130	0+
A. Coal bed without slate or shale, average of 2 exposures	7	7
Pebble rock, sand rock and shale, partly exposed on Dunga Creek and northwards, perhaps	800	
D. Sidra's unworkable coal	1	10
Shales and sand rock ? poorly exposed, if at all	130	
Coal traces, 300 yards west of D. Sidra's		
Shales, sand rock and pebble rock ? poorly exposed perhaps	500	
	3,936	9

Unconformity

Igneous rock rising to unknown heights, exposed, a little, south-east of Mount Lantauan and probably in the western part of the Boy Claim.

We have, then, say 4,000 feet of the coal-bearing rocks hereabouts, with unconformable coralline limestone above and igneous rock below.

In each of the districts of Cebu there is a limestone horizon just above the coal measures and conformable with them, which is very characteristic and which can be used as a datum. This limestone is very compact bluish to buff-colored rock containing myriads of large Foraminifera of the genus *Lepidocyclina*, of which *L. richthofeni* Smith and *L. insulae-natalis* Ch. are the commonest species.

In Mesaba Creek, barrio of Cantobaco, about 0.5 kilometer north of the Cebu-Toledo Road, on the coal land leased by Quintin Rivera and associates, there is a fine section which, roughly, is as follows:

TABLE 33.—*Section in Mesaba Creek, Cebu.*

	Meters.
Coarse, heavy bedded SS	20–30
Lepidocycline limestone	5–10
Sandy shale	1–2
Coal	0.3–0.6
Sandy shale	12–15
Coal	0.3–0.5
Sandy shale, bottom of section.	

At this place the strike is north 40° west and the dip 15° to 20° south-west.

On Catanduanes Island, which is about 30 kilometers north of Batan Island, there is coal which may be the continuation of one or more of the Batan seams, though it is more than likely that the coal on the several islands of the Philippine group were formed in separate basins.

We are indebted to Mr. E. H. Koert for the following section of the coal measures of that island:

TABLE 34.—*Section of Coal Measures on Catanduanes: from above downward.*

	Meters.
1. Sandstone containing marine fossils in lower portion	
2. Shale and "slate"	
3. Coal	5
4. Shaly sandstone, thin layer	
5. Coal	1
6. Blue-yellow clay, probably fire-clay	
7. Iron ore	2–3
8. Tuff, blending into red shale, thickness not given	
9. Sandstone with conglomerate at bottom, thickness not given	
10. Diabase, thickness not given	

In some manuscript notes L. A. Faustino calls attention to the similarity between the Enriqueta seam at Mount Licos, Cebu (whose thickness of 1.2 meters and 5 to 7 centimeters shale parting about 45 centimeters from the roof is similar to the main seam at Camansi, Danao, Cebu) and another one in tunnel 14 at Gotas, Malangas, Mindanao, and the principal seam on East Batan. Owing to the geologic conditions, one cannot be certain that these seams are to be correlated over such distances, but the similarity is suggestive.

Geologic Factors Affecting Coal Mining

Several geologic factors are of extreme practical importance in the mining of Philippine coal, and these are the lack of persistence of the coal, faulting, igneous intrusions and flows, amount of folding, and the age of the coal.

The lack of persistence of the coal seams in many localities has been commented upon by several persons who have studied Philippine coals. The pinching out of the seam just when one is driving ahead and counting on a certain definite and steady output is very disconcerting. Pratt has discussed this subject in a special paper, and I have alluded to it. It appears that the chief reason for such lack of persistence is the irregular deposition of sediment due to torrential precipitation which probably was the rule throughout the whole of Malaysia during the Tertiary, as it is to-day.

In many coal-beds in the Philippines lack of persistence is due to a totally different cause; namely, faulting. However, once the system of faulting in a given district has been learned and the seam been re-located, it is usually found to persist, which is not the case in pinching. Faulting, on both a major and a minor scale, is found in almost every Philippine coal-field. Throws ranging from only a few centimeters to hundreds of meters are known, and such faulting is going on at the present time. Some examples of thrust faulting on a minor scale are known, but most of the faults are normal. In the Uling coal-field this condition is well shown where the Uling Coal Mining Company is mining a block of about 10,000 tons of coal that has dropped down and is practically

separated from the rest of the field. The faults can be easily seen in the galleries.

At Licos the Esperanaza and the Enrique Abella veins are faulted in No. 8 tunnel, where there is a displacement of 50 meters and a throw of 12 meters. The direction of this fault is north 65° east. In the old Montanes tunnel a fault was encountered with a throw of 25 meters. Faults of far greater magnitude on this island are indicated by the topography.

The influence of igneous rocks upon coal seams is well known. In the Philippines the coal seams have been intruded and disturbed perhaps more than is at present realized. At Butong, Sibuguey Peninsula, Mindanao, the coal measures have been intruded by dikes and sills of igneous rocks, and in that field a semi-anthracite coal is found. In places completely recrystallized coal occurs, simulating the hexagonal jointing in basalt.

The degree of folding also is very important. Facts in support of this statement need not be reviewed, as they are learned by experience and are discussed in any good text-book. Perhaps nowhere in the Philippines can the effect of folding and the resultant changes be better seen than on Batan Island. On the west end of that island the formations are intensely disturbed, the coal strata being tilted at high angles and faulted as well. In all this crumpling the coal seams have been sheared in some places; in others they have cracked and opened. This has accelerated the process of distillation, which would ordinarily proceed slowly, and as a result the coal near Liguan has a higher percentage of fixed carbon than has the coal on the east end of Batan, where the seams are less strongly folded.

The age of the coal is very important also. It is a common saying among American prospectors that Philippine coal is "too green" to be any good, and this is not very far from the truth. Philippine coal is of Tertiary age, most of it having been formed in the Miocene period of that era, although it may yet be found that some of the lowermost seams are somewhat older. Usually Tertiary coal, no matter in what part of the world it is found, is inferior to coal of Cretaceous, Jurassic, or Carboniferous age.

Most Philippine coals are very similar to the Eocene and the Miocene coals of the West Coast of America, which in turn are decidedly inferior to the Cretaceous coal of British Columbia or the Carboniferous coal of Eastern America.*

It is true, as already pointed out in connection with the Butong coal of Mindanao, that, owing to peculiar local conditions, a high grade of coal (in this case semi-anthracite) has resulted from the metamorphism of Tertiary coal.

It is obvious that four of the geologic factors named above have a profound influence upon the method and the cost of mining. This is well exemplified by the difference in system and cost of operating the mines on East Batan and those on Cebu. Usually, and fortunately so, the commercial value of coal seams is in direct proportion to the difficulty and expense of mining the coal.

Conditions Affecting the Mining of Philippine Coal

There are some factors of importance, aside from those discussed in earlier paragraphs, to be considered in the mining of Philippine coal; these are taxation, regulations, labor, and the paquiao system.

The Philippine Government has in operation a coal-leasing law which in the main is very liberal and under which coal operators can work. The regulations accompanying the law have now been revised. In coal-mining, which is the most difficult kind of mining, Filipino labor has done fairly well. Labor costs differ in the different districts. In general, capataces receive 50 to 75 pesos per month; miners, timberers, wagon men, and outside men, 1.10 to 1.60 pesos per day.

A very important factor in the economical production of coal in the Philippines is the so-called paquiao system, which seriously concerns the coal operator in two ways. In the first place, the paquiao system is a local contract system which is the crudest and most wasteful (a sort of "gophering" along outcrops) with which operators have to compete. Second, this system ruins much good coal-mining territory for future large-scale operations. I have been underground where new development work has run into these old "gopher holes" and have seen the damage, particularly in the rainy season, resulting from this pernicious system.

*An exception to this statement has been noted by Doctor Kryshtafovich in the coals of Saghalien Island.

Steps have recently been taken to curtail some of this kind of mining, but a great deal of damage has already been done. The system has been in wide use on Cebu Island. There are scores of such coal-mining operations on that island now.

Methods of Mining

The common method of mining coal adopted by the larger operators in the Philippines is the "room and pillar" system, but in some of the mines the work follows no regular system. In the Philippine Coal Company mine the seam is so nearly flat that it is very easy to lay out the work systematically and follow it out; but, when the seams become more and more highly inclined, as they do in Cebu, it is not so easy. In some of these properties a system like the "battery" would probably work better. In the flatter seams, like those on eastern Batan, the "long wall" might be the best method, but a bad roof is the chief objection there.

In the paquiao work the Filipino and Japanese laborers simply undercut an outcrop with small Japanese picks until they are either driven out by water or bad air or until the ground caves. They do a certain amount of a poor sort of timbering, which consists merely of a few irregular props.

The larger mines, superintended by white men, are usually provided with good timbering and ventilation. As yet very little undercutting by machinery is employed and only a small amount of shooting coal is done. Many kinds of timber are used, but, owing to the hot and wet condition of most of the mines, *pagatpat*, or mangrove, a very durable wood, has been found the most serviceable.

Preparation of the Coal for the Market.—Modern coal-washing equipment has been installed only at Malangas, on the property of the National Coal Company. At Uling a very satisfactory coal-washing and screening apparatus of home manufacture has been used successfully for a year or so.

Market.—The entire output of Philippine coal-mines is disposed of in the Philippines, the bulk of it being used by inter-island merchant vessels. Some other local uses are found for it in operating hemp presses, road rollers, ice plants, railroad locomotives, etc. That it could be more economically used to a greater degree than at present is indicated by the success attained by the Philippine Bureau of Science, where electric power has been produced by means of a 67-horsepower Otto suction producer-gas plant at 0.03 peso per not kilowatt hour (pre-war figures).

An important consideration in placing Philippine coal on the market is transportation; this is either very poor or absolutely lacking in many localities where a fair grade of coal exists, and inter-island freight rates are exorbitant.

There is no good reason, save high cost of labor, why almost all imported coal cannot be replaced by domestic coal.

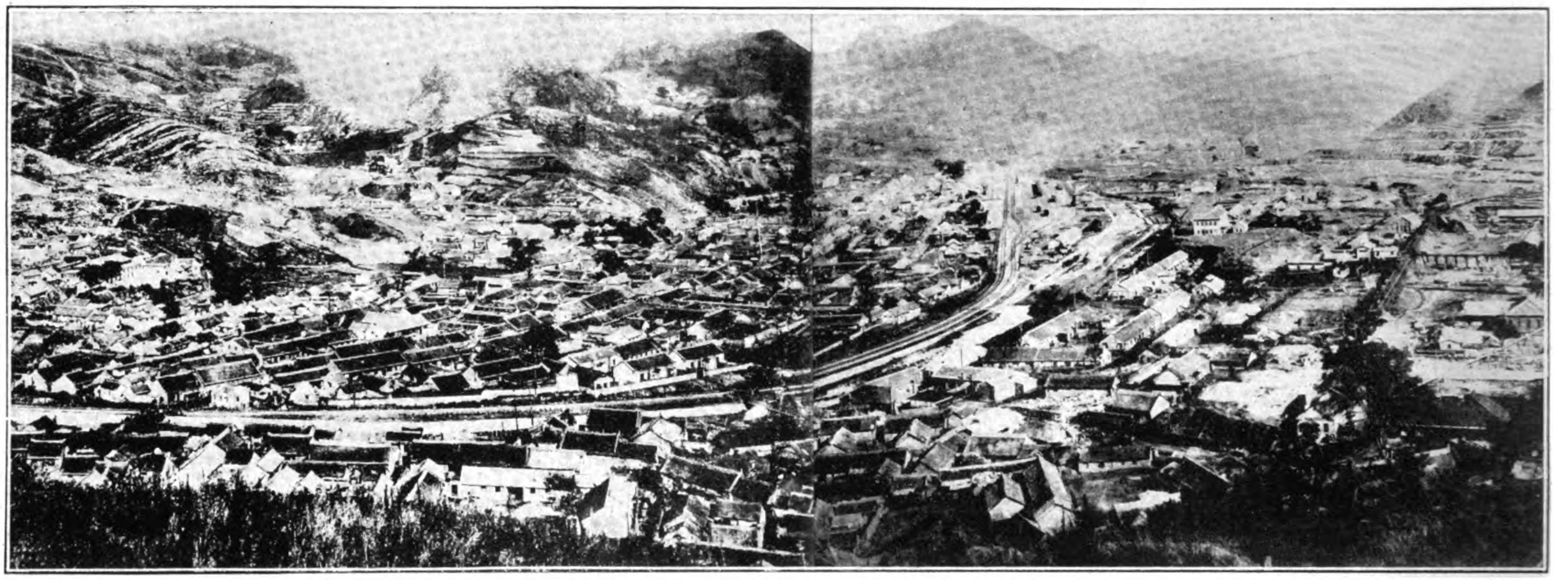
TABLE 35.—*Minimum Costs per Ton of Mining and Marketing Philippine Coal and Manila Price of Chinese "Slack" as of June,* 1921.

[Data furnished by a Coal Engineer.]

	Pesos.
Mining	3.00
Freight	5.00
Unloading and stock piling	2.00
Loss, about 10 per cent.	1.00
Taxes	2.00
Total	13.00
Chinese "slack" from Tientsin now selling in Manila	16.00
Margin	3.00

As very few operators ever cut their mining costs to as low as 3 pesos it can readily be seen how small is the margin of profit in normal times. During the war period prices for local coal were inordinately high, owing to the cutting off of the foreign supply, and many persons have unwisely made plans based upon those figures. Needless to say, a rude awakening awaits them. In fact, coal prices have already dropped, and they will continue to do so.

Conclusion.—In conclusion, it may be said with confidence that a good industry can be built up by developing Philippine coal deposits. There are adequate coal reserves, but there are many features which make the business a difficult one. The Filipinos are for the most part more given to agriculture than to mining at present, but the younger generation may take a hand in the mining industry.



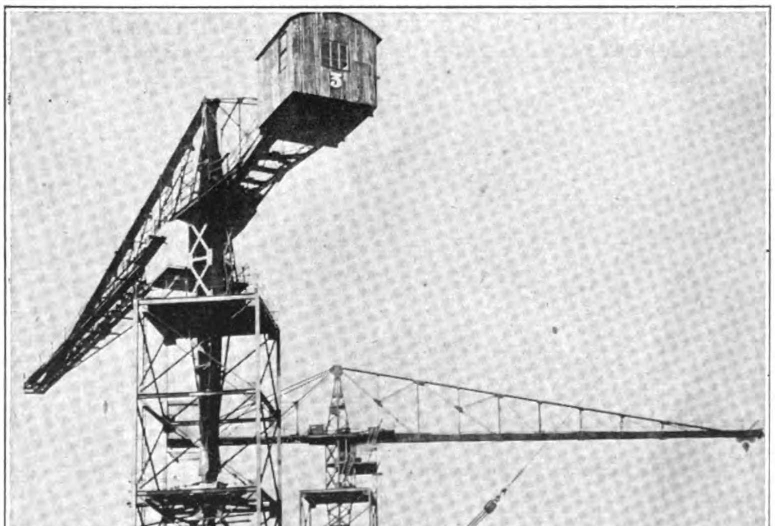
Pen Hsien, a Coal and Iron City in Manchuria

Modern Tendencies in Eastern Steel Markets.

By Sir Edgar R. Jones, K.B.E.

UP to a period a few years before the war, the British steel manufacturer relied upon the quality and the low price of his steel, and because of that, purchasers came to him from all parts of the world, and he did not have to get up an aggressive selling organization to canvass for orders. Since that time America and various European countries have succeeded in producing steel for their own requirements, and become competitors as to quality and price in the general markets of the world. The coming of this competition brought into existence a large number of merchants, who either as sole agents for manufacturers or otherwise, created and maintained connections for canvassing orders for British steel goods.

In the main, that is the organization that exists to-day, although some steel manufacturers have recently set up their own order-seeking organization. The big fact of recent developments is that not only European countries and America have steadily closed up their markets against our products, but India, Canada, Australia, and South Africa have also commenced to produce on a substantial scale for their own requirements. It is inevitable that those Dominions that have been for many years the great markets for our products will in time all follow the example of Europe and America in providing for their own needs. If, therefore, the British steel industry is to maintain its production it must constantly find in the less-developed parts of the world new markets to take the place of the markets that are closing up. It is because there is a prospect of such a great new market in the Far East that one would emphasise the importance of paying serious attention to that part of the world.



Tower Crane Manufactured by the Kameido Workshop

Japan

For reasons that will appear, it is advisable to dispose of Japan at once. From the point of view of the steel trade, Japan has practically come into the category of the European markets. She has already 51 blast furnaces and 134 steel furnaces, producing two and a quarter million tons of steel of every commercial form per annum. Up to the present there is a great market in Japan for sheets and tinplates. From America and ourselves she is taking about 250,000 tons of steel sheets, and 70,000 tons of tinplates a year. Not so long ago she bought the sheets galvanised and corrugated. To-day there are 80 galvanising works, and the sheets are taken in the uncoated form as black sheets. Recently they have gone further, and last year they produced over 35,000 tons of thin sheets. Last year further new works were started for producing more of these thin sheets, and unless Britain and America can make it impossible for these works to compete in quality and price in such sheets, it is inevitable that this large market will be filled up from within.

For the present the shutting out of tinplates is not so probable, although a small beginning in the production of tinplates has already been made.

The Prince Regent at Yawata Steel Work

Not so long ago practically the whole of the sheet and tinplate imports of Japan were from this country, but to-day the Americans are securing almost as much of the sheet business and more tinplate business than we are. The critical question is whether, as a result of that competition, it will or will not be possible for the Japanese firms themselves to fill their own book and shut out both Britain and America. Having put forward those facts, it can be seen that Japan may in the course of a few years become a serious competitor in the great Eastern market that is open to us, but is only beginning to develop.

The main function of this address is to examine the Eastern market, and for this purpose we may lay down the following propositions: (1) We want that market very badly for the next 30 or 40 years; (2) it may grow during that period to be the biggest open market in the world; (3) we can secure and keep that market if we exert ourselves at once in the right direction; but (4) if we drift along the lines of business that now exist we will not get that market. Leaving out Japan, the Far East may be divided into two sections—(*a*) the islands, (*b*) China.

Far Eastern Islands

Included in the first group there is Java, with a population of thirty-six millions, practically equal to that of England and Wales; a rich country, well developed and laid out by the Dutch, with a very industrious population, producing very valuable products in great profitable quantities. There is the enormous island of Borneo, with a population of two millions, and the almost as large island of Sumatra, with a population of four millions; practically empty countries when their population is compared with the size of the area. There are the Malay States, with a population of about three millions, and a large number of other islands with a population of from two millions to five millions. There are also the Philippines, with a population of nine millions, in connection with which there is no need to assume that the Americans will keep the bulk of the trade; and there is French Indo-China, with a population of seventeen millions, where also there will be great opportunities for British trade. And Celebes and New Guinea, with a population of about a million. In the total, a population of over seventy millions. Two facts about that large population are worthy of note:—

In the first place, it is a mistake to minimise its importance by regarding it as an uneconomic savage population. It is to-day nothing of the kind. British, French, Dutch, and American firms have established great companies with enormous capital in these productive districts. Oil, tin, rubber, sugar, coal, tea, tobacco, and many valuable products mount up to a total trade of enormous value. There is room for immense development, and that development is steadily proceeding. Railways, docks, works, new cities are being built, and for them, and for the marketing of the products, large quantities of steel are already being consumed, but this steel consumption is only the beginning, and the market possibilities during the next half-century are very considerable. In moving around these valuable centres of growing industries, one cannot fail to observe the lack of power, system, initiative, and attack by the steel interests of this country. Before the war the Germans showed a great fondness for this part of the world. They are beginning to get back. Is the British steel industry going to drift in an attitude of *laissez faire* and let the Germans get hold of this great prospective market?

In the second place, the whole of this interesting part of the world is being run by Chinese. They are the shopkeepers, artisans, engineers, merchants, and producers. Large rubber factories as well as estates, substantial pineapple canneries and estates, tin mines, and various kinds of plantations have been organized by Chinese business men, who have made already great fortunes by their business foresight, ability, and methods that are not inferior to those of any German-American, or English business man. What, there, fore, is to be said about China has a great bearing upon the whole of those territories, the industrial and commercial matters of which are Chinese, even though the Governments be nominally American, French, Dutch, or British.

China

In China there is to be found one-fourth of the population of the world. The Chinaman has behind him an intelligent civilisation, which in the industrial arts for thousands of years was in advance of the rest of the world. In the extraordinary strength, skill, and patience of Chinese workmen, in the wonderful social and trade guilds and organizations that they possess, in the intelligence, astuteness, and business capacity of its merchants and leading citizens, the population of China can become as advanced and formidable, man for man, with any race in the world.

For historical reasons that are plain, this powerful mass of one-fourth of the world's population has delayed longer than Europeans, Americans, and Japanese in resorting to the methods of modern industry. They have, however, reached the point where it can be said that they have made a substantial beginning. Where there is peace and social order, as in the Treaty Ports for example, in Canton, Shanghai, Pekin, and Hongkong, it is astonishing to see the progress that Chinamen have been able to make. Already the utilisation of steel and all that follows from it has carried them a long way. It is amazing how, in spite of the practical non-existence of a central government, as we understand it, the Chinese business men have been carrying on their industry, so that even last year, in the midst of an appalling state of civil war, the turnover of the Customs revenue was a surprising record. My definite conviction is that in the course of the next half-a-century China will be calling for more steel than any other importing market in the world. To-day the market is fairly substantial; she imported in 1923 over 20,000 tons of galvanised sheets and over 60,000 tons of tinplates. These figures are trivial compared with the figures that will appear during the coming years.

The question is, who will get this enormous business? America is beginning to be a competitor; Japan close by has also commenced. For the moment the bulk of the market, insignificant as it is compared with the future, is in our hands. Here is the greatest opportunity that lies to-day before the British steel industry. Are we going to be equal to it, and are we going to secure it? China will be taking in fifty years' time a tonnage of sheets and plates equal to the whole of our production to-day. Is that tonnage going to be our production? It all depends on the steps taken in organization. If the Americans, or Japanese, or Germans, get ahead of us with the right kind of established organization we shall be out, but there seems to be no reason, except lack of enterprise, why with the initial advantage that we now possess we should not be the first and best organized.

Need for a Selling Organization

That achievement depends upon the clear recognition of certain definite facts: (1) We must recognize that China will never

(Continued on page 570.)

Zinc Metallurgy in Tonkin

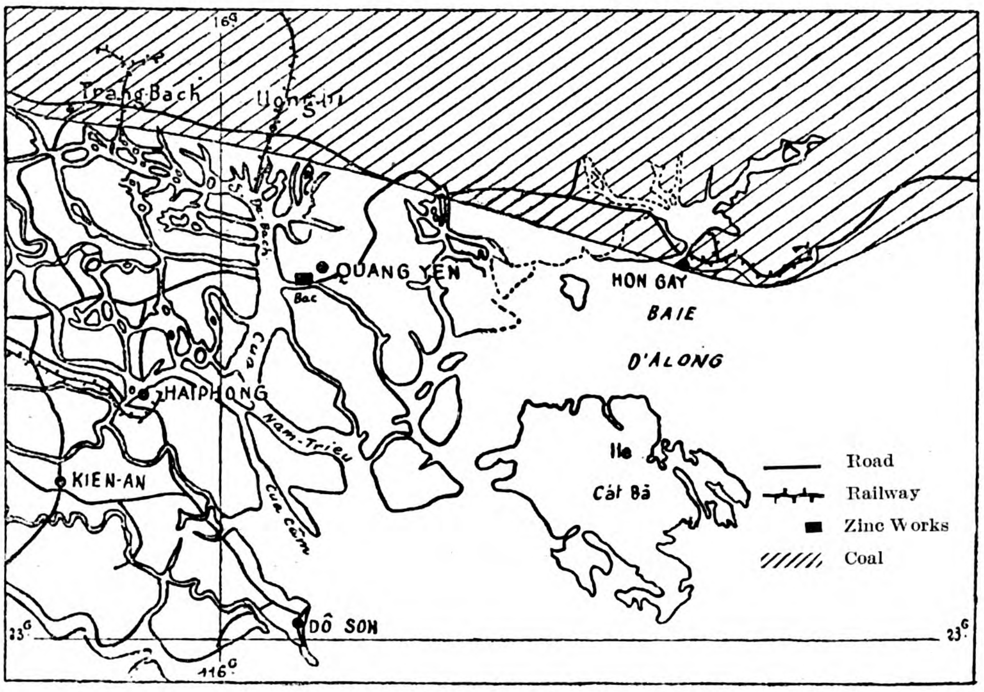
The Zinc Works of Quang-Yen.

By M. Raby, Chief of the Mining Department, French Indo-China

THE Ore and Metallurgic Company of Indo-China was, founded on March 4, 1919, with a Capital of Fcs. 1,600,000 and in 1920 decided to erect at Quang-Yen, a Zinc Works capable of handling, at first, Oxide of Zinc ores. In 1921 the Capital of the Ore and Metallurgic Company was raised to Fcs. 16,000,000.

This Company acquired, in 1920, the property of the rich Zinc mines of Chodion, the honor of their development being due in particular, to Mr. Bault, who invested about a million dollars for the construction of a Railway-Line, 32 kilometres in length, in order to convey the ore extracted from the mines.

The construction of the Zinc Works was commenced in 1921. The following is a description of the different buildings erected, as also the characteristics of the projects of the company, in order to show how much has been accomplished and the difficulties inherent in the establishing, in an undeveloped country of a metallurgic industry as complicated as that of Zinc is.



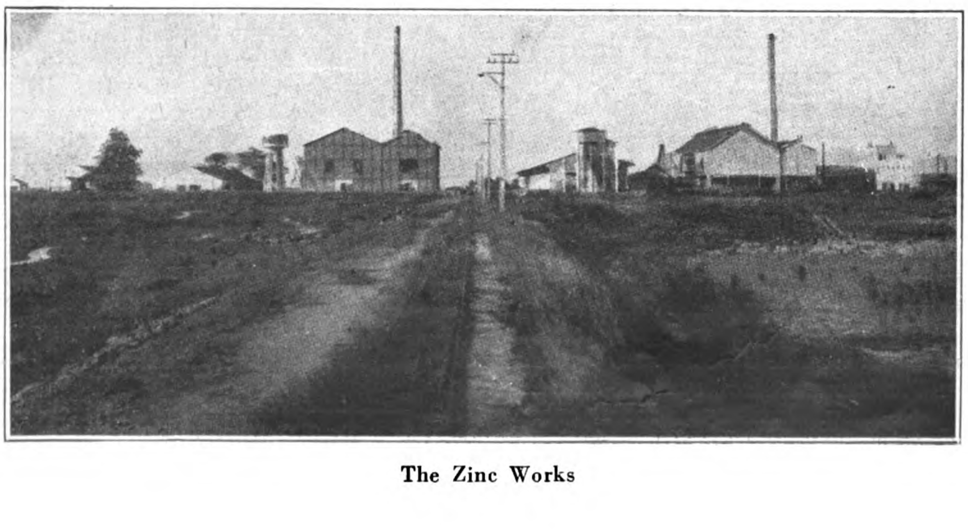
The Zinc Fields

Situation of the Works

The Works have been installed in the immediate neighborhood of Quang-Yen, the capital of a Province in Tonkin, and on the banks of the Song-chang, which is a navigable river, regular communication by small steamers being assured between Ouang-Yen, Hongay, Port Wallit and Moncay.

The situation chosen is, moreover, in the South and near the coal region of Dong-triéu and the bay of Along, advantages of great importance in the Zinc industry owing to the great amount of coal required. Anthracite from the coal area mentioned can thus be brought easily and at slight cost, and the Port where the Smelting Works are situated, 8 k.m. only, from the loading Port of the Societe des Charbonnages (Coal-Mining Society) of Dong-triéu and 40 kilometers from the Port of Hongay.

The existence along the Southern side of the Anthracite region of Dong-triéu of a bed of fire-clay, which can be used in part at least, in the making of crucibles and Zinc-condenser is on the other hand very important for the enterprise.



The Zinc Works

Moreover, another very interesting economic factor, in a region where fresh water is scarce, is that the works is easily supplied with water by means of a well, 2½ kilometres distant, where water was reached at 10 metres from the surface.

We will also draw attention to the fact, that the Works being situated at the month of the delta and in a healthy district can easily procure, locally, all native labor necessary.

Projects of the Company

The Works are fitted up to cope with an annual output of 6,000 tons of metal, which will be attained by employing, in the treatment of oxide of Zinc ores, the classical Belgian method of smelting in small retorts.

There will be six Van Gulck Zinc furnaces, fire of which will be constantly in use, each furnace giving 3,600 kilogrammes of metal per 10 tons of ore in 24 hours.

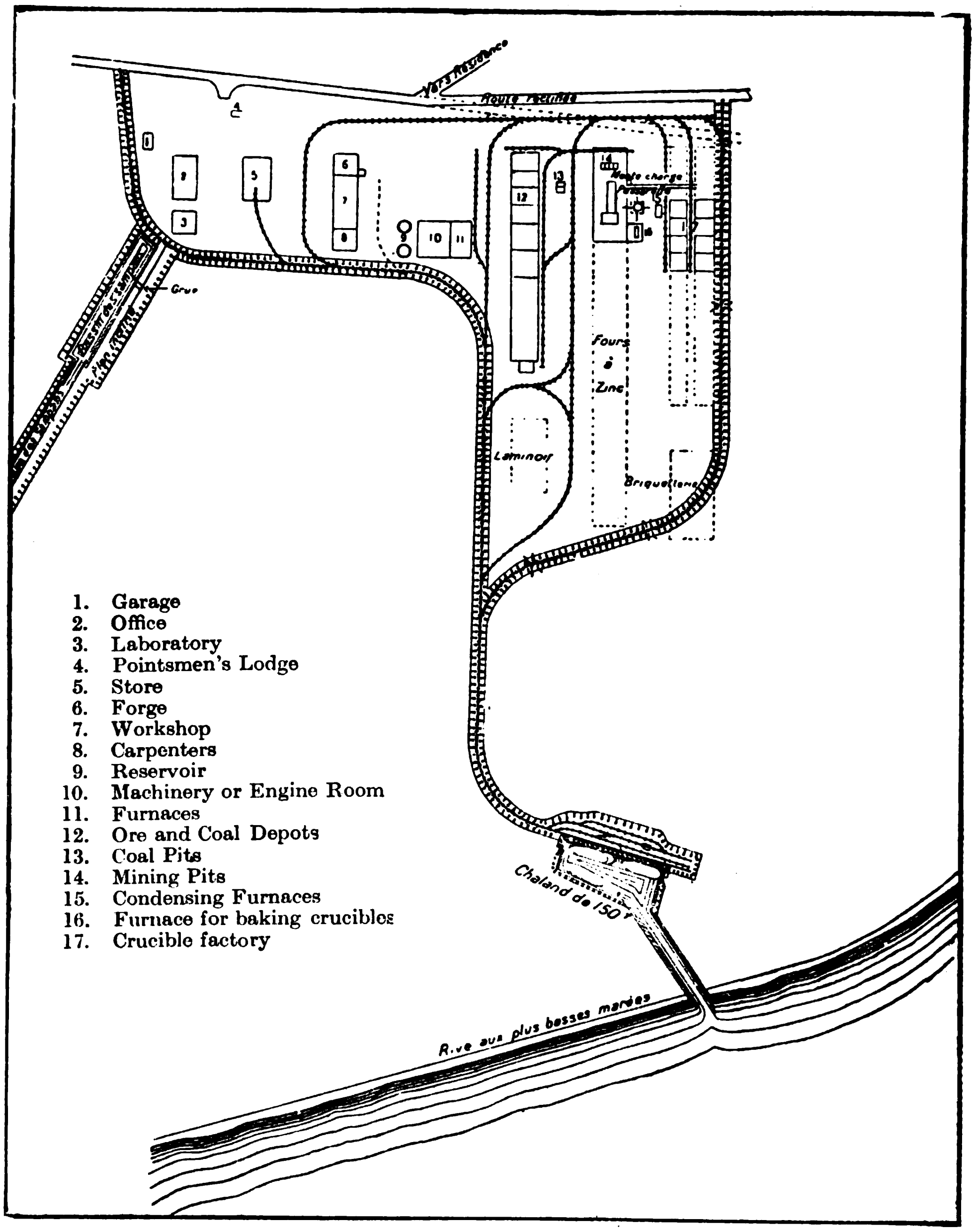
The Works, it is estimated, will need daily 90 to 95 tons of coal as follows :

12% for central consummation
26% for smelting
62% for heating the furnaces by gazogéne.

The first furnace is now finished, as also the greater part of the installations which will allow of the employment of the six furnaces. The Mining Company, will delay the erection of the five other furnaces until they have brought to the desired point the smelting of the metal, and the training of the native workmen by means of the present furnace.

The project which is being carried out, has in view, moreover, the construction at a later date of Zinc rolling plant, consisting of a reducing-roller and two finishing machines (train finisseurs), the installation being capable of reducing 3,000 tons of metal per year.

Lastly, it is possible that when the above proposed installations will be in full operation, the Mining Company will consider the treatment of Sulphate of Zinc ores, which will, doubtless, constitute more and more one of the most important industries of the mines of Tonkin. A workshop for making blend wire-work, can then



The Zinc Foundry at Quang Yen: Plan of the Plant, scale $\frac{1}{3,000}$

be added to the existing works, the sulphuric gas resulting from the wire-work will be used probably in the production of sulphuric acid.

If the Zinc industry succeeds in the Colony, we can look forward to equally the making of white Zinc and the working of Galena-blend, frequently to be met with in sulphate of Zinc Ores.

The accompanying plan will show the general arrangement of the buildings already constructed. Those intended to be built later on, these latter being designated by dotted lines.

Dock

A basin, 60 metres in length and capable of berthing simultaneously 3 lighters of 150 tons each, has been constructed and linked up with Song-Chang by a canal, accessible at high water, during a period of 12 hours. At low tide there is a depth of 2 metres in the (basin) Dock.

A 2-ton crane facilitates loading and unloading.

The ores which arrive directly by lighter are forwarded at once to the ore pits situated in the Shed H, where are also the coal pits.

Ore and Coal Depot

This building is 110m. by 15m. and is divided by transvers partitions into compartments, into which the materials to be stored are brought by means of small waggons running on an overhead mono-rail, loaded from elevators at the Dock. The taking of the ore and coal for working purposes is done by means of a mono-rail system on the ground-floor of the building, the ore being sent to the crushing works and the coal to the boilers, furnaces or gas works.

The ore crushing installation is situated to the north of Shed H, and consists of two crushers with perforated bottoms, grindstones to crush and sift the ore, two elevators and two hoppers. The installation will be double, and the half which exists at present will suffice for the ordinary output, each crusher being able to cope with 10 tons an hour.

Building for the mixing of Ores and Reducers.

This building, partly underground, is at the extreme north of the Furnace House. The materials, crushed ore and reducing coal (coal dust, 40 to 45 per cent. in weight of the ore used) are brought to the Shed H by mono rail, and poured into the mining-pits, where the mining is done by means of a Campistrou mixer. The resulting mixture is then raised by means of an elevator and poured into a hopper.

Furnace or Retort House

The mixture, spoken of above, is taken at the hopper by small waggons and deposited in a heap in front of each section of a furnace, which is of the Van Gulck regenerator type.

The reducing is carried out in eliptical refractory fire-clay crucibles (the interior axis being 190mm. by 270mm.) having an interior length of 1m. 50 arranged in each furnace at a slight angle on fire-clay supports. The furnace on the first story of the building consists of five independent sections, divided each, into two symmetrical parts and communicating by the top; each half-section opens on a different (back to back) side of the Furnace House, and contains four super-imposed rows of eight crucibles, and thus each furnace contains a total of 320 retorts. These retorts are heated exteriorly by gas generated in the two door gas-generators, placed at the southern extremity on the ground floor of the Furnace House, and fed with into or from the mine of Hongay or the coal mines of Dong-triéu.

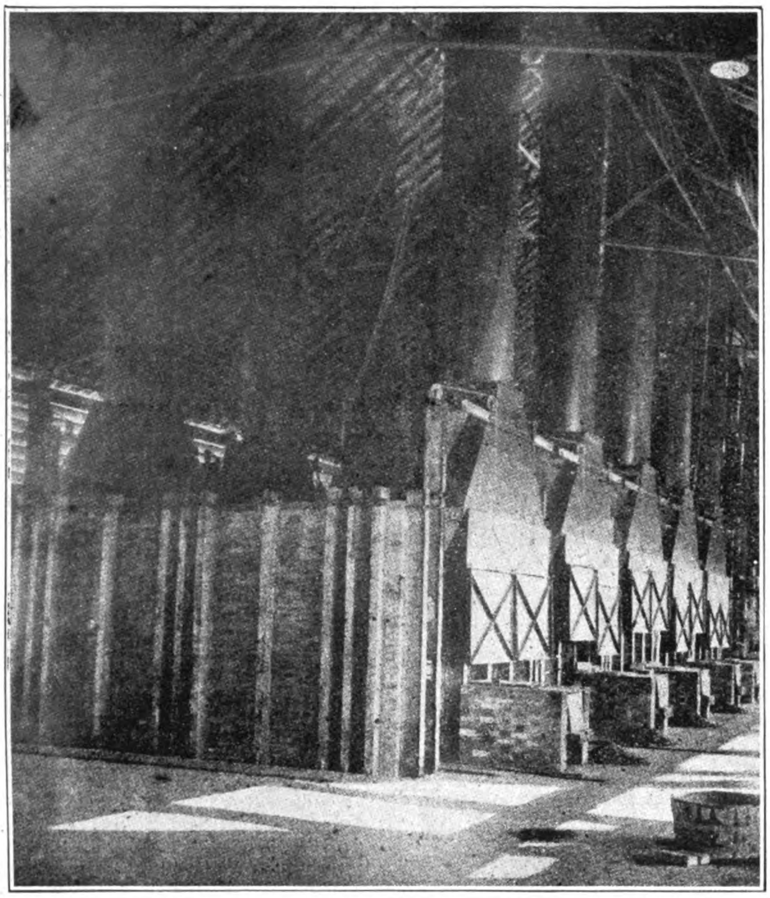
The gas taken in each section in derivation on the supply pipe burns whilst circulating successively in the two symmetrical parts of the section; whilst ascending in the interior of the first, and descending on that of the second; the currents of gas are then directed to the chimney, passing through a saving device which permits of reheating the air to mix with the gas to be burned.

The reduction of the ore being, generally, complete between 1,250° and 1,350°, it is necessary to obtain a temperature approaching 1,450° in the exterior zone of the retorts. The metallic vapours resulting from the reduction, are collected in refractory fire-clay condensers, called "tubes" arranged at the back of the retorts and near the furnace where the temperature is about 500°.

It is in these "tubes" that the workman collected the metal, which he has caused to run into a curved cavities channel, by means of a rake, after having extracted the sheet-iron damper, usually placed at the extremity of the condenser during the process, to collect the residue.

The work of reduction takes 24 hours, and during that time the zinc is extracted two or three times, each retort giving about 12 kilogrammes of metal.

The principal difficulty to be met with in the work is in the handling of the retorts and the arranging of them in the interior of the furnace on refractory supports. The retorts must, in fact, before their introduction into the furnace, be heated red hot in a special furnace situtated near the reducing furnace. They



Van Gulck Zinc Ore Reducers

are then carried to one of the openings of the furnace, and we can easily understand of installing a retort, heated to about 1,000° and weighing 75 kilos, in the exact place reserved for it, a difficulty all the greater the higher the row may be in section. It is also necessary to draw attention to the fact that Annamite labor is less robust than that employed in smelting works in Europe, therefore, the Society adopted, from the outset, retorts weighing 75 kilos, whereas Belgian retorts vary between 50 and 100 kilos.

The empty retorts, once placed in position, are then filled with about 42 kilos of mixture to be treated, and which had been previously piled up in front of each section. This operation needs to be carried out with the greatest care in order to avoid empty spaces being caused between the mixture and the sides of the retort, for pockets of air could then give rise to very dangerous blasts of matter heated to a high temperature.

The loading is done by throwing the mixture by shovelfuls to the bottom of the retort, without leaving any empty spaces, and ramming the whole down if necessary.

When the work has been completed, the cleaning of the retorts is done by hand, a large rake being used to cause the hammer-slag to fall to the floor of the Furnace room, from which it is carried away in small waggons.

A retort is, on an average, useless after being used twenty times only. We can thus understand the necessity of having important works for the making of retorts, and also that the question of having an adequate supply of refractory earth at reasonable price, is of prime impoitance for this industry.

Retort House

The Drying House already installed off the Retort House, can give an output of 50 retorts per day, whereas the daily requirement of a furnace is but 15 retorts only.

Retorts

The earth utilized in the making of the retorts is, on the average, kept at 10 degrees of humidity, and this is lowered to 1-5 or 2 degrees in the drying chamber, heated by winged radiators through which run currents of hot air drawn from the Field boiler. (Ch.)

After being weighed, this earth is mixed in the proper proportions, and the mixture is passed through a Johnson crushing machine, fitted with grindstones, B, making 15 turns a minute, the bottom having a floor of perforated sheet-iron, pierced with holes, which assures that no mixture will pass through but what is less than 3mm. in dimension.

The crushed material then passes through a noria and disturbing hopper, T, to a mixer where the requisite amount of water is added, and from thence to the working-up machine, M.

The material which comes from the working-up machine contains from 13 to 14 per cent. of humidity, remains for from 10 to 20 days in the chambers a, b, c, called maturing rooms, where a transformation takes place which gives a uniform texture and plasticity to the whole mass which is absolutely necessary for the successful making of retorts.

The matured matter after another kneading in the mixer, M, transformed by a special vertical kneader into " balos " or " full cylinders," 58cm. in height by 38cm. in diameter.

A hydraulic press P1, permits of obtaining, at once, from each "balo" of a retort by a process similar to the making of a cartridge shell. Another press P2, similar to P1, will be installed soon.

The retorts are afterwards dried in the chambers situated on the first floor of the building; 15 rooms can accommodate 4,500 retorts. The drying process takes about three months, the retorts during the first month being kept at an ordinary temperature which, during the second month, is gradually raised to 55$\frac{3}{4}$ and maintained fairly constantly at that temperature throughout the third month.

The heating is obtained by means of the Simon-Carves method which consists in causing currents of hot air to circulate in the chambers blown in by means of the ventilators V and V1. Nevertheless, the use of this method of heating for the drying of the retorts being new, six chambers are heated by means of a current of vapor, passed through cast iron conductors, winged, situated in the flooring, a method commonly employed in similar installations.

Tubes

The making of tubes which must be submitted to temperatures approaching about 500° only, needs less care and the employment of refractory earth less refractory than that necessary for the making of retorts which have to sustain a temperature of 1,400°.

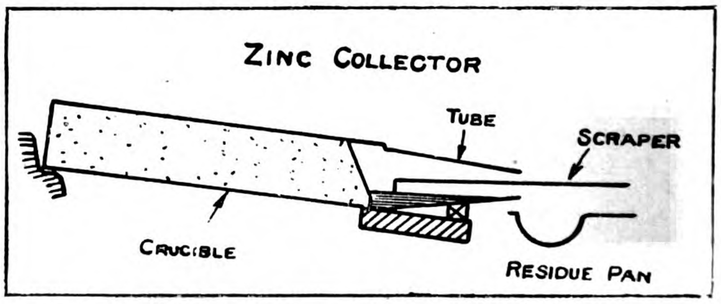
The refractory earths for condensors are prepared by means of a crusher B, a mixer M, and a kneader M.

The tubes are actually made by hand in moulds, the matter being compressed between a fixed truncated envelope and solid cone, which a workman raises and allows to fall alternatively.

Trials are being carried out to use the native workman in the making by hand of inflated tubes whose shape is better adapted for the reception of liquid zinc. The making of condensors, mechanically, by means of the rhenane method is also contemplated in the near future.

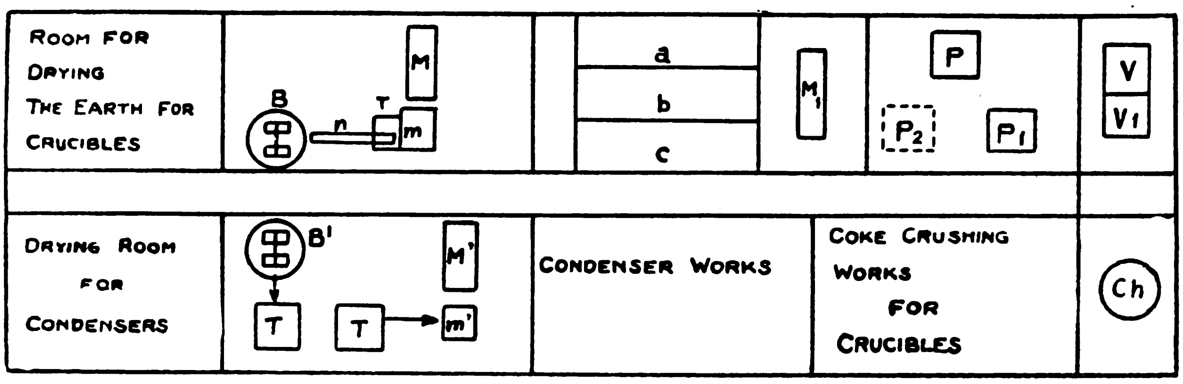
The tubes thus obtained are dried during 15 days in specially heated chambers, heated by means of wing-radiators furnishing currents of vapor.

The study in the laboratory of materials from the abovementioned region allows us to hope for good results, some being sufficiently plastic and beginning to itinerate or soften at about 1,630° only, whereas the most refractory clay used in France and Belgium resist temperatures but slightly above 1,680° to 1,770°.



Zinc Collector

CRUCIBLE HOUSE (GROUND FLOOR)



Often in Europe are used mixtures nearly of the .following composition : 45 per cent. of fresh refractory fire-clay, 45 per cent. of calcined earth or debris of bricks and old retorts, and 10 per cent. of coke.

The Mining Company proposes to utilize several series of retorts made, either solely of fresh earth imported, the cost price laid down at the works not reaching 300 francs a ton, or of local clays in varied proportions costing laid down at the works, but $10 a ton only and having had the necessary mechanical preparation. Graphite coming from Laokay, or imported carborundum are incorporated with certain mixtures in order to study the possibility of doing away with the use of Tonkinese coke, the quality of which is rather variable.

The laboratory experiences having, on the other hand, shown that certain elements which lower the degree of fusibility of the local earth of That-Khe and Dong Linh (Silica, Mica, feldspar) can be easily separated by washing, it is proposed by the Mining Company to install another undertaking comprising cleansing and decantation works in the neighborhood of the retort works, in order to allow of the obtaining of a good quality of refractory fire-clay.

Local refractory clays are exclusively employed in the making of tubes, being mixed in about equal parts with ordinary baked clay. The condensors are cooked, after having been dryed and before being used, in a special furnace.

Central

The motive-power necessary for the adequate running of the Factory is composed of the following :—

2 Belleville Boilers having 105m² of heating surface, with forced draught to 325 and Green economisers.
2 Dujardin horizontal, mono-cylindrical machines of 205 h.p. each.
2 Three-phase current alternators of 200 kw., 500 v 50 periods.
50 kw., at most, will be taken for the electric lighting of the office at Quang-Yen.

The heating of the boilers is effected by using anthracite 0/15 burnt in layers of 10 to 12cm on Gennevey grating, forced draught being used.

Workshop

A complete workshop, installed right from the beginning of the factory allows all the usual works to be carried on, with the exception of moulding. It has two lathes, two boring machines, a planing-machine, a vice-filer, a Mortiseuro.

The principal economic value of the importance of working-up the Zinc ores of Tonkin on the spot, is in the economies realised on transport : transport of material from Indo-China to Europe to be treated, as also of the metal required from Europe to Indo-China to allow of the adequate functioning of the factory in all its branches.

The cost of freight to Europe, etc., in October 1924 was at the rate of 90 francs for ore and 150 francs for metal, which represent, respectively, 15-8 per cent. and 5-6 per cent. of the value of the products at Haiphong, the figure 15-8 per cent. corresponding besides, to a mineral 45 per cent. rich in metal. We can, therefore, see the advantage resulting from the construction on the spot of a Factory. It will become still more important when less rich ores are smelted, the freight for which would then equal 30 to 40 per cent. of the products.

When the whole installation will have been completed, and a Rolling-Mill fitted up, Indo-China consumers will then be able to procure in the Colony the 1,220 tons of metal they need, annually, a quantity based on the average of imports for the four years, 1920-1923, an average which is but slightly greater than that imported before the War : 1,100 tons for the period, 1910-1913.

The figures given below give, on the other hand, the importance of the markets which Indo-China Zinc can find in China and Japan.

The Japanese needs are now more considerable than before the War, the raw-metal worked or contained in ore, attained in fact, an average of 11,670 tons for the period, 1910-1914.

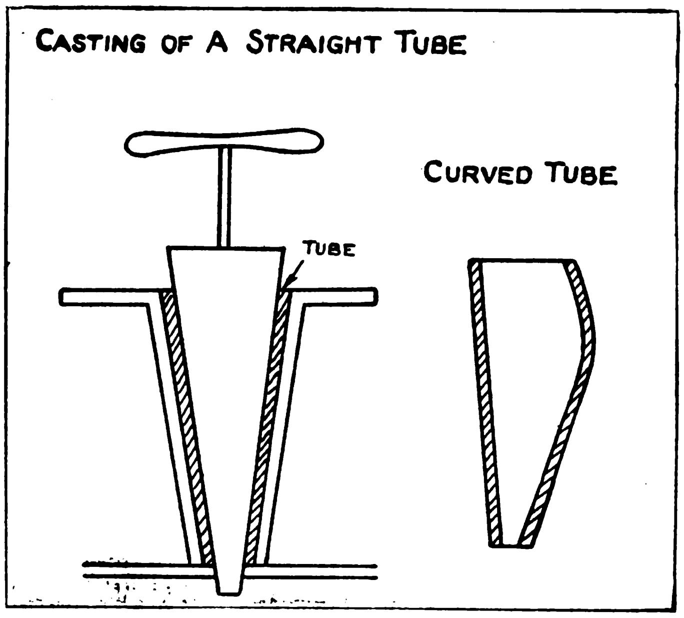
Ores Smelted—Metal Obtained

The first ingots of Zinc were cast on the 12th November, 1924. Since then the Company has methodically worked to bring the casting, etc., up to the point desired, as also the training of the native workman. No serious difficulty has been met with. The smelting of the ores from the mines of Chodien has been carried on normally, the proportion of Zinc in the residue of the retorts being quite comparable to similar undertakings, The native labor adapted itself, perfectly to the delicate handling of the retorts, and to the charging of them. Great progress has been obtained since the start in the fixing in place of the crucibles and the luting of the different joints so that the loss through matter escaping, which was rather great in the beginning, has been considerably reduced.

The irregular working of the furnace during the months of November and December, 1924 gave 72 tons of Zinc. Under ordinary conditions the average daily output during the first half of January reached, 2 tons 800 lbs. (fr.)

The Mining Company has been using, from the time the Works were in full working order, the rich calcined calamine earth coming from the mines of Che-dien (Firsts) ; but it is evident that it will be, above all very interesting to smelt in Tonkin, the poorer ores of less commercial value and enable to bear less than the richer ores, the actual high freight charged.

Therefore, since the month of December the smelting of the poorer kinds of Calamine ores has been carried on, that is those of a secondary order, and in January those of a third class were undertaken. Later on, if need be, the utility of smelting mixtures of different qualities will be considered.



An analysis of the different elements contained in the ores extracted from the mines of Cho-dien is given below :—

CALAMINE.

	Firsts (Carbonate.) %	Seconds (Silicate.) %	Thirds (Silicate.) %	Fourths (Silicate.) %
Silica	4 to 7	20 to 25	20 to 25	25 to 30
Iron	12 to 14	5 to 7	7 to 12	12 to 15
Zinc	50 to 53	45 to 50	40 to 45	35 to 40

The ores used contain but little Cd. (Cadmium), or Pb, (Lead) : 12 to 0.64 of Pb ; 0.015 to 0.079 for Cd. according to the analysis carried out by the Mining Company of average specimens obtained from First and Second Calamines. This is why we can obtain, direct from the Condensors, a marketable metal ready for use without needing to undergo any refining.

The analysis, carried out in the Laboratory of the Mining Department of a specimen of Zinc, gave the following results :

	%
Zinc	99.50
Iron	0.05
Lead	0.41
Cadmium...	0.02

This metal is therefore classed under the ordinary marks (g.o.b. good ordinary brands) on the London market, or as " Prime Spelter " on the New York market. The " New Metal Exchange " in fact, defines this last quality as not containing more than 2 per cent. of lead and of 0.08 per cent. of iron.

Under ordinary conditions, when the six furnaces will have been erected, the Factory will be able to smelt 50 tons of ore daily and if we admit a yield of 80 per cent. for ores to 45 per cent. of metal, the output of Zinc will total 10 tons a day.

Indo-China, whilst being a Zinc producer, will remain an exporter of ore if the amount extracted from the mines does not diminish.

The amount of ore extracted in 1924, as registered, was as under :—

MINING AND METALLURGIC Co. (Mines of Cho-dien).

Output for 1924	Calamine	24,656 tons
	Blende	146 „
Other Mines in Tonkin	Calamine	7,409 „
Output for the first half-year of 1924,	Blende	1,429 „

Modern Tendencies in Eastern Steel Markets

(*Continued from page 565*)

become Westernised in the way that Japan has. She cannot abandon her commercial system, because it is rooted in the whole of her social system. (2) The merchanting of British steel must be done through an organization that fits in with the peculiar organization of Chinese life. (3) Drifting along without such an organization is certain to end in abject failure.

It is true that there exist in China many important branches of British merchant firms or many British merchanting firms acting as general agents. I had an opportunity of calling upon most of these merchants in the East, and of discussing the situation with them. There was a striking unanimity of opinion amongst these merchants. As there are so many of them dividing the small turnover of steel business at present, and as the margin of commission or profit which they can add to the price of steel goods in face of modern competition is very small per ton, the result is that it does not pay them to spend money upon seeking such small orders. To put it briefly and perhaps rather roughly, steel orders are to those firms a sideline that does not permit of expenditure for canvassing and selling. Taking that phrase, I again emphasise the serious point that the big future business in China will not be secured if our steel goods are handled as a doubtful commercial sideline. If, however, the whole turnover, even of to-day's tonnage, were handled by one organization, the small percentage per ton permissible for selling costs would be sufficient to provide an aggressive selling campaign. But this question of organization goes further and deeper. After all, the existing merchants are mainly tied by the leg to offices in a few of the Treaty Ports, whereas the immense future business of China will be found far inland.

It is quite common all over China for goods to be transported by vessels of substantial tonnages along the rivers for from 600 900 miles to great cities that are populous centres of industrious provinces ; cities that are great river ports as far from the sea as, say, Constantinople or Moscow are overland from London. The organization suggested must spread into these internal entrepôts of trade, and, as already stated, it must be through, and by, and according to the methods of, the Chinese. There are two or three British firms dealing with other products that have organized on these lines for many years, and because they have done so they have made profits of many millions of money in China, and they are holding the trade position beyond the reach of any late-coming competitor. There will be from now on as great a demand for steel goods as there has developed a demand for other goods, but they must be provided and supplied to the millions of Chinese consumers with similar facilities to those provided by the successful exploiters referred to.

What has been said should make it clear that this situation cannot be handled in a small way with small capital by small firms. Such an organization must of necessity be a large and powerful organization. One cannot believe that the steel trade of this country will let it all go by default. If it is not to go by default one of two things must be done at once ; either the merchants who are interested in Chinese trade should create such an organization amongst themselves, or if they do not do it, the steel manufacturers should create such an organization. If the merchants neglect to do it, then they will have estopped themselves, as the lawyers say, from any fair cause of complaint if the manufacturers are driven to do it, and thus supersede them.

Manchuria Spinning Mill, Liaoyang

THE Manchuria Spinning Mill, newly completed at Liaoyang, of which Baron Ito is President, is the first Japanese plant of its kind in Manchuria. It is now turning out coarse yarns, 16's and 20's. Ten thousand spindles out of 32,000 are being worked, the entire installation being expected to be operated early next spring. In the future finer classes of yarn will be put out. At present the mill employs 700 hands, mostly Chinese, and their number will be increased to about 2,500 in the spring. The expert hands have been trained at a Tsingtao mill allied to the Liaoyang plant. Both Indian raw cotton and native raw cotton produced about Mukden and Liaoyang are used. The native cotton is available only in a limited quantity, but is of splendid quality. The new mill covers 20,000 *tsubo* of land, but another 30,000 *tsubo* is held for future extension.

The mill is capitalized at Y.5,000,000, half of which has been paid up. Its shares number 1,000,000. Construction work was begun last June, on a site west of Liaoyang, the cost amounting to Y.3,000,000. Machinery has been imported from England, and the looms from Nagoya, Japan. The power required by the plant is 1,300 h.p., wholly supplied by the Fushun Collieries. The installation of machinery has progressed to the extent of 90 per cent. When the mill is operated to its full capacity, 3,500 or 4,000 hands will be employed. The working gang includes only 70 Japanese. The Chinese laborers in Manchuria come mostly from Shantung. They used to be easily recruited, but there is now more difficulty, and the labor problem is pressing. The apprentices range from 15 years to 20 years in age, but in a sparsely-peopled country like Manchuria the hiring of so large a number of young Chinese is a matter of much difficulty.

As to the output, when completed, the mill will manufacture about 3,000 bales of 16's a month. As regards cotton cloth, the chief products are grey sheetings. Jeans are also manufactured, the daily output being 700 rolls.

Native raw cotton has been found to be satisfactory, as raw material, both the black and white species, are suitable. The black species have longer and soft fibres. The Chinese make no distinction between the two species, and grow them together, and this often causes a lack of uniformity. Liaoyang raw cotton used to be employed for stuffing quilts, and it is only in recent years that it has come to be turned to spinning account.

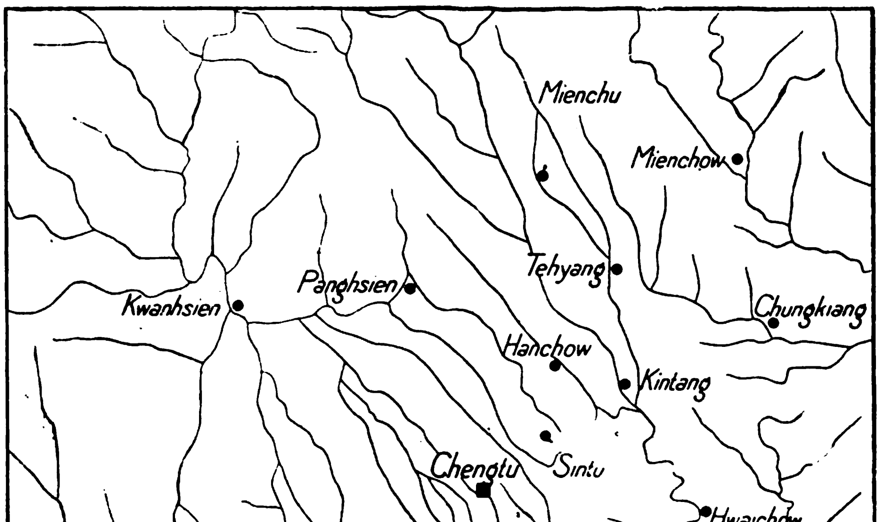
Capital Dam of the Chengtu Plain Irrigation

FOREIGN TRAVELLERS in Western China never cease to marvel at the system of irrigation of the Chengtu plain, Szechwan province. The enterprise, which dates back to the fourth century, B.C., is universally acclaimed as a wonderful engineering feat, all the more meritorious because it was initiated in the days when engineering was an unknown science. It succeeded in transforming an almost barren plain, 3,500 square miles in extent, the only large expanse of level ground in Szechwan, into probably the most fertile area in China, supporting in prosperity a population estimated at six millions. This area is part basin and part alluvial delta, having an elevation of from 1,500 feet above sea-level on the south and east to 2,300 feet on the north-west and west. E. H. Wilson, in the first volume of "A Naturalist in Western China," says: "A striking feature of the plain is the enormous number of large houses and farmsteads dotted here, there, and everywhere, and shaded by groves of bamboo, nanmu and cypress. The frequency of these houses with their enveloping groves gives a well-wooded appearance to the entire region, and the general view is broken up in such a manner that from no point can many miles of the plain be seen at one time." Because of its wealth of agricultural products, it was known in Empire days as the "Prefecture of Heaven," and foreigners refer to it still as "the garden of Western China." Its rice crops never fail; it is a veritable land of Canaan.

The author of the system is stated to be Li Ping, who was Prefect of Shuh, the old division of part of Szechwan province, soon after this region was conquered by the State of Ts'in in B.C. 316. He is said to have conceived the idea and to have started the work on the canals, and his son is credited with the realization of the skeleton of the entire project. The Rev. T. Torrance, F. R. G. S., in the "Journal of the Royal Asiatic Society of North China," Volume LV, is inclined to challenge the story that Li Ping was the sole originator of the scheme. He says it is open to serious doubt whether "Li Ping did all that some nowadays give him credit for," and is inclined to uphold the claims of two other engineer-administrators who lived about Li Ping's time. One of them, Kai Ming, is recorded to have originated several irrigation undertakings which were so meritorious that the Emperor of Shuh vacated the throne in his favour. This point, however, must be left to the savants. The Chinese give the credit for the achievement to Li Ping and his son, whom they have deified, and they are supported by local history.

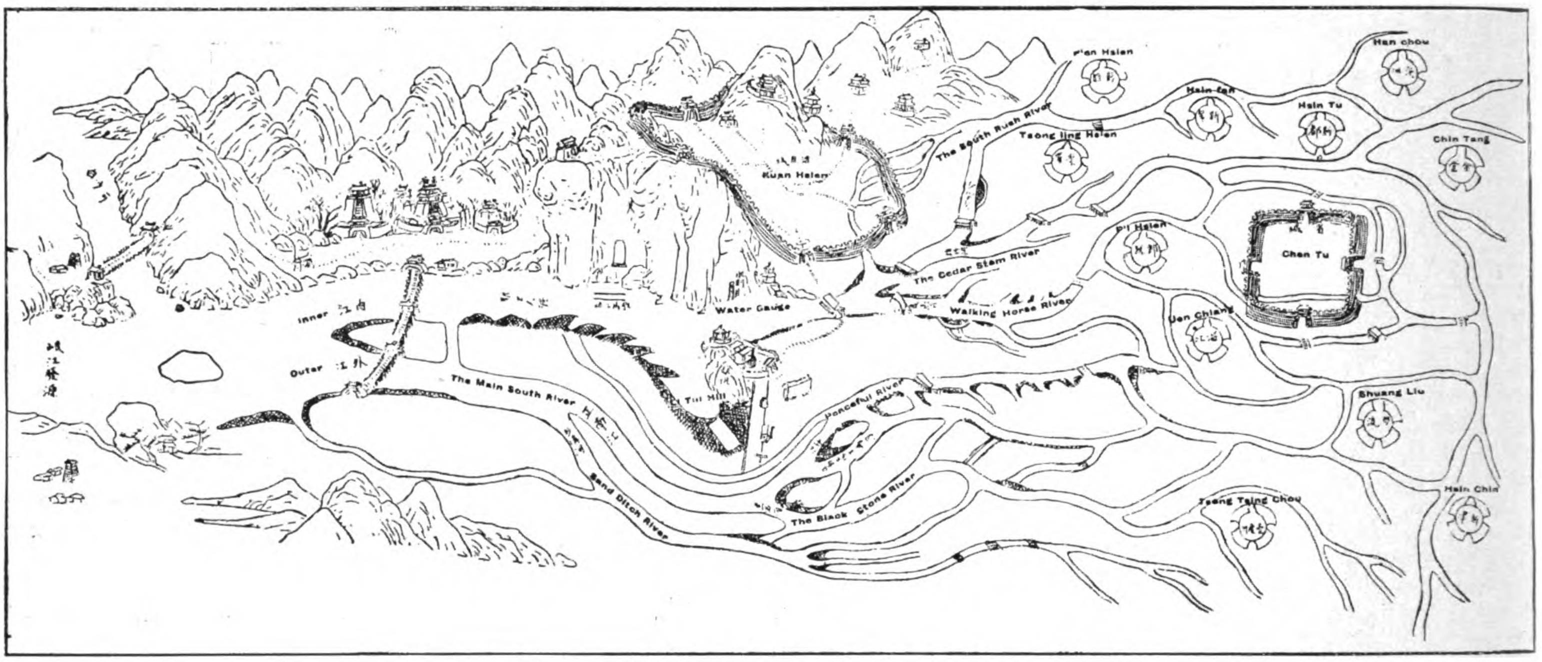
Li Ping was the first prefect of Shuh after it had been conquered, and instead of forcing the new rule down the throats of the conquered by force, he won them over by reforms and improvements. He found the Chengtu plain a barren land, over a great portion of which not even rice could be cultivated. The reason, of course, was lack of water. So Li Ping planned to better the lot of the Chengtu people, and after a thorough examination of the country determined to distribute the rushing waters of the Min river over the whole of the region. To do this it was necessary to cut through an intervening hill called Li Tiu Shan, just behind Kwanhsien, which is situated on the north-western edge of the plain, about 120 *li* from Chengtu.

That is how the system was started. Kwanhsien is the point of origin of the works, which are concerned solely with the fertilizing waters of the Min. The Min itself debouches from the mountains behind the Li Tiu hill. Its waters are partly diverted through the cut and then distributed along a fine network system of canals. The work took many years to execute, but, as initiated by Li Ping and his son, was successfully carried through by later generations, acting on Li Ping's, motto "Dig the bed deep, keep the banks low," meaning that a river whose high current runs below the level of the surrounding country could never become a menace to the people. When the enterprise was finally completed the great plain was criss-crossed in all directions with ditches and canals, which injected new life into the soil, and made it as productive as previously it had been barren. The whole of the plain was sub-divided into small fields, every field or series of fields having its own level, differing sometimes by one or two inches from that of its neighbors. This arrangement necessitated a complicated code of regulations, determining the proportions in which the water of any one canal is distributed into its branches, and the order of succession in which the farmers are allowed to make use of it.



A General View of the Irrigation System of the Chengtu Plain

More and more people were attracted to the region, and gradually custom, combined with common sense, rendered the preservation of the scheme the first duty of the inhabitants. Every year the bunding is repaired and all silt removed from the beds of the channels. An official styled Shui-li Fu—"Prefect of Waterways"—residing at Chengtu, has charge of the system. In late winter the water is dammed at Kwanhsien to admit of the removal of silt, and in the following spring the annual ceremony of turning on the waters is conducted with time-honored pomp and ritual. The Rev. Joshua Vale, writing in the "Journal of the Royal Asiatic Society of North China" Vol. XXXIII, describes this ceremony as follows: "The first day (of the ceremonies) is spent in inspection and worship at the temple (Kwanhsien), then on the morning of the second day the officials of the district with the Taotai proceed to the entrance of the dyke; the workmen then remove the barrier, and the water of the Min rushes into the channel of the Inner river,



CAPITAL DAM OF THE CHENGTU PLAIN IRRIGATION

This map is taken from one issued in the "Journal of the Royal Asiatic Society," No. XXXVI. The Rev. Joshua Vale, whose article this map illustrated, stated that it was of " entirely Chinese workmanship and . . . not drawn to an accurate scale. It is, however, the best procurable at present and will give some idea of the separation and distribution of the waters of the Min.

" On the map the two great branches and their various channels are quite distinct. The inner branch, after passing Kwanhsien city, divides into three main streams: the first, called the Walking Horse, flows directly east, irrigating the districts of Tsong-ling P'i-hsien, Uen-chiang, Chengtu and Hua-yang.

" The second, or central stream, called the Cedar Stem River, flows north-east, irrigating the western and northern parts of the districts above named, and unites with the Walking Horse River at different points on the way. The third stream, called the South River, flows north towards the districts of Hsin-fan, Hsin-tu, Han-chou, Kin-tang and thence to Chien-chou, Tz-chou, Lui-chiang, uniting with the Yangtze at Lu-chou.

" The ' Outer ' branch is the original channel of the Min. This branch is divided into four streams almost immediately opposite the Li-tui hill at Kwanhsien. The first (on the left) is named the River of Peace, and irrigates the districts of Kwanhsien, P'i-hsien, Uen-chiang Hua-yang and Shuang-liu. The second, or central stream, is called the Main South River or Sheep-Horse River, and irrigates portions of the above-named districts of Kwanhsien, P'i-hsien, Uen-chiang and Shuang-liu, and unites with the first branch at Hsin-chin. The third stream (on the right) is called the Black Stone River, and irrigates the districts of Ts'ong-ching-chou and Hsin-chin, uniting with the other branches at the last-named place. The fourth, called the Sand Ditch River, separates from the main streams some distance below the rope suspension bridge at Kwanhsien and flows south-west, irrigating parts of the districts of Kwanhsien, Ts'ong-ching-chou and Hsin-chien."

and the runners of the various officials lash the water with their whips to hurry it on its way; old women and children also stand on the banks and throw stones at the water to hurry it on its work of fertilization." This is apparently an original version of the practice of blessing the waters which is carried out in other countries. The irrigation system is perfect, each rice field receiving exactly at the right time a sufficient supply of running water.

Simple as is the conception of the system, it is very intricate in detail. The broad outline, taken from " A Naturalist in Western China," is as follows:

" An obstructing hill called Li Tiu Shan was first cut through for the purpose of leading the waters through and distributing them over the plain. The passage having been excavated, the waters of the Min River were divided, by means of an inverted V-shaped dyke, a little distance above the canal into two main streams, the ' South ' and ' North ' Rivers, as they are called. The waters of the ' North ' streams are carried through the Li Tiu Shan cut, and after passing through the city of Kwanhsien are divided into three principal streams. The most southerly of the three, called ' The Walking Horse,' flows directly east, and irrigates the districts of Pi Hsien and Chengtu. The central stream, called the ' Cedar Stem River,' flows north-east, and is utilised to irrigate the western and northern parts of the above-named districts. Branches of these two streams flow past the south and north walls of Chengtu, uniting near the east gate of the city. The third, or northern branch, known as the ' South Rush River,' flows north towards the city of Peng Hsien, and then south-eastwards past Han Chou. All the sub-divisions of this branch and its anastomosing canals and ditches unite near Chao-chia-tu to form the head waters of the To River, which flows due south past the famous salt-wells of Tzu-liu-ching, and finally enters the Yangtsze at Lu Chou. This ' South Rush River ' is fed by numerous torrents which descend from the ranges bounding the north-west edge of the plain. These streams—broad, stony, irresponsible things with no defined banks—exist only during rains or the melting of the snow in spring. In crossing the northern parts of the plain the traveller can form some estimate of what the whole was like before the irrigation canals were dug and dykes erected.

" But to return to the system at Kwanhsien. The ' South ' River, whch occupies the original bed of the Min River, is divided into four principal streams almost immediately opposite the Li Tiu Hill. The most easterly branch, named the ' Peaceful River,' irrigates the districts of Kwanhsien, Pi Hsien, and Shuangliu Hsien. The next branch, called the ' Sheep Horse River,' irrigates other parts of the above-named districts, uniting with the ' Peaceful River' at Hsinhsin Hsien. The third stream, called ' Black Stone River,' irrigates the department of Chungching Chou, and unites with the other streams at Hsinhsin Hsien. The fourth stream, called ' Sand Ditch,' flows south-west through Tayi Hsien and Kiung Chou, joining the other streams at Hsinhsin Hsien. All the streams which intersect the Chengtu Plain, save those forming the upper waters of the To River, unite at Chiangkou, a village at the extreme south-eastern edge of the plain, some 45 English miles south of Chengtu city.

" This system of anastomosing canals, ditches, artificial and natural streams, forms a complex yet perfect network. The current in all is steady and swift, the bunding secure, and floods unknown. Not only are all these streams and canals available for irrigation, but they are also utilized to generate power required in various industries. Flour-mills abound, driven by vertical or horizontally fixed water-wheels. Similar mills are used for crushing Chinese rape-seed, preparatory to pressing for the extraction of the oil."

Little is known of Li Ping's original scheme beyond a skeleton account, but local history furnishes many interesting details about the progress of the undertaking to its recent state of perfection: The Rev. Joshua Vale, writing in the " Journal of the Royal Asiatic Society of North China," Vol. XXXIII., gives the following summary:

" We gather from various quotations of other works in the History of Kwanhsien some accounts of these additions and improvements. It appears that, apart from the necessary repairs and yearly cleaning of the channels to ensure a plentiful supply of water, no additions or improvements were made till the first year of the Yuan dynasty (A.D. 1280-1368), some fourteen hundred years after its completion by Li in the Ch'in dynasty (255-206 B.C.). In that

year we are told that the Judicial Commissioner Chih Tang-p'u, who regarded the Tu Kiang, *i.e.*, ' Inner ' river, as the chief stream of the ' Min ' river, had an iron tortoise moulded out of 66,000 catties of iron ; this was placed in the bed of the river and fastened in position by an iron pillar to resist the force of the water and keep back the *débris*. Having taken this preliminary precaution, he commenced his intended improvements as follows : he lined all the dykes with quarry stone, stopping up all the holes with molten iron; he also mixed T'ung oil with lime and calked up the cracks and leakages, thus preventing the water from soaking through the dykes and banks. At those places most likely to fall in he filled in closely with stones out of the river bed. He planted willow trees on the banks to strengthen them, and shrub briars as close together as the teeth of a comb, thus securing solidity and durability. The old channels he had cleaned out, causing the waters to flow freely, and opened up new channels, reducing the force of the water. At the junction of two streams he made flood-gates that could be opened or closed at pleasure, in order to disperse or store up the water. In fact, the writer says, ' he did everything that wisdom could devise and strength carry out.'

" The next addition was made in the year of the same dynasty by Li Ping-i, who was Assistant Judge of Shensi. Having paid an official visit to Kwan Cheo (Kwanhsien), he ascertained that in times of great floods the waters of the Min frequently damaged the dykes, and further that the yearly tax upon the people for repairs was regarded by them as a burden ; he therefore ordered that the dykes should be built more securely, but when the ' old men ' of the district heard of his plan they objected because they were afraid that if the waters were dammed up, when a flood arose it might do serious damage to the capital, Chengtu. Li, to convince them of their folly, ordered them to throw a stone into the stream ; when they had done so he asked them ' Did the water flow over or under the stone ? ' ' Over,' they answered ; whereupon he appointed officers to oversee the work, which was completed in three months ; thus in flood times the waters flow over the dam, and in times of drought the waters are kept in reserve to irrigate the fields. ' The benefits of Li Ping-i's additions,' says the writer, ' are felt even down to the present day.'

" The next addition was made in the reign of Kia Ch'ing of the Ming dynasty. A certain official, Shi Ch'ien-ts'iang, made a pair of iron oxen out of 70,000 catties of iron ; each ox measured 10 feet ; he made the oxen to come together in the shape of the character ' man,' the head and tail meeting. The sharp angles of the oxen were put so as to meet the force of the water. Above the edge of the dyke, on the heads of the oxen, he had these words engraved :—

' The ox's head reveals the top,
His feet disclose the bottom.'
' Covered by the floods the horns,
Betoken plenty in the barns.'

" Referring to the making of these oxen, a writer says : ' When water is brought in conflict with any substance the heaviest prevails ; it is possible to bring together tens of thousands of stones, but you cannot unite them in one body, but tens of thousands (catties) of iron may be melted and thus united in one ; being united, it makes one solid weight, of which there is nothing heavier. When water is brought in conflict with such a weight it rebounds and divides itself into many streams ; divided thus, its strength is weakened ; in this weak condition even bamboo, wood, or sand may resist it ; thus, though there is nothing more swift than the waters of a dyke, yet there is no better way to cope with it than by using iron.'

" One Kao Kong Shao, in speaking of this work, said : ' Shi Ch'ian K'iang first of all placed bamboo baskets and fences 30 feet above the entrance to the dyke, in the bed of the river, to cut off the stream ; he then dug out the channel and drove in some 300 cedar piles closely together, and filled in the center with earth, level with the top of the piles ; he then spread beams crosswise over the piles and covered the whole with stone slabs ten feet long and two feet thick. Having done all this he bound the whole together with iron clamps. At the bottom of the river, near the oxen's feet, he made a plate of iron which was shaped like an ox's head above the level of the water.'

" Further improvements were added in the ninth year of Hong Chi, of the Ming, by the District Magistrate of Kwanhsien, whose name was Fu Kuang. We are told that he lined the old foundations of the dyke with quarry stone and plugged them together with three iron spikes, each 12 feet long. This he did to break the force of the water. In the centre of the embankment he also used putty and lime for a distance of 25 feet to keep the whole together. We are told that in these works he used 33,200 catties of iron, 500 catties of putty, 200 catties of hemp, and 2,500 pieces of timber. The total amount of labour of all kinds was 253,200 days !

" Again, in the reign of Wan Lih, of the Ming Dynasty, there being a great flood on the Min river, the Governor, Kueh, gave orders that iron pillars should be added to the dyke and that the channel should be cleaned out ; he also ordered that along the banks at Pao Ping Kuo, San Pei Tung, Wu Tou Kou and Fu Tou, thirty iron pillars, each 10 feet long, should be placed. These pillars took 30,000 catties of iron. This official also planted trees to support the pillars, and built embankments to protect the sides of the dyke. It is stated that the Governor himself drew the plans and had the work completed in six months, at a cost of 300 catties of gold.

" Having briefly traced under our last head the additions and improvements during the various dynasties down to the end of the Ming, we now proceed to describe the present condition of the dykes, their yearly cost, etc.

" The present system of using bamboo baskets filled with stones, instead of the iron oxen, tortoise, etc., dates from the Ih Hai year of the Ming dynasty.

" We have no account of the actual cost of the original dyke, and only incomplete statements of the cost incurred by the additions and improvements. One of the writers above quoted says that formerly there was an inequality in the selection of workmen to repair the dyke; therefore Lu-i, 'Superintendent of Water Communications,' ordered that one man for every farmer paying taxes on 300 bushels of rice should be selected. These men were selected for eight courses covering a period of eight years. He also ordered that the farmers in the Ch'engtu district should supply the required bamboo for the yearly repairs, and also appoint an official to superintend the plaiting of the baskets and filling them with the stones. Lu-i said hundreds of thousands of taels were spent on iron pillars, iron tortoises, etc., which were swept away when a great flood arose, bamboo baskets being more economical and convenient, as everyone would admit. This system of taxation instituted by Lu-i does not seem to have worked satisfactorily, as we find that in the 9th year of the same dynasty the Governor, Hsia Uen, seeing the inconvenience of the system, ordered that the two districts of Kwan and P'i should raise the required number of workmen between them, and that the other districts using the waters of the dykes should supply the required materials. In the 16th year of the present dynasty the Governor, Kao Min-chan, with the Taot'ai and other civil and military officials, made a subscription of 20,000 taels for the repair of the dykes.

" In the 18th year of the same reign the Governor, T'ong Feng-ts'ai, memorialized the throne on the subject. He said that after the rebellion of Chang Hsien-chong there was a scarcity of people and the dykes fell into decay, and that the subscription of the various officials in the 16th year of the same reign only served to have the dykes cleared for the time being ; he therefore petitioned that the old custom of selecting workmen according to the tax paid should be reverted to; then the people would have no fear of drought, and the Government no anxiety in regard to revenue.

" In the year of K'ang Hsi there was a great flood which carried away the dykes. This flood caused much suffering to he people, the towns, villages and hamlets alongside of the river being inundated. When the sufferers reported their cases the Governor, Leng T'ai, subscribed for their relief and also devised a scheme to avert a similar calamity in the future. To accomplish this he reduced his own stipend, and all the officials followed his example, from the Treasurer downwards.

" It is said that at that time the yearly repairs were done by selecting workmen from amongst the farmers according to the number of fields under cultivation, but in the 48th year of K'ang Hsi this was changed to a tax of one tael for each workman ; thus Kwan-hsien, which formerly supplied 69 workmen, was taxed 69 taels, and the other districts rendered official service when required.

" In the 8th year of Iong Cheng, when the measurement of the land was completed, the Governor memorialized the throne on the subject. After enumerating the various steps in the building of the dykes from Li Ping downwards, he says : ' Formerly the yearly expenditure was supplied by selecting workmen according to the number of fields using the water ; thus Kwan-hsien had 69 ; Uen Chiang, 11 ; P'i Hsien and T'songling together had 480 ; Hsin Fan, Kin T'ang, Ch'engtu and Hua Nang each had 90 ; and Hsintu 36, making a total of 883 men for the nine districts, which, reckoned at a tael

each, equals Tls. 883. From the time of Iong Cheng the yearly expenditure has varied; some years five or six hundred taels sufficed; other years the amount was as much as seven or eight hundred. In the fifth year of that reign an embankment at Jen Tze Dike having fallen in and choked up the channel, the expenditure rose to the sum of twelve hundred taels; 'therefore,' says the memorialist, 'it is calculated that there should be an amount of twelve hundred and thirty taels yearly to meet the expenses likely to be incurred, and thus avoid anxiety.'

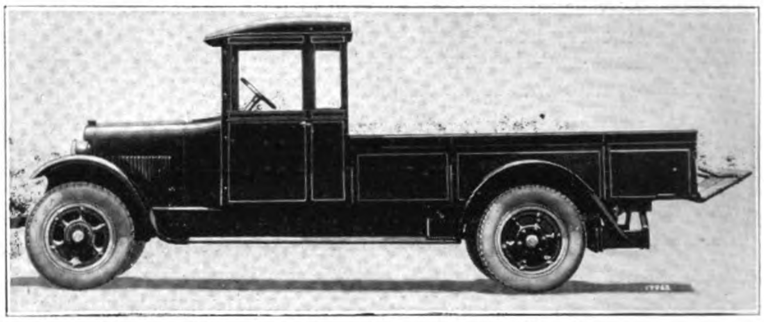
"He continues by saying that formerly the workmen were selected according to the number of fields cultivated, but this arose because there was no certain record of the acreage under cultivation; but now, that having been ascertained, if the old system still be followed with no regard to the size of the field, a great inequality will be the result; therefore, it is requested that the calculation and allotment be based on the number of acres cultivated; thus partiality will be avoided. 'Now,' he continues, 'it is ascertained that Kwanhsien and P'i-hsien, being near to the source of supply, get full advantage of the water, and that Uen Chiang, Hsin Fan, Hsin Tu, Kin T'ang, Chen Tu, and Hua Iang, being at a distance of over one hundred *li*, there therefore should be a distinction made of the assessment; thus Kwan, P'i, Ts'ong are assessed at .015 per acre. Again, there are places in the Hua Iang districts, having a small supply of water, and they are assessed at .010 per acre. Now, according to the "Records of Measurement," Kwanhsien has 116,198 acres and pays a yearly tax of Tls. 232.39; P'i Hsien and Ts'ong-ling together have 191,625 acres and pay a yearly tax of Tls. 383.25; Uen Chiang, 1,294 acres and a tax of Tls. 1.95; Hsin Fan, 46,753 and tax Tls. 70.13; Hsin-tu, 76,971, tax Tls. 115.46; Kin-t'ang, 55,357 acres, tax Tls. 83.35; Ch'eng-tu, 192,726 acres, tax Tls. 298.89; Hua-yang, 54,639 acres, tax Tls. 81.96; the acreage in the Hua-lang district, with insufficient supply, amounts to 24,975 ares, and pays tax of Tls. 29.98; thus the total acreage is 760,539, and the total tax Tls. 1,282.23. This amount is collected yearly from the various districts and forwarded to the "Prefect in Charge of Water Communications" at Kwan-hsien. This official prepares an estimate of probable cost for the yearly repairs, giving each item of intended expenditure; this estimate is sent to the Intendant of the Long Meng Circuit, who forwards the same to the Provincial Treasurer. Another list is also sent, after the repairs have been completed, for examination. Should there be an overplus, it is kept at Kwanhsien to meet any expenses incurred during the summer or autumn by high water or floods.

"'According to the regulations, the yearly allowance of bamboo poles used for repairs is 393,540; forty bamboos are plaited into one basket thirty feet long, one foot eight inches in diameter: the parallel slips of the baskets are the width of four fingers and the cross slips the width of three fingers. The official price of each basket is fixed at Tl. 16 cents each.

"'The baskets used to dam the river for the yearly cleaning are priced in proportion to the other baskets, each costing 19 cents. If the baskets used exceed the annual allowance, then the price for the additional baskets is raised to 34 cents. The yearly allowance of bamboo baskets is 13,743.'"

The same writer, in Volume XXXVI of the "Journal of the R.A.S.," in describing the dams, gives the following account of one feature of the subsidiary workings of the system:

"Before closing the description of the Capital River Dam it may be of interest to point out a few special features in connection with the main branch of the 'Inner' river after passing the capital to its junction with the 'Outer' branch at Kiang-kou. This branch, which is the chief waterway to the capital from the south, is known locally as the Fu river, *i.e.*, the prefectural river (this is the name given to the Min locally from this point on to its junction with the Yangtsze at Sui-fu). During the flood season, usually from May till September, it forms quite a considerable stream, and large passenger-boats ply between the capital and the south; but when the waters are cut off at Kwanhsien to clean the inner channel, this river becomes a very shallow stream which can be forded at many points. During this season the larger boats tranship their cargo at Kiang-kou and either go on the rest of the journey empty or stay at Kiang-kou. For the purpose of irrigating the plain on either side for a distance of about 40 miles, there are, at stated intervals, some 44 dams or weirs, with some 200 Persian wheels in groups of three, four or six. These wheels raise the water from the river and spread it over the plain, irrigating a wide area some distance from the riverside. In addition to the weirs above mentioned, or in conjunction with them, there are a number of places with channels for mills. But the chief point of interest is the dams, of which there are three. The first is the Stone Ox Dam, one mile below the capital. This dam supplies the plain with water for a distance of about eight miles, where there is a second dam, called the Elder Sister Dam. During the early summer, when the water is needed for the fields, these two dams are closed, *i.e.*, the river is cut off completely and all boat traffic is stopped. During this season, which usually falls between the end of April and the end of May, hundreds of boats congregate above and below the dam, and when the dam is opened to allow official boats to pass up or down, a perfect panic takes place amongst the boatmen. The third dam is some 20 miles below the capital and is much larger and more substantial than the two others, being built of stone. This dam irrigates 1,733 acres of land on the left side of the river, re-uniting with the main stream again at Kiang-kou."



Graham Brothers 1½-ton Canopy Truck

Graham Brothers in First Place

Sturdy Truck Makes Remarkable Advance

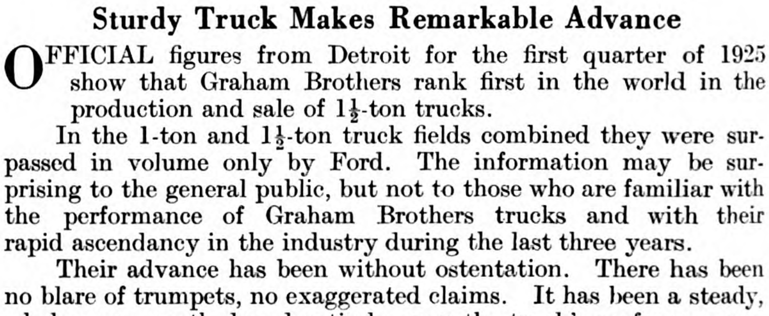
OFFICIAL figures from Detroit for the first quarter of 1925 show that Graham Brothers rank first in the world in the production and sale of 1½-ton trucks.

In the 1-ton and 1½-ton truck fields combined they were surpassed in volume only by Ford. The information may be surprising to the general public, but not to those who are familiar with the performance of Graham Brothers trucks and with their rapid ascendancy in the industry during the last three years.

Their advance has been without ostentation. There has been no blare of trumpets, no exaggerated claims. It has been a steady, wholesome growth, based entirely upon the truck's performance.

Less than three years ago Graham Brothers were in twentieth position. Now they are manufacturing trucks at the rate of over 100 a day, marketing their entire output through Dodge Brothers dealers. This sales and service advantage of a strong dealer organization, combined with the exceptional merit of the truck itself, is regarded as one of the chief reasons for the rapid advance to leadership. Dodge Brothers dealers everywhere are highly regarded, and their service facilities are uniformly above the average. Service is an exceedingly important factor in the operation of a truck, and business men are not slow to appreciate the advantage of having genuine parts instantly available when needed. Graham Brothers attribute their rapid advance to the following four reasons:

1. Distinct price advantage.
2. Pronounced quality advantage.
3. Dodge Brothers engine.
4. Substantial character of Dodge Brothers dealer organization.



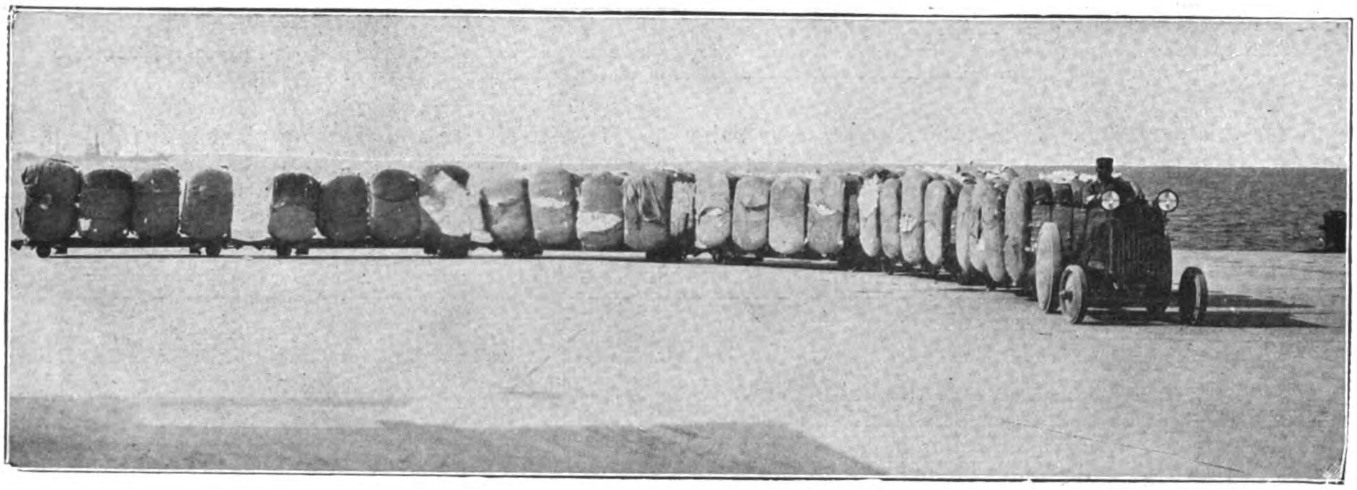
Standard 1½-ton Graham Brothers Express Trucks with Closed Cabs

Handling Bales of Cotton

Heavy Duty Trailers with Roller Bearings

A NEW PROBLEM in industrial hauling came to light when the Norfolk Warehouse Corporation, of Norfolk, Va., built a cotton compress plant in connection with large storage facilities leased at the big army supply base near Norfolk.

This army base plant was built during the war for concentrating and shipping army supplies to France. After the Armistice the War Department decided to release all vacant storage space for industrial purposes, the cotton trade of the port of Norfolk taking over room for the storage of approximately 200,000 bales of cotton.



Loading heavy bales of cotton requires a low trailer with small wheels. These trailers are run in trains of six

The plant consists of eight units about 150-ft. wide by 1,700-ft. long, divided into twelve compartments each, all served by railroad facilities on one side and concrete roads on the other. In such a lay-out the distances are great indeed. In addition to the warehouse units there are two enormous deep-water piers capable of handling a number of ocean-going vessels at one time, both discharging and taking on cargo. Water-borne cotton cargoes are assembled at shipside on these great piers, and the cotton is hauled to them from varying distances, the longest haul being 4,400-ft., with the average somewhere around 2,500-ft.

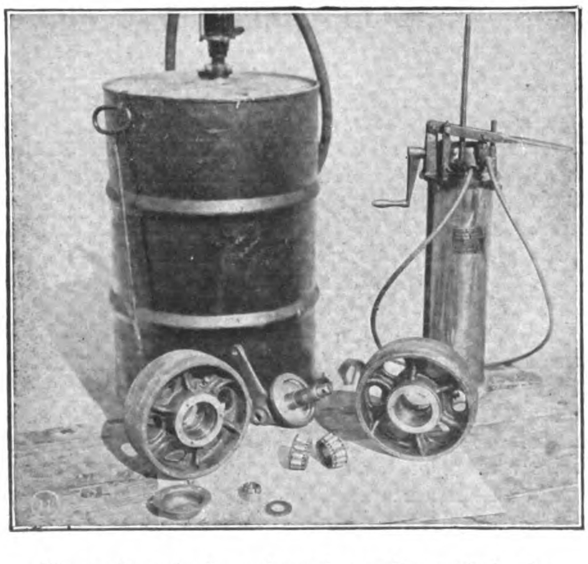
Since before the Civil War all cotton in the port of Norfolk had been handled by the old familiar hand-truck, with negro labourers as the motive-power. It was a jolly crew in the old days of short trucking distances and cheap labour, but the new situation demanded radically different treatment.

A survey of available mechanical equipment did not offer a solution; hence something new became necessary. It was found that for quick, cheap and accurate handling an industrial trailer 10 in. high, 36 in. wide and 10 ft. long would be the ideal, and such a design was drawn up. This design offered some mechanical troubles, due principally to the small wheels. A compromise was made by using 10-in. wheels, and making the height of the trailer 12 in. from roadway to top of loading platform.

With such small wheels the "castor" type of trailer was automatically eliminated. It also being necessary to have trains which could be hauled from either end, only the "four-wheel-steer" type was suitable and practicable for existing conditions, and this type was adopted. After two years of constant supervision and study, this equipment has now been brought up to a reasonably efficient performance.

Originally, 125 trailers were used, equipped with roller bearings and hauled by storage battery tractors. Later on, gas tractors, with a special design water-cooled muffler and fully protected engine were tried out, and have largely replaced the storage battery tractors, on account of greater speed, larger hauling capacity and more flexible operation. The difference in speed of train movement between three miles per hour by electric tractor and ten miles per hour by gas tractor is a valuable asset for this operation. Both types of tractors are in use now; the electrics for short haul and the gas for continuous long haul.

Speed of train operation and amount of equipment needed is determined by the maximum output of the compresses, which varies from 90 bales per hour to 130 bales per hour per press. Wherever located on the plant, and wherever it must be delivered after compression, the incoming flow and distribution of compressed cotton (or the outgoing flow) must never retard the operation of the compresses. A loss of only a few minutes at a press means a loss of many dollars.

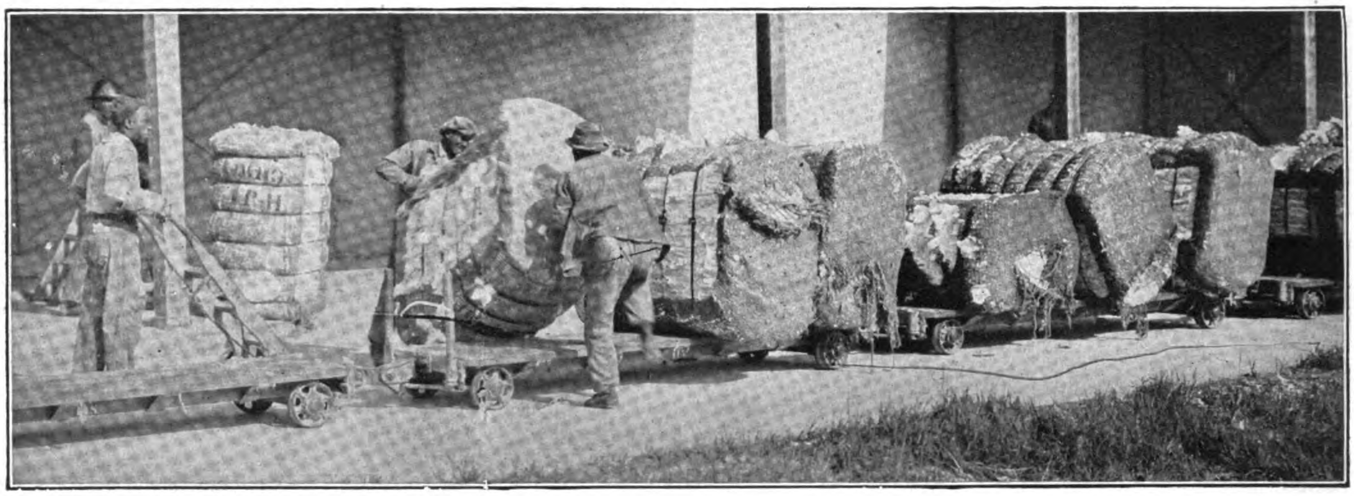


The trailer wheels are here shown dismantled. In the background is shown the Alemite pressure system, using Dixon's Lubricant No. 677, with which all parts are lubricated. Note the dust-proof cap

This season the Norfolk Warehouse Corporation's equipment consists of 175 Lakewood trailers, six gas tractors, and four Lakewood electric tractors. The trailers are equipped with cast-steel wheels, using adjustable heavy-duty Timken tapered roller bearings. Dust-proof design keeps the bearings free from the cement dust raised by the train movement over concrete. All parts are lubricated by Alemite pressure system using Dixon's Lubricant No. 677.* Operating results with the present equipment are satisfactory.

Trains of six trailers each are run. Each train is a unit, found to be the

*Messrs. Walworth International Co., of 29, Szechuen Road, Shanghai, are representatives in China and the Phillippine Islands for Messrs. Dixon's manufactures.



Trailers ten feet long, three feet wide and twelve inches high, and equipped with roller bearings, are used on this concrete pavement. Each trailer carries four bales of cotton, or an average load of 2,000 lbs.

proper length for this operation. Each trailer carries four bales of cotton, or an average load per trailer of 2,000 pounds, going to the compress. After compression, five bales are loaded per trailer, due to the decreased size of the bales, making an average load of 2,500 pounds per trailer.

Service station and charging plant is maintained, in charge of competent mechanics, to keep all equipment in proper operating condition. The equipment and operation, says the *Railway Purchases and Stores*, is probably as unique an installation as will be found anywhere in connection with cotton handling.

Railway Engines for Ceylon

Announcement has just been made that the Railway Department of Ceylon has requested the Finance Committee to include in the 1925-1926 Budget Rs. 1,080,000 for the importation of six engines to replace scrapped engines, and ten others to meet the growing traffic requirements, as well as Rs. 984,718 on account of importations of wagon underframes. It is suggested that there would be a substantial saving over a number of small contracts if all this material were ordered at one time, and the Crown Agents in London are to be consulted as to the most advantageous method of importing it. In view of the rapidly expanding revenue of the island it is probable that the expenditure on railway improvements in general will be larger in the current year than it was previously.

Owing to the recent extension of the railway from Bandarawela to Badulla, a distance of 20 miles, the doubling of the line between Colombo and Palawela, and developments at other points, covering a total of 293 miles, certain of the modern type of engines owned by the Ceylon Government Railway had to be run last year from 50 to 100 per cent. more miles than in 1911-1912. The frequent engine troubles experienced of late are attributed to this hard work, which has rendered it more or less impossible to keep the engines in prime running condition.

New Tin Dredger for Malay

The recent launching at Goss Moors, near Roche, Cornwall, of a 200-ton tin dredger marks a new departure in alluvial tin mining in Great Britain. Although a familiar figure in the Malay States, this is the first time a dredger has been used in England for this purpose. The cost of the dredger was in excess of £12,000.

It has been constructed to the order of the British Alluvial Tin Syndicates Ltd., who have leased over 1,000 acres of alluvial tin deposits from Lord Falmouth. The dredging apparatus on the ship is worked by three 80-h.p. engines, the entire operation of converting the alluvial into tin concentrates being carried out on board as the dredger proceeds. It has forty buckets which are capable of dealing with three tons of alluvials per minute, and has on board 16,000 square feet of dressing tables. It is stated that the alluvial deposits being worked assay 70 per cent. of tin concentrates, which, with the price of tin metal at not less than £200 per ton, are worth £140 per ton. The area to be worked is estimated to yield 7,000 tons of tin concentrates. The prospect of a long period of employment to a considerable number of men is a source of great satisfaction in Cornwall, where employment in the tin mining industry has long been very restricted.

Germany Building British Ships for Far Eastern Service

Undoubtedly the most important shipbuilding contract placed for many months past is that which the Furness, Withy Line has recently given to the Deutsche Werft, of Hamburg, for the construction of five fast motor-ships of 10,000 tons deadweight each. This is the biggest order that has been placed by British shipowners since Andrew Weir & Co. ordered their twenty motor vessels some months ago, and, with the guarantee that was granted to Sir William Petersen under the Trade Facilities Act, now withdrawn, it is likely to be the largest order for some time.

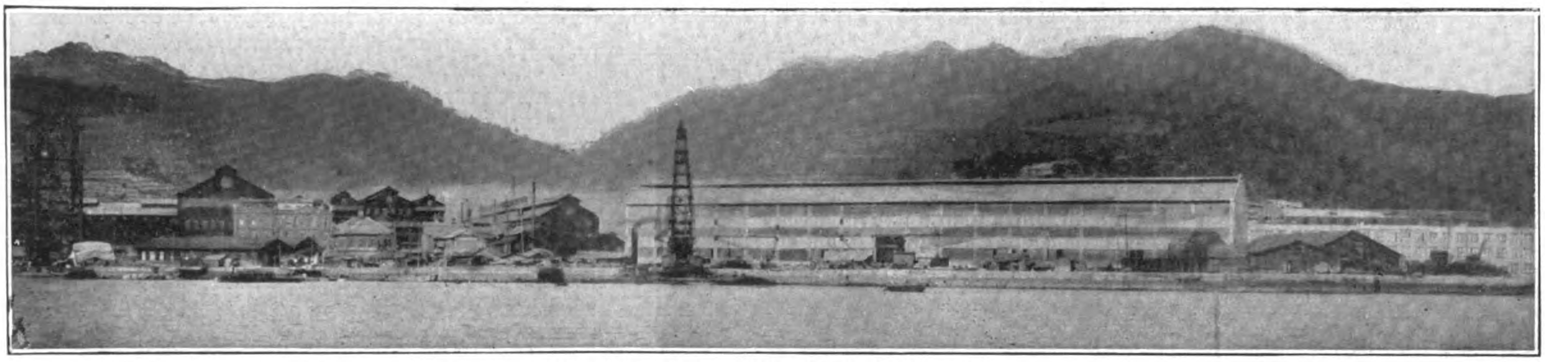
Messrs. Furness, Withy have been planning for some months the details of these new vessels, which are intended for their new Far Eastern service. This service will be run on most competitive lines. The German tender for the vessels was well over £66,000 per ship less than the lowest British, and there was also an appreciable difference in the time guaranteed for delivery by the German yard. The line has under consideration the addition of seven more motor vessels. When it is decided to place orders for these it is hoped that British builders and engine firms will be in a better position to compete with German and other Continental firms.

Another New P. & O. Launching

There was launched on January 27, from the yard of Messrs. Alexander Stephen and Sons, Ltd., Linthouse, Govan, the large steamer *Chitral* for the Peninsular and Oriental Company.

The *Chitral* is a twin-screw steamer of 15,000 tons gross, her length being 546-ft., breadth 70-ft., and depth 46-ft. The vessel is one of the P. & O.'s new class now building for the Far Eastern mail service, and will make her first trip to Australia. She is fitted with very up-to-date and extensive accommodation for 200 first-class and 100 second-class passengers. She is also specially designed for cargo trade and is fitted with large refrigerating chambers, as well as ordinary holds and 'tween decks for the carriage of goods and mails, which are handled by a large number of electric winches.

The vessel is designed for a speed of 16 knots on service, and the propelling machinery consists of twin screw quadruple expansion balanced engines developing 13,000 i.h.p. and making steam from seven large boilers burning oil fuel under forced draught. The *Chitral* was launched by the Hon. Elsie Mackay, daughter of Viscount Inchcape, chairman of the Peninsular and Oriental Steam Navigation Company.



Mitsubishi Shipbuilding Yard at Nagasaki

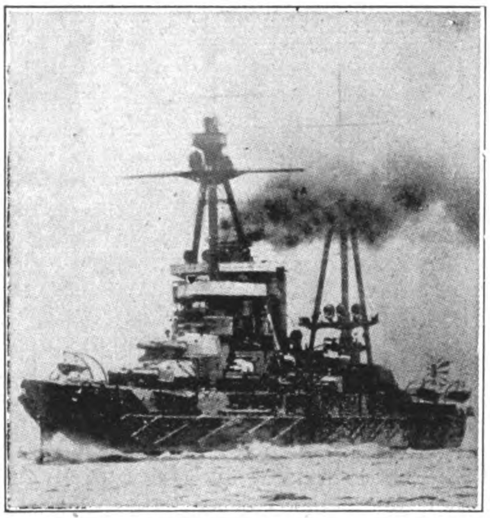
Japan's Contribution to Naval Architecture

By Dr. F. P. Purvis

JAPAN'S indebtedness to outside help is no doubt a prominent feature in the material and other progress she has made. This country's share in that help is notable in many directions. Other countries besides our own have had their share in rendering help; it would be interesting, but outside the purpose of the present paper, to give an account of Japan's technical advisers from time to time. There is one who must be mentioned, viz., M. Emile Bertin, so recently deceased, an honorary member of our own Institution.

In company with the name of M. Bertin it seems only natural to record the names of the British constructors—Sir Edward Reed, Dr. Elgar, Sir William White, Sir Philip Watts, Sir Alfred Yarrow. At various times and in various ways they did not a little to assist Japan in the development of her Navy; from the designs of the last three were built, respectively, at Elswick, the protected cruisers *Naniwa* and *Takachiho*, and later the Armstrong cruisers, and, at Poplar, the Yarrow torpedo-boats and destroyers; of these ships the two first-named distinguished themselves particularly at the battle of the Yalu River, and again, in 1905, at the battle of the Japan Sea in the Russo-Japanese War; the armoured cruisers helped prominently in the battle of the Japan Sea; and the Yarrow vessels in the attacks on Port Arthur in the same Russo-Japanese War. On the one hand, Japan has received much assistance in and from other countries; on the other, she has known how to appreciate and use this assistance in a very practical way.

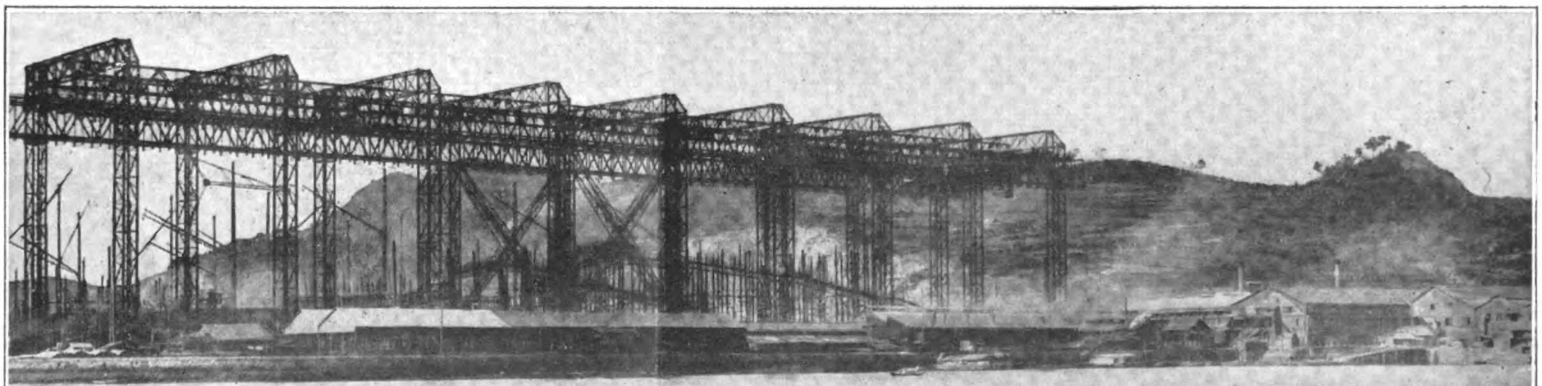
In 1909 the Japanese Navy Department commenced the construction of its experimental tank at Tsukiji, Tokyo; experiments were started in 1911 under the direction of Constructor Vice-Admiral (then Rear-Admiral) Kondo, now retired. Its dimensions were 500-ft. by 20-ft. by 11-ft. depth of water; an addition of 80-ft. to the length was contemplated but never carried out. The structure was wrecked by the terrible earthquake of September 1, 1923, and completely destroyed by the fire that followed. The loss of this tank will be temporary only; the Navy Department has instituted studies to help towards the building and equipment of a new tank adapted to its needs; in due time these studies will certainly lead to a tank establishment capable of carrying out all investigations that can be anticipated for it. On more than one occasion the author has indicated to friends connected with the Tsukiji tank that it is a great pity the profession was not told from time to time a little about their work and progress; the answer has always been that a Government Department, no less than a private individual, is the best judge in its own house of what it allows to go outside.



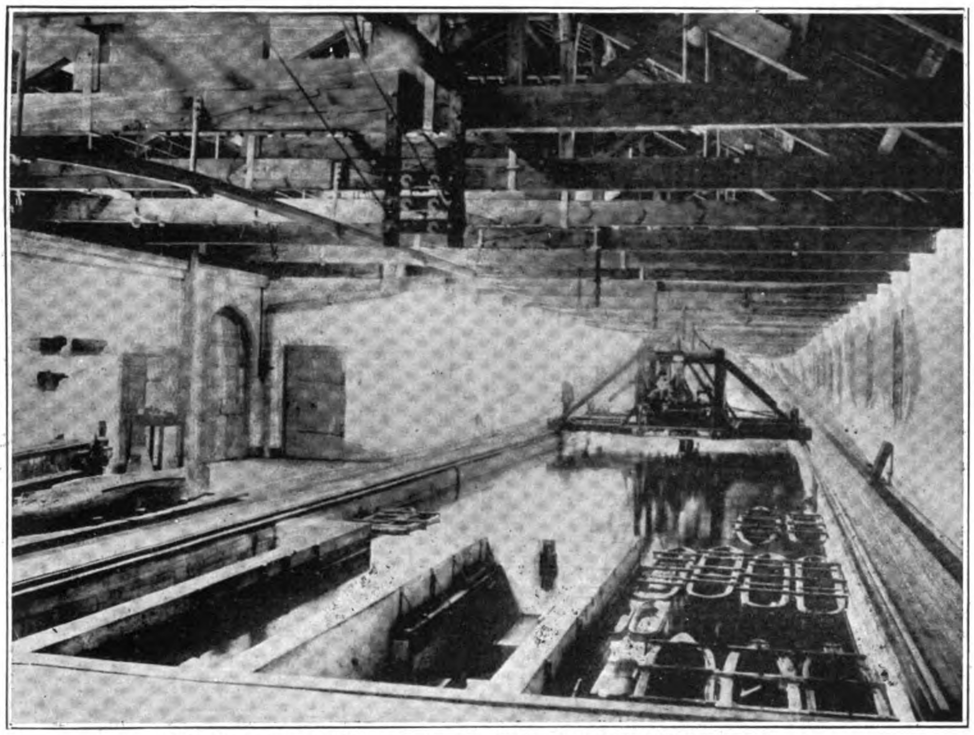
A Recent Type of Japanese Battleship

Another experimental tank in Japan is that constructed in 1908 by the Mitsubishi, Shipbuilding Company at their Nagasaki shipyard—its dimensions are 430-ft. by 20-ft. by 12-ft. depth of water. From the first Dr. Motora has been in charge. Of the work done at this tank not much information has been published; but in 1922 Dr. Motora described (in Japanese) to the Society of Naval Architects (Zosen Kyokai) an invention of his own which he had thoroughly tried out in it.

In 1904, during the Russo-Japanese War, the Japanese Volunteer Fleet Association became active as a body analogous to the Russian Volunteer Fleet, so influential and important in the days of its power. Three ships were built in Japan under the auspices of this Association; they may have fulfilled the expectations formed of them, but did not establish any particular record. In 1914 the functions of the Japanese body were extended to embrace also ship



Movable Crane at Mitsubishi Yard



The Experimental Tank at the Mitsubishi Shipbuilding Yard

classification duties, and the hope was entertained that this side of its functions might develop into an important national responsibility ; the Association then or earlier became known as the Teikoku Kaiji Kyokai, words which have had a varying English translation and are now rendered Imperial Japanese Marine Corporation.

Japan's influence, direct and indirect, on the development of modern types of warships would form an interesting study ; but this must be left to those who have taken an active part in the naval progress of the last two decades, or who have traced the connection between war experience and subsequent construction. One detail may be referred to here, and that is the design and construction of the *Tsukuba* and *Ikoma*, laid down at Kure Imperial Dockyard in 1904, and launched in 1905 and 1906 : armoured cruisers with a displacement of 13,750 tons and speed of 21 knots, provided for the first time in the development of the type with an armament of four 12-in. guns. These ships are regarded in Japan as initiating in some respects the evolution of the battle-cruiser type, afterwards so highly developed in our own Navy in association with other features of the Dreadnought type of battleship. In his own country the designer of the *Tsukuba* and *Ikoma*, Constructor Vice-Admiral Kondo has been duly honoured on their account ; it is interesting to note that he was a student at Greenwich in 1888-1890.

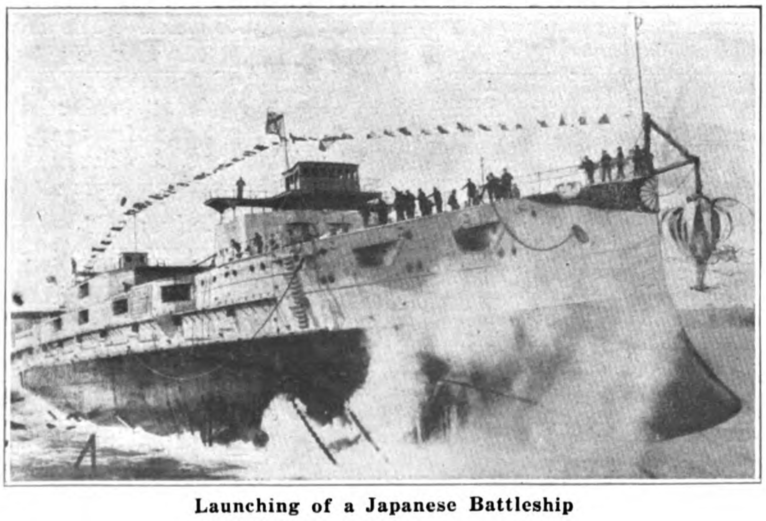
In the United States there have been a number of ships to which the Sperry Gyro Stabilizer has been applied, the largest being the troopship *Henderson*, of 10,000 tons displacement. Japan is the first country outside the U.S.A. to adopt this appliance; of dimensions, also, not previously attempted. The seaplane carrier *Hosho*, of 9,500 tons displacement, was completed at the Yokosuka Imperial Dockyard in 1922, and to make her more efficient she is fitted with the stabilizer.

On the engineering side developments have taken place corresponding to the progress made otherwise in maritime matters in Japan. In the Navy Department Engineer Rear-Admiral Fujii told us in 1911 of water-tube boilers of the "Miyabara" and the "Navy" type.

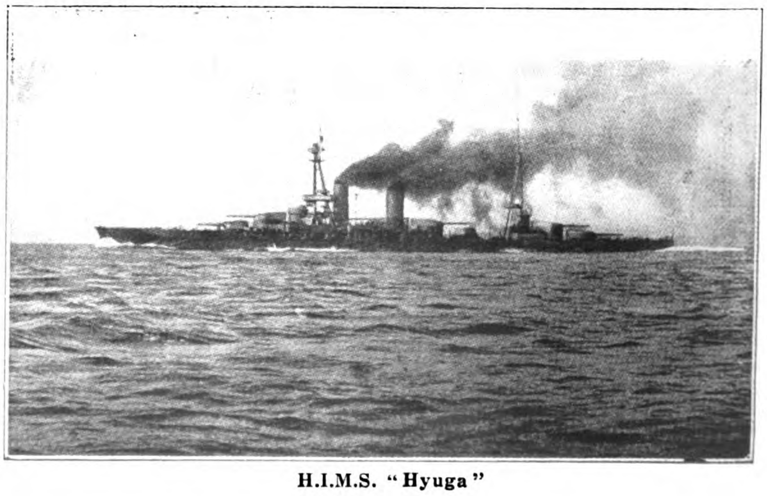
In the mercantile marine the first steamer to be built in Japan and driven by Parsons turbines (direct-coupled) was the *Tenyo Maru*, launched in 1907 and built by the Mitsubishi Shipbuilding Company at their Nagasaki shipyard. A little earlier this company purchased the right to manufacture the Parsons turbines, but imported from England those required for the *Tenyo Maru* and her sister ship, the *Chiyo Maru ;* in subsequent years, they built successively turbines direct coupled, triple-expansion engines exhausting into low-pressure turbines, and geared turbines with both single and double reduction, the turbines in all these cases being of the Parsons type. In a somewhat similar way the name of the Kawasaki Dockyard Company is associated with the manufacture in Japan of the Curtis turbine. The company secured the licence and built turbines of this type for both naval and mercantile vessel. More recently Diesel and other internal-combustion engines are receiving very considerable attention, the three types most in favour being the Vickers, the Sulzer, and the Camellaird-Fullagar; the right to manufacture these engines has been secured by various engineering companies in Japan. Besides these principal types, other types of internal-combustion engines are being made by one and another of the numerous small engine works so characteristic of industrial Japan.

For the education of its future shipbuilders Japan, like this country, has always had the drawing offices of its various establishments, naval and private, as the main fields. In various places technical institutions and night schools have supplied, with more limitations, similar instruction to that provided by such institutions in this country.

The future labour conditions in Japan are going to be no less difficult than elsewhere. Owing to the rush for production during the war, wages rose to an inordinate extent, and, as elsewhere, the high cost of living has since operated against reduction. The present low value of the yen no doubt makes high wages less of an incubus ; on the other hand, neither in steel material nor in wood is the country self-supporting, and the low exchange makes the cost of these and other imports a too serious set-off againt the gain in wages. A rather disturbing element also, in labour, only too noticeable during a period of lessening production, is a sort of principle that workmen once employed must receive compensation if discharged. In Japan, as perhaps everywhere, the solution, or even partial solution, of labour difficulties is a first necessity to the country's prosperity.



Launching of a Japanese Battleship

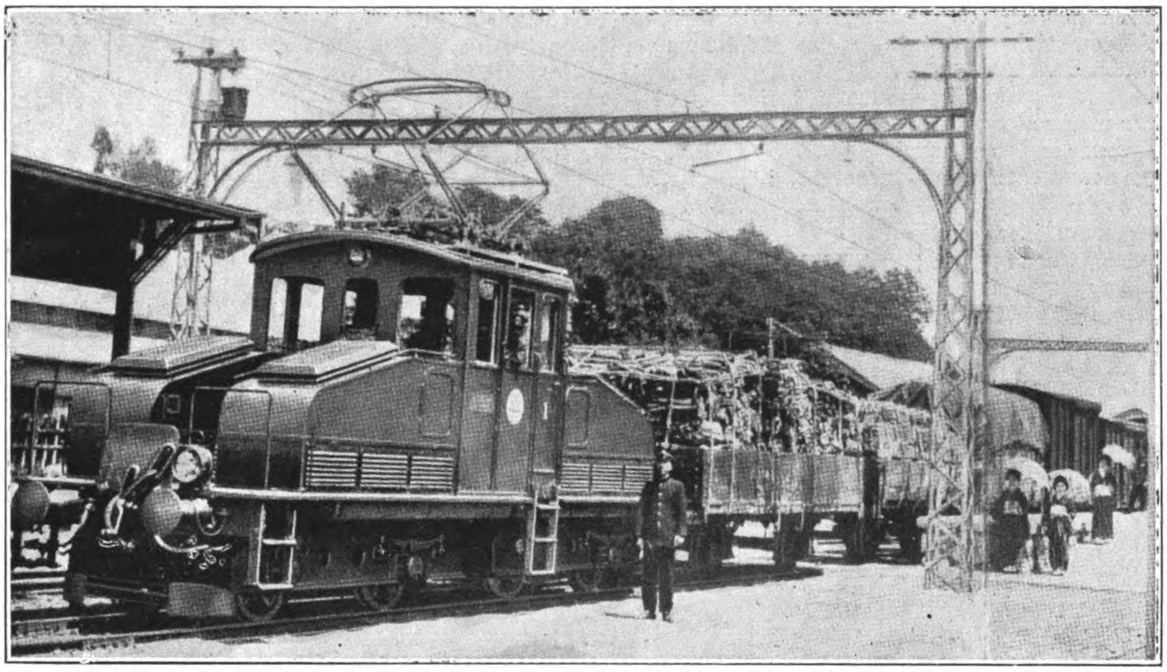


H.I.M.S. "Hyuga"

Direct-Current Locomotives for the Yoshino Railway, Japan

AT the end of 1923 Brown, Boveri & Co. delivered to the Yoshino Railway Company of Japan a four-axle goods locomotive. Its performance under working conditions so pleased the purchasers that in May 1924 two more similar locomotives were ordered, which were delivered some time ago.

The track of the Yoshino Railway is situated in the mountainous country to the south-east of Osaka, and is famous throughout Japan for the magnificent orchards of cherry trees through which it passes. Every year, at the blossom time, groups of excursionists, including many pilgrims, visit the numerous temples and shrines found in the vicinity of Yoshino. The hills and mountain slopes near the railway are covered with thick woods; hence the transport of timber forms a considerable proportion of the traffic on this line.



YOSHINO RAILWAY, JAPAN
Goods Train drawn by a B-B Locomotive in Shimoichiguchi-Station

The Yoshino Railway runs from Yoshino to Yoshino-guchi, where it connects with the Japanese Government Railways. The rails are laid throughout on their own separate track. The length of track is 11.6 km., and the gauge 1,067 mm. (3½-ft.), which is the same as that used almost exclusively in Japan, especially on the Government railways. The maximum gradient on this line is 2 per cent.; the smallest radius of curvature on the open track is 160m., and 120m. where points occur; the admissible axle pressure is 8 tons per axle. A new line from Yoshinoguchi to Unebi, which is 13 km. in length, and includes short inclines of 3.3 per cent., is under consideration and will later be joined to the Yoshino Railway.

The Yoshino Railway was previously steam operated and was only electrified in 1922–23. The system of supply selected was 1,500 v. direct current; this is furnished by a sub-station, the mean trolley-wire pressure amounting to 1,400v. The trolley wire is suspended throughout from a single messenger wire, which in turn is supported by steel lattice poles fitted with cross members, the construction of which varies according to the span; the height of the trolley wire above the upper surface of the rails is 4.1-5.2 m.

The goods locomotives referred to were intended primarily for the transport of timber, but also for passenger traffic should it be necessary. The purchaser's stipulated perform-

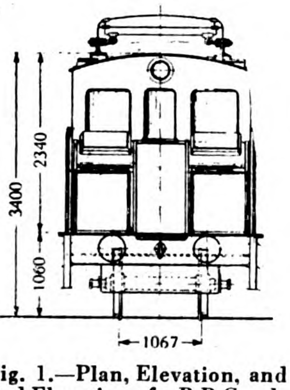
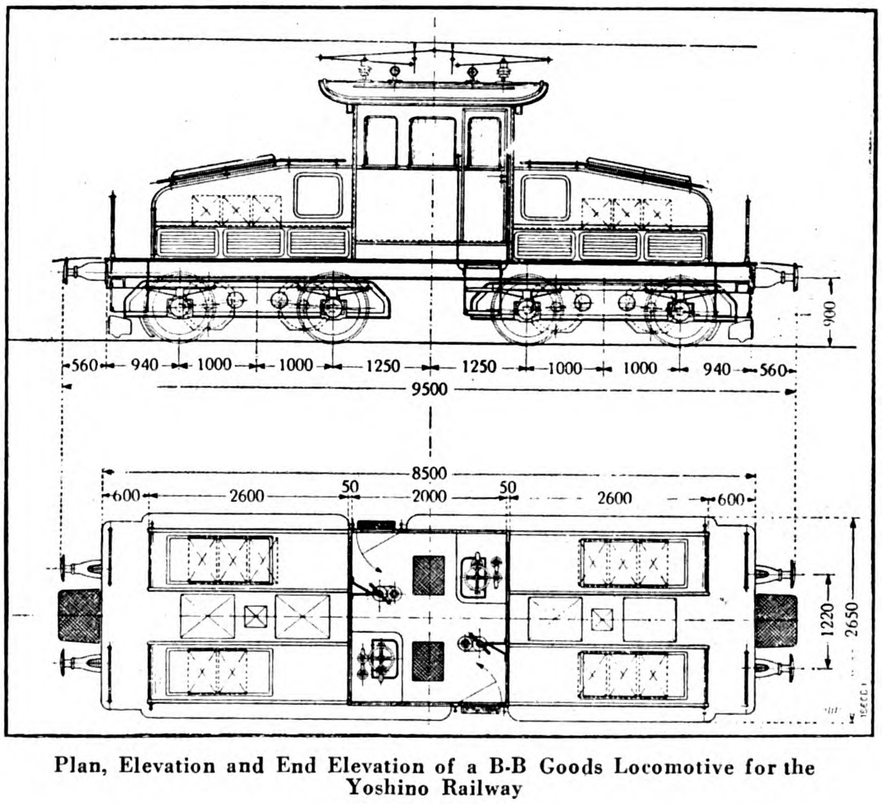


Fig. 1.—Plan, Elevation, and End Elevation of a B-B Goods Locomotive for the Yoshino Railway



Plan, Elevation and End Elevation of a B-B Goods Locomotive for the Yoshino Railway

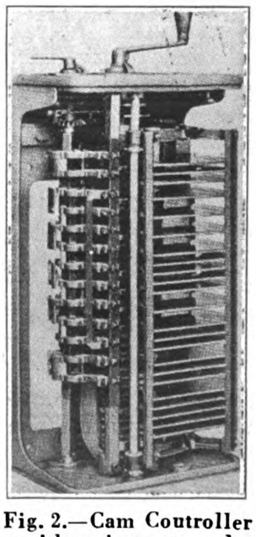


Fig. 2.—Cam Controller with casing removed

ance was, that when loaded with 150 tons, the locomotive should be capable of attaining a speed of 19 km. per hour on a 2 per cent. incline, and a maximum speed, on the level, of 40 km. per hour. To fulfil these conditions the locomotives were designed for a continuous rating of 240 h.p. at the shafts, to be developed by the driving motors running at 750 r.p.m. with a trolley-wire pressure of 1,400 v. The chief particulars are given in the following table :—

Length over buffers	9,500 mm.
Length of frame...	8,380 mm.
Maximum width of body	2,300 mm.
Maximum height of roof above rails	3,400 mm.
Diameter of driving wheels	860 mm.
Wheel base of bogies	2,000 mm.
Distance between bogie centres	4,500 mm.
Weight of mechanical portion	15.4 tons
Weight of electrical portion	8.7 tons
Total weight of locomotive	24.1 tons
No. of motors	4
Type	direct-current, series-wound
1-hour rating per motor at tread	75 h.p.
Continuous rating per motor at tread ...	60 h.p.
Terminal voltage across each pair of motors...	1,400 v.
Gear ratio	4.93 : 1

Fig. 1 gives a general idea of the design and dimensions of the locomotive, while on the preceding page is a photograph of a locomotive attached to a goods train.

The mechanical part consists chiefly of two two-axle bogies and a rolled-steel frame upon which is built the small body of the locomotive and the two extensions or end casings. The central portion comprises the driver's cab, which is fitted with two complete driver's stations situated in each case to the left hand looking in the direction of travel. This arrangement is contrary to the usual practice of providing a single central driver's station. The cab is constructed of steel and wood, with a double wooden roof to protect the driver from the heat of the sun. Three windows, one of which is moveable, are provided on every side of the cab, and two doors are fitted.

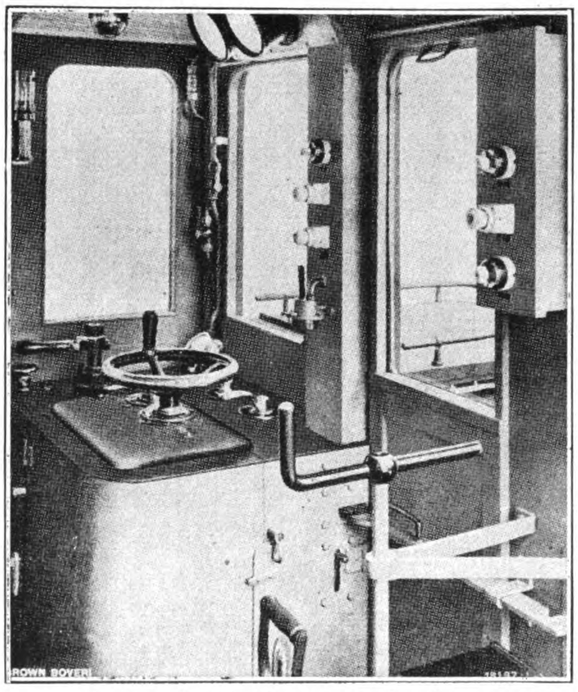


Fig. 3.—Interior of driver's cab, showing one of the control desks

On each of the end walls of the driver's cab a control desk is provided, which contains a controller, control valves for the current collector, and for the main switch, also the compressor motor and an air-brake valve. The steel end casings at the front and rear of the cab contain the starting resistances, the main switch, the air compressor, the lighting battery and various fuses. As shown in the photograph on the preceding page, each of these casings is made in two parts with a clear gangway between them. A means of inspecting the enclosed apparatus is provided by inspection covers, partly interlocked with the actuating valve for the current collector, fitted in the control desk, the walls of the cab and the end casings. Certain inspection covers, including those of the driving motors, can be opened from the above-mentioned gangways between the two parts of the casing. Each end casing has louvred openings and an air intake for cooling the resistance and for supplying air to the compressor.

The underframe of the body is made of rolled steel sections. In accordance with the standard practice of the Japanese Government railways, central draw-gear and double-buffers are fitted. Both bogies are constructed of sheet steel and rolled steel sections. Simple laminated springs are employed which are supported on the axle-boxes ; these are fitted with pad-lubricated journal bearings of the usual type. The eight brake blocks of the locomotive can be applied by hand, from either of the driving positions, or by a direct-acting Westinghouse compressed air brake equipment which works on the same linkwork as the hand brake. The mechanical parts of the locomotive have been constructed by the Swiss Coach Works, Schlieren, near Zurich.

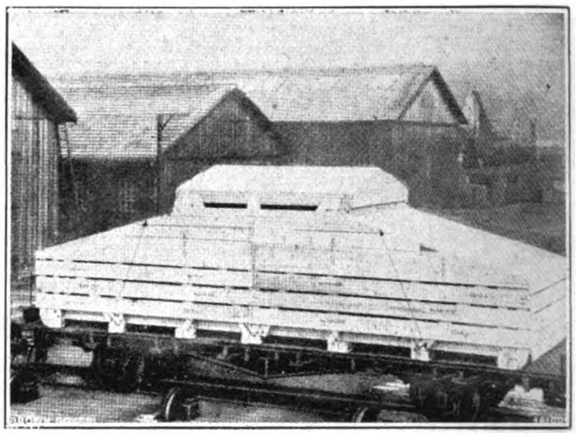


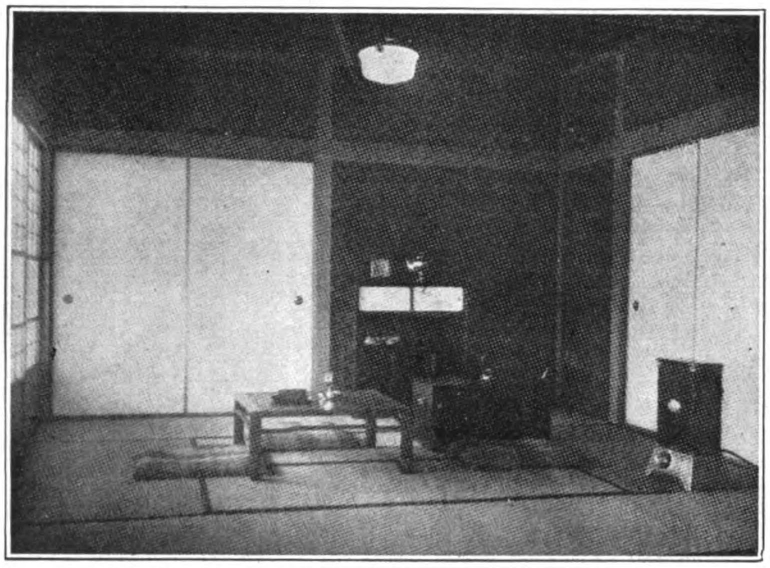
Fig. 4.—Locomotive ready for transit

The electrical equipment is as follows :—Each axle is driven by a self-ventilated D.C. series motor, Type GDTM6, as used for tramways. These motors have a one-piece casing. They can be used easily in a metre-gauge locomotive so that the field of application of this type is considerably widened. The motors in each bogie are permanently connected in series, but the two groups so formed are arranged for series-parallel control. Contrary to the practice hitherto general for pressures in excess of 1,000 v., a controller with remote control from the control desk is not employed in this case, but each desk has incorporated in it a vertical hand operated controller externally resembling those used on tramcars. These differ from tram controllers, however, in that they do not make and break the circuits by means of contact segments and contact fingers mounted on a drum ; but as with the larger electric motor coaches and locomotives on high-tension railways, the main drum is replaced by a number of contractors controlled from a cam-shaft and provided with electro-magnetic blow-out coils to ensure reliable interruption of the arcs formed. The controller is arranged for series-parallel control of the two pairs of motors, it is provided with six series and four parallel running positions, and, on rotating the cam-shaft in the reverse direction, resistance braking is obtained for seven positions of the control lever. By means of a second drum the direction of the locomotive can be reversed, or either pair of motors can be disconnected should a defect develop (Fig. 2).

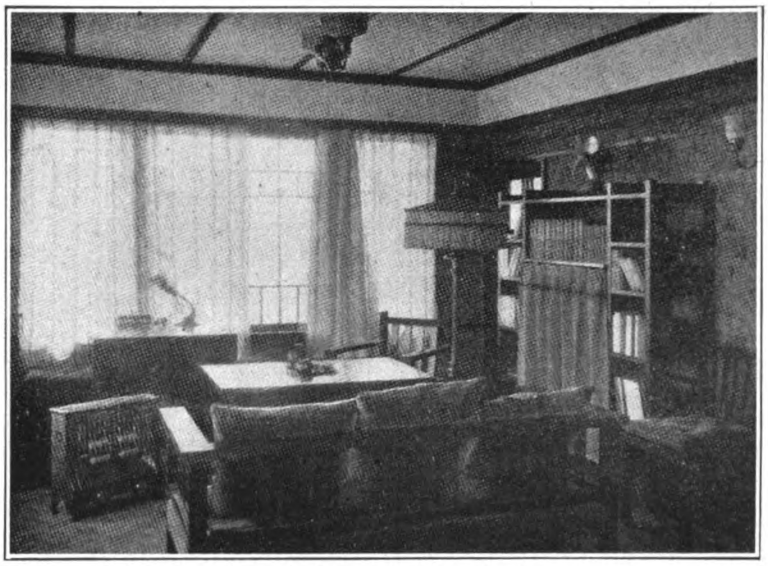
The starting and braking resistances consist of cast-iron elements assembled in frames situated under the end casings of the locomotive. The automatic main switch and the pantograph current collector are operated pneumatically from the control desk. A motor-compressor set, Type GC2, supplies the compressed air for the above apparatus and also for the Westinghouse brake equipment. This set, which is supplied with current at trolley-wire pressure, compresses 590 litres of free air per minute to a pressure of 4.5-6 kg. per sq. cm. The current for lighting the locomotive is supplied by a small 12 v. accumulator battery, which is periodically recharged at a charging station. The driver's cab is heated by two heating elements and two electrically-heated foot-plates, all connected in series and supplied with current from the trolley wire.

The electrical equipment was constructed by Brown, Boveri & Co. in their works at Baden and Munchenstein.

Messrs. Smith, Major and Stevens, Ltd., of Northampton, have published another interesting illustrated catalogue, showing the tremendous improvements that have been made in door springs, the manufacture of which has apparently developed into a science. The purpose of a door spring is to make it possible to open and close a door with a maximum of ease and a minimum of noise. A reading of the catalogue easily shows how the products of this firm accomplish this purpose.



Tea Room of Japan's First Home Electric



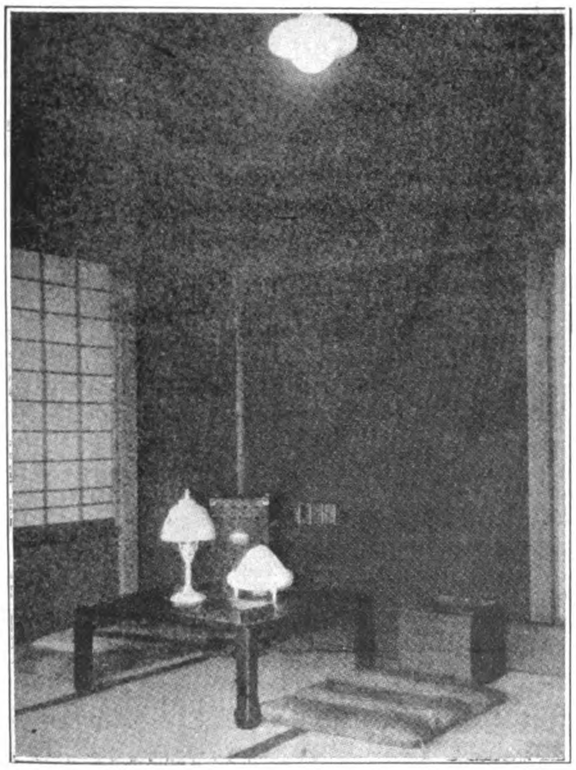
The Library on Second Floor, furnished after the manner of the Occident

The Opening of Japan's First Home Electric

F. D. Fagan, Tokyo Electric Company

WHEN an electric home for Japan was proposed there seemed to be no association under whose auspices it could be demonstrated. Those interested in the electrical industry have not, up to date, formed an association similar to that of the Contractors, Dealers and Jobbers, and the Society for Electrical Development that exist in America, but the tendency is toward the forming of such association in Japan, and within the next six months some general association is likely to be formed that will function to the interests of all the electrical industry.

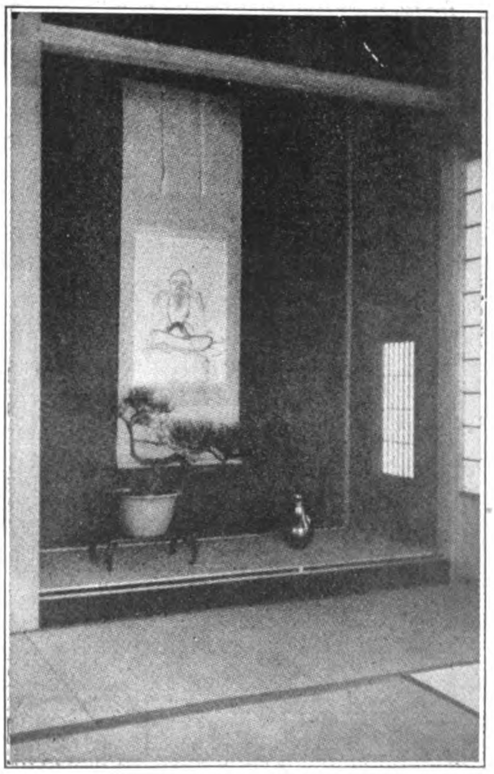
To introduce the Home Electric a committee was appointed by the sales manager of the Tokyo Electric Company, and after a few weeks' investigation arrangements had been made with a representative group, including one of the leading newspapers of Tokyo, the *Tokyo Nichi Nichi*, a building company, a real estate company, an electric street car company, a department store, a manufacturer of electrical heating and cooking devices, and the Tokyo Electric Company, a manufacturer of incandescent lamps. These companies formed a committee and arranged for the division of expense and investment in the building of an electrical home. The real estate company agreed to take over the home at the expiration of the demonstration period.



Bedroom

The home was built, and consisted of entrance hall, living room (foreign style), sun parlor, dining room, kitchen and bath-room (Japanese style) on the first floor. On the second floor a library (foreign style) and bedroom (Japanese style). These rooms were furnished and completely equipped with electrical devices for lighting, heating and cooking, the kitchen being a complete electric one in which was installed a two-plate electric range.

On October 11 the opening ceremony was held. There were in attendance Japanese girls trained to talk on the uses of various devices, and one of them was assigned to each room. As the home was open from 8.00 a.m. until 8.00 p.m., two shifts of girls were employed. About eighty invited guests attended, it not being customary to open such affairs by inviting the general public. Viscount Shibusawa, one of the best-known men in Japan, made a short opening address and pressed the button that started the electricity through the house. Many important officials, college professors and prominent members of the electrical industry were at the opening ceremony. The home was opened to the public October 12, when a large group of ladies, especially invited by the *Tokyo Nichi Nichi*, inspected the electric home and listened to lectures on home lighting and home building. On October 16 the dealers of Tokyo were invited to be guests of the Tokyo Electric Company and, after visiting the Home Electric, took part in a track and field meet, where all were entitled to enter. Approximately one thousand dealers accepted the invitation, in spite of the fact that it was a rainy day. This was the first gathering of electrical contractors and dealers ever held in Japan, and was reported as a very successful day, and had the effect of bringing about a better feeling between the contractors and dealers.



The Tokonoma, in which are placed choice works of art

On October 26, at 1.30 p.m., the Princess Dowager was a visitor, and was very much interested in the various demonstrations of the use of electricity in the home. Many other prominent people were reported as visitors, among them Viscount Shibusawa, Baron Mitsui, Mr. Nakamura, Mayor of the City of Tokyo, Dr. G. Yamakami, Dr. Yamamoto, Dr. B. Natomi, Dr. K. Kishi, and Mr. Y. Kamata, former Minister of the Department of Education.

On October 29 a lecture on home electrification was given in one of the large meeting halls near Uyeno Park, and several hundred people attended.

During one week of the time that the home was open a special demonstration was held by the Mitsukoshi Department Store, which was interested in the Home Electric. This demonstration presented a purely Japanese home completely equipped electrically. It is estimated that in excess of 150,000 people attended.

The Home Electric was located in a suburb of Tokyo called Chofu, on an electric line running between Kamata and Meguro. The reason for selecting this particular site was that it was not the desire of the committee to secure a large number of curiosity seekers who were not really interested, and as the expense from the city of Tokyo was from 25 cents to 35 cents, we feel that all who came were interested parties and not merely attracted by curiosity. In Japan it is not customary to open a demonstration of this kind to the public all day. The morning was reserved for invited guests, when they were privileged to see the home between eight and twelve o'clock.

The weather was not as favorable during the twenty days as we should have desired, as we had seven cloudy and rainy days, but in spite of the weather and the fact that it was the first Home Electric to be built in Japan there were 16,000 visitors, the largest attendance being on the last day, 2,636 people. The smallest attendance was 44 on a day when there was a pouring rain.

The general opinion of all interested is that the Home Electric was a great success, and those investing money and sharing part of the expense are well pleased with the result. The fact that such progress has been made here is of great significance to those interested in the development of the electrical business in Japan.

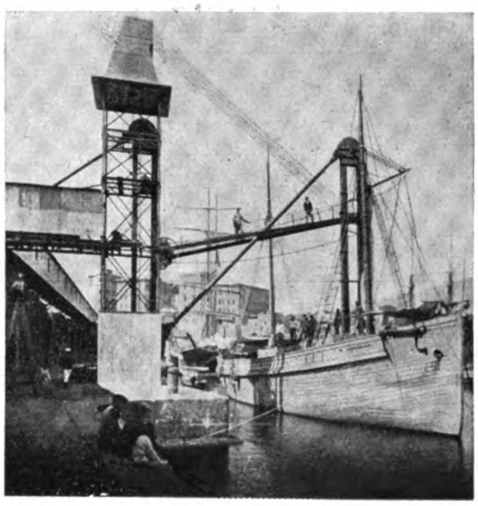
The home was purchased prior to its closing day by Mr. Shibusawa, and he will make it his permanent residence.

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 Employees abt. 2,000



Moulin Feola & Jeandeau Drydock Crane in Action

SPECIALITIES:

Portland Cement Works
Brick and Tile Making Plants
Chocolate and Cocoa-Factories
Breweries and Malteries
Powder and Celluloid-Presses
Crushing and Breaking Machinery
Silico-Calcareous Brick Works
Paste-Goods Factories
Briquetting Plants
Rice-Mills
Roller Mills for Soap and Paint Manufacture
"Duplex" Newspaper Printing Presses
Conveying Plants of every kind

For particulars apply to the

Far Eastern Office: BUHLER BROTHERS

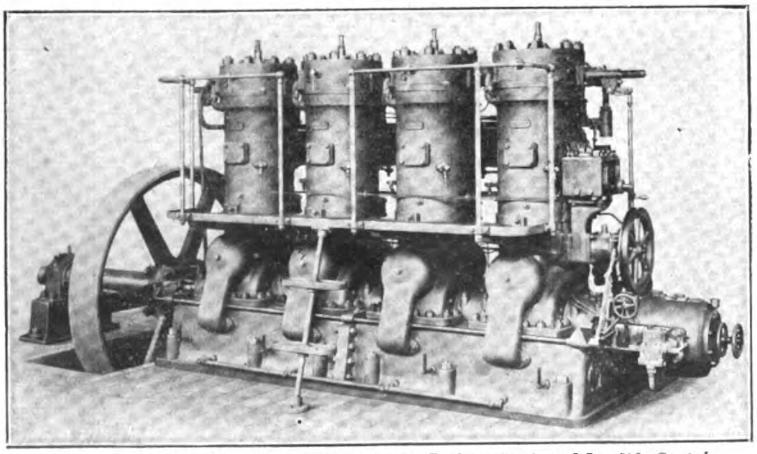
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE

4 AVENUE EDWARD VII.

蘇爾壽工程事務所
上海愛多亞路四號
本公司常備目錄供給各界
垂詢工程事務亦易誠酬答



Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, Stationary and Marine Diesel Engines, AIRLESS INJECTION DIESEL ENGINES, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

4-CYLINDER AIRLESS INJECTION DIESEL ENGINE

SIMPLE DESIGN; SIMPLE ATTENDANCE; RELIABILITY AND ECONOMY

WINTERTHUR. SWITZERLAND.

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.
NOV 11 1925

THE FAR EASTERN REVIEW

FINANCE ENGINEERING COMMERCE

遠東時報

上海仁記路拾六號

TARIFF AUTONOMY FOR CHINA

UNIFICATION OF ADMINISTRATIVE CONTROL OF THE RAILROADS OF CHINA

CAN EXTRATERRITORIALITY BE ABOLISHED IN CHINA

MR. BYWATER'S FRIGHTFULNESS

THE DEVELOPMENT OF THE PORT OF DAIREN

PETROLEUM IN THE PHILIPPINES

PETROLEUM IN WEST CHINA

LUNGHAI RAILWAY EASTERN EXTENSION

HISTORY OF BAMBOO STEEL

Vol. XXI September, 1925 No. 9

Reconstruction Number

of

The Far Eastern Review

PRESS REVIEWS

North-China Daily News:

An Echo of the Earthquake

The Reconstruction Number of the "Far Eastern Review," which has just come off the press, is one of the most remarkable publications ever issued in the Far East. Consisting of more than 400 large quarto pages, the magazine gives a fully illustrated and graphic account of the efforts of the Japanese Government and Japanese engineers to reconstruct Tokyo and Yokohama. Excellent reproductions of photographs depict the enormous damage done by the earthquake over a wide area and also the feats of reconstruction the Japanese have accomplished since. To Chinese, this publication ought to be of the utmost interest at this time, when so much of the wealth of the country is being wasted in destructive efforts, while Japan is constantly forging ahead because of the constructive genius of the Japanese people. Although primarily of interest to engineers many others will feel that $5.00, at which price this special issue is sold, will be well invested in acquiring a copy. It is printed by *The North China Daily News* and is on sale at all booksellers.

Shipping and Engineering:

Mr. George Bronson Rea, Editor and Publisher of the *Far Eastern Review*, Shanghai, is heartily to be complimented on the Japanese Reconstruction Number of the Journal, which has just made its appearance, and which is probably the most valuable, interesting and praiseworthy issue of any periodical that has yet been printed in the Far East. Dedicated to the Japanese engineer, "whose monument will ever be the recreation of Tokyo and Yokohama after the terrible earthquake and fires had reduced those cities to veritable dust," this noteworthy issue of a monthly magazine which already stood in a class alone and apart, constitutes a printed and pictorial record of one of the mightiest industrial and engineering efforts in history—the reconstruction of Japan's capital and her largest port after one of the worst calamities in the records of mankind; and one cannot pay the *Far Eastern Review* a greater compliment than by saying that the Reconstruction Number is a worthy record and appreciation of the mighty effort its pages depict so well. As an example of the printer's art, too, it stands as a glowing testimony to the *North-China Daily News & Herald, Ltd.*, which, with all its long record, has done nothing better than this, and has produced a magazine of more than 400 pages in a manner which could not be improved on by any printing concern in the world.

Hongkong Telegraph:

Japan's Reconstruction

It is now just two years since the greatest calamity that Japan had ever known in her history affected a large area of her most populous territory—destroying one of her large seaports and wrecking a great deal of her capital. There was terrible loss of life, and scenes of horror such as only a vast catastrophe can give rise to. There was not a single country of the world that did not deeply sympathise with the Land of the Rising Sun in its disastrous grief, and help came pouring in from all sides. It was realised that the country's sorrows were such as to render its programmes of development nugatory to a large extent, and it was perhaps wondered in some quarters whether the land was not actually crippled for some time to come. However, with characteristic energy, the Japanese people and Government immediately proceeded to remedy the effects of the stroke of fate that had been dealt them, and within a few months everything went on almost as usual. The terrible effects of the great earthquake are still evident at both Yokohama and Tokyo, but a great amount of reconstruction work has been accomplished. In the comparatively short space of two years the Japanese engineers and their assistants have rebuilt much that had been destroyed, and it should not be long before practically all the broken achievements of the past are replaced. We are reminded of this achievement by the recent publication of a journal devoted to a description, graphically illustrated, of the feat that the reconstruction department has performed—and it is undoubtedly an accomplishment of which the Japanese nation can be justly proud; and which should form an example to certain other races which put words before deeds, and get no further along the road of progress.

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum.

VOL. XXI SEPTEMBER, 1925 NO. 9

CONTENTS:

	PAGE
TARIFF AUTONOMY FOR CHINA	583
UNIFICATION OF ADMINISTRATIVE CONTROL OF THE RAILROADS OF CHINA..	588
CAN EXTRATERRITORIALITY BE ABOLISHED IN CHINA?	590
MR. BYWATER'S FRIGHTFULNESS	591
THE DEVELOPMENT OF THE PORT OF DAIREN ..	*592
PETROLEUM IN THE PHILIPPINES	*595
THE PROBLEM OF TRADE MARK PROTECTION IN CHINA	599
PETROLEUM IN WEST CHINA	*600
LIGHTING THE BUND OF SHAMEEN	*604
THE LUNGHAI RAILWAY EASTERN EXTENSION ..	*605
COPPER IN THE PHILIPPINES	*609
CLARK H. MINOR, NEW HEAD OF I. G. E.	*610
THE ELECTRICITY SUPPLY OF SHANGHAI	*611
THE SELEMDJA ALLUVIAL GOLD DEPOSITS.. ..	*614
CHINA'S TIN INDUSTRY	*617
HISTORY OF BAMBOO STEEL	619
NEW P. & O. STEAMERS	*621
THE SIAMESE GUNBOAT "RATANAKOSINDR" ..	*623
J. G. BRILL COMPANY'S GASOLINE CARS	*626
A NEW ARMSTRONG-WHITWORTH PNEUMATIC GRINDER	*629
BRITISH COMPETITORS' POSITION IN EASTERN RAILWAY CONTRACTS	629
TIENTSIN NATIVE CITY WATERWORKS CO. ..	*630

Illustrated with Maps or Photographs

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allan, Whyte & Co., Ltd. 27
Allen & Co., Ltd., Edgar 11
American La France Fire Engine Co., Inc. 73
American Locomotive Sales Corp. .. 25
American Tool Works Co. 1
Armstrong, Whitworth & Co., Ltd., Sir W. G. 19
Associated British Locomotive Manufacturers for China .. 49
Attwater & Sons 48
Avery, Ltd. W. & T... 11

Babcock & Wilcox, Ltd. 36
Baldwin Locomotive Works .. 65
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 17
Bethlehem Steel Export Corp. .. 31
Bliss Co., E. W. .. Under Index
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Brown & Sons, Ltd. David 3
Browning Co., The 63
Bucyrus Company 63
Buhler Brothers 630
Butterfield & Swire 44

Canada Carbide Co., Ltd. 70
Chambers Scott & Co., Ltd. .. 14
Chartered Bank of India, Australia & China 48
Columbia Ribbon & Carbon Mfg. Co. 72

Daido Electric Power Co., Ltd. .. 28
Dai-Ichi Ginko Ltd. 62
Dai Nippon Brewery Co. 34
Diamond State Fibre Co. 74

Dixon Crucible Co., Joseph .. 70
Dodge Brothers 5
Drewry Car Co., Ltd. 15

Electricity Department, S. M. C. .. 6
Escher Wyss & Cie 16
Etchells Congdon & Muir, Ltd. .. 74
Evans & Sons (Wolverhampton) Ltd., Joseph 2
Exchange Bank of China .. 61

Fairbanks Co. 21
Fairbanks Morse & Co. 72
Fuji Gassed Spinning Co. 10

Gaspary & Co., Dr. 14
Gleniffer Motors, Ltd. 15
Goodell Pratt Co. 72
Goulds Manufacturing Co. .. 14
Green Island Cement Co., Ltd., The 20
Greene Tweed & Co. 74

Hennef Engineering Works .. 50
Hongkong Rope Mfg. Co. Ltd. .. 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co., Ltd. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. .. 58
International Banking Corporation 55
International General Electric Co., Inc. 51

Japan Sugar Co., Ltd. 6
Jardine Engineering Corp., Ltd., The 12
Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. .. 10
Kawasaki Dockyard Co., Ltd. .. 33
Kokusai Kisen Kaisha 45

Link-Belt Co. 73
London Directory Co., Ltd. .. 50

Mather & Platt, Ltd. 2
McConway & Torley Co. 14
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd... 38
Mitsubishi Marine & Fire Ins. Co., Ltd. 38
Mitsubishi Shoji Kaisha 18
Mitsubishi Warehouse Co., Ltd. .. 38
Mitsubishi Zosen Kaisha, Ltd. .. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. Ltd. 18
Mitsui Bussan Kaisha Ltd. .. 26
Mustard & Co. 14

Nippon Menkwa Kabushiki Kaisha 52
Nippon Yusen Kaisha .. 46, 47
Nipponophone Co., Ltd. 34
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. .. 24
One Hundredth Bank, Ltd., The .. 59
Osaka Shosen Kaisha 42
Oster Manufacturing Co. 73

Petters, Ltd... 35
Pooley & Son, Ltd., Henry .. 4

Redpath Brown & Co., Ltd. .. 15
Reuther & Reisert, C. 50
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 70

Sale & Frazer, Ltd... 8

Shanghai Dock & Engr. Co., Ltd. .. 32
Shanghai Municipal Council 6
Shibaura Engineering Works, Ltd. .. 7
Siemens China Co. 36
Simons & Co., Ltd., Wm. 13
Smidth & Co., F. L. 41
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. 27
Standard Oil Co., of N. Y. 29
Standard Underground Cable Co. .. 14
Stewarts & Lloyds, Ltd. 16
Sturtevant Co., B. F. 63
Sulzer Bros. 630
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd. 60
Superheater Co., The 17

Thornycroft & Co., Ltd., John I. .. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 50

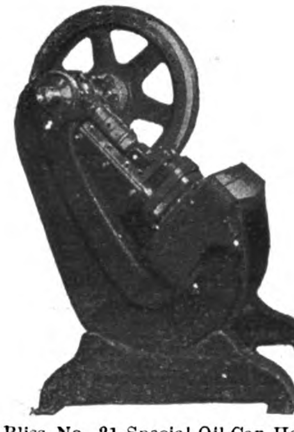
Ujigawa Electric Power Co., Ltd. .. 50
United States Steel Products Company .. ..23, 37, Back Cover

Waggon-und Maschinenbau Aktiengesellschaft Gorlitz 71
Wallace & Tiernan Co., Inc. 17
Walworth International Co. 4
Westinghouse Electric International Co. 76
Williams & Co., J. H. 3
Worthington Pump and Machinery Corporation 75

Yarrow & Co., Ltd. 21
Yasuda Bank, Ltd. 62
Yokohama Dock Co., Ltd. 34
Yokohama Specie Bank, Ltd. Cover
York Manufacturing Co. 35

ONE OF THE MANY TYPES OF TIN CONTAINERS

MADE ON BLISS MACHINERY.



Bliss No. 21 Special Oil Can Head Press.
For blanking and forming tops and bottoms of rectangular oil cans.

For the manufacture of rectangular olive oil or cottonseed oil cans such as illustrated above, we build complete lines of machines.

The machine shown is one of a number required for making approximately 2,500 cans per day of the type illustrated.

Building machinery of this kind has been our specialty for over 68 years. Our machines embody the most modern and best devices developed by experience in actual use.

In order to quote intelligently on the equipment best adapted to your work be sure to send us samples or sketches showing dimensions and state the approximate daily production you wish to obtain.

BLISS FOR MACHINERY

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N. Y., U. S. A.**

American Factories: BROOKLYN, N.Y. HASTINGS, MICH. CLEVELAND, OHIO. SALEM, OHIO.

FOREIGN SALES OFFICES AND FACTORIES:

ENGLAND, Pocock St., Blackfriars Rd., S. E., London ITALY, 345 Via Nizza, Turin FRANCE, 54 Blvd. Victor-Hugo St. Ouen, Paris

FOREIGN REPRESENTATIVES:

India—Duff Engineering Co., Ltd., D. S. Clive Building, Calcutta

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, SEPTEMBER, 1925 No. 9

Tariff Autonomy for China

An Analysis of the History of the Tariff in China—The Movement for Autonomy—The Attack on British Predominance in the Customs Service

THE tariff problem in China differs from similar problems in other countries in that China has not the right to increase her tariff without the consent of a large number of other Governments, some of them Great Powers, others, small and unimportant European or South American States. China lost this right in the first war with a European Power, the so-called Opium War, which ended in the signing of the treaty of Nanking in 1842. Although the Chinese contend that that war was fought over the question of opium, not a word is said with regard to the drug in the Treaty, but trade and the rights of foreigners to trade in China is discussed at great length. From the standpoint of the British, this was not a war to force China to purchase opium, but to force China to recognize the equality of nations, the right of one people to hold intercourse and to have commerce with another. This right had become well-established in Europe. It was still unknown in Asia. Although the economic ideas of the time, suggest a wide *laissez faire* policy ; yet it was nowhere contended that a country could not take steps to regulate the import of goods and the outflow of gold and silver, although the free traders in England, under the influence of Adam Smith's objections to mercantilism believed that any impediments to trade were disastrous.

Such were the ideas of the first Britons who came to trade with China and who not only found that there were numerous impediments to trade, that mercantilism was the dominant economic doctrine, but that the administration of the government of the country was such that any official could place such exactions upon trade as to make it precarious. They found that the Viceroy of the Liang Kwang and the Hoppo of Canton preferred smuggling to the establishment of a regularized system because they personally profited more from the smuggling. They found that instead of being permitted to land in peace, to visit the country freely, to study the market, to have intercourse with the people. Instead, they were couped up in a small island. They were forced to deal through an association of merchants, the co-hong, which hampered trade, gave the foreigners misinformation and working together with the officials, caused exactions to be levied on goods, which made trading in the usual commodities of commerce, cotton and woollen goods, outside the scope of the standard of living of the people. Opium was the profitable commodity of commerce. But the trade in opium was illegal and caused economic distress because so much of the silver of the country was exported to pay for this ruinous articles of commerce.

The opium trade proved particularly offensive to the Emperor of China, Taokwang, and to Commissioner Lin, who had been appointed by the Government to suppress the opium trade. Commissioner Lin was a man of integrity and ability. To him, opium represented not only bad national economics but bad morals. Opium was vice. But the foreigners could not deal with Commissioner Lin directly. They could only reach him through the Co-hong. To misunderstanding was added misunderstanding. To irritation was added irritation until war resulted. In the war, China was defeated.

The subsequent treaty lost for China, tariff autonomy. In treaties which were later made with other nations the " most favored nation clause " was inserted, so that all Treaty Powers enjoyed the right of participation in the regulation of China's tariff. This condition exists to this day.

The amount levied on good in China in accordance with the various treaties and agreement was a 5 per cent. *ad valorem* duty. Often, the actual market value of goods made it necessary to hold conferences to bring the duty up to an effective 5 per cent. During recent years, the Treaty Powers have agreed to a famine relief fund surtax. Duties of 5 per cent. are levied on exports as well as imports and there is a tax on goods exports, as between ports.

In 1902, a treaty was arranged between Great Britain and China, known as the MacKay Treaty, by which it was hoped that China might obtain a more equitable arrangement with regard to her tariff rights. Goods in China, in transit, are taxed either under a system known as Likin or through the Chinese Maritime Customs on a transit pass. Morse describes Likin as follows :

Likin

" The exigencies of the Government during the Taiping rebellion drove the authorities to devise new forms of taxation, and Likin (" contribution of a thousandth ") was instituted. It was first heard of in 1853 ; and about 1861 when the active suppression of the rebellion called for largely increased expenditure, it was applied generally to all the Provinces then under the control of the Imperial authorities. The original theory of the levy, one-tenth of one per cent. on the value, imposed no great burden on trade, a tax of the same amount levied as wharfage dues for the maintenance of the foreign municipalities at Shanghai, Tientsin, Hankow and elsewhere, being scarcely felt ; but practice soon parted company with the theory, and the official rates were much increased. Nor is the tax uniform in its incidence in all the Province. Hunan is proud of its independence and freedom from non-customary exactions, and in this Province the payment once of the full tariff rate of likin exempts goods from further payment within the provincial limits, while the accretions and irregular exactions are less than elsewhere in China ; Hunan is, however, exceptional. Kwangtung is more nearly typical of the Empire ; here between Canton and Wuchow, a distance of about two hundred miles on the West River, there are six Likin " barriers," each constituting a barrier to the free movement of traffic, and each involving delay, vexation, and payment. Along the Grand Canal between Hangchow and Chinkiang, likin stations, alternately collecting and preventive, are established at distances averaging ten miles one from the other and in that part of Kiangsu lying south of the Yangtze there are over 250 stations, collecting or preventive. . . . . . . To get at the amount paid by the people is more difficult in the case of likin than of other taxes. The land tax and the grain tribute are assessed according to registers very strictly kept, and both are under the control of the Hsien (District Magistrate), the 'Father and Mother of the People,' and yet as we have seen, the regular legal accretion is, at the very lowest estimate, from 100 per cent. up to almost anything in reason. Likin is a new levy with its own administration independent of all other taxing agencies, and the collection is much more in the hands of the officer in charge of each barrier and his subordinates than is possible with other taxes."

To avoid the payment of Likin, the "Transit Pass" was devised. By the Treaty of Tientsin (1858) it was agreed that a fixed sum might be paid at the port of entry or at the first likin station in addition to the regular customs dues. The certificate issued upon such payment exempted the goods from further payment of likin. This rule was applied to goods for export or import. The amount agreed upon is 2½ per cent. *ad valorem* in addition to the 5 per cent. collected by the Chinese Maritime Customs. The Transit pass has not always proved satisfactory. Mr. Gerald King in an article in the FAR EASTERN REVIEW discusses this subject:

"The transit pass is, of curse, a great deal better than nothing. The main difficulties are, that in order to see that the goods being conveyed are those covered by the pass the authorities at the various barriers must have the right of examination. This is just, as, did they not the dishonest merchant would be able to profit by it. But the power of examination gives them the chance of making additional squeezes, for they can always demand a *pour boire* for not examining: threatening to examine if it is refused, and so causing a delay of three or four days at each of the barriers to be passed. These difficulties will only cease with the total abolition of the barriers. . . . . If the merchant elects to move his goods without a Transit Pass, he must make his own arrangements with the authorities. This is usually done by large Chinese firms on the basis of a fixed monthly payment, or fixed sum for each movement of goods. The Government is doubly defrauded by this system, since the merchant pays on less goods than he moves, and the official reports less duty than the merchant paid. . . . .

"It sometimes happens that Likin officials will compete with the Transit Pass system, by offering a rate which is just cheaper than the cost of the pass, and of course arranging to the merchant's satisfaction that there will be no delays, disputes or attempts to avoid the bargain. This can only be done where the goods have not far to go, or they would pass other barriers than those under the control of the man with whom the original bargain was made."

The Sino-Japanese Treaty of 1896 which states this subject more clearly perhaps than any other treaty, reads:

Article X.—All articles duly imported into China by Japanese subjects or from Japan shall, while being transported, subject to the existing regulations, from one open port to another, be wholly exempt from all taxes, imposts, duties, likin, charges and exactions of every nature and kind whatsoever irrespective of the nationality of the owner or possessor of the articles, or the nationality of the conveyance or vessel in which transportation is made.

Article XI.—It shall be at the option of any Japanese subject desiring to convey duly imported articles to an inland market to clear his goods of all transit duties by payment of a commutation transit tax or duty, equal to one-half of the import duty in respect of dutiable articles, and two and one-half per cent. upon the value in respect of duty free articles; and on payment thereof a certificate shall be issued, which shall exempt the goods from all further inland charges whatsoever. It is understood that this Article does not apply to imported opium.

Article XII.—All Chinese goods and produce purchased by Japanese subjects in China, elsewhere than at an Open Port thereof and intended for export abroad, shall in every port of China be freed from all taxes, imposts, duties, likin, charges and exactions of every nature and kind whatsoever, saving only export duties when exported, upon the payment of a commutation transit tax or duty calculated at the rate mentioned in the last preceding Article, substituting export duty for import duty, provided such goods and produce are actually exported to a foreign country within the period of twelve months from the date of the payment of the transit tax; all Chinese goods and produce purchased by Japanese subjects at the ports of China and of which export to foreign countries is not prohibited, shall be exempt from all internal taxes, imposts, duties, likin, charges, and exactions of every nature and kind whatsoever, saving only export duties upon exportations; and all articles purchased by Japanese subjects in any part of China, may also, for the purpose of export abroad, be transported from open port to open port, subject to the existing Rules and Regulations.

The MacKay Treaty sought to obviate the difficulties arising from this double system of taxation. The preamble to Article VIII of this treaty reads:

Article VIII.—Preamble.—The Chinese Government, recognizing that the system of levying *likin* and other dues on goods at the place of production, in transit, and at destination, impedes the free circulation of commodities and injures the interests of trade, hereby undertake to discard completely those means of raising revenue with the limitations mentioned in section 8.

The British Government, in return, consent to allow a surtax, in excess of the Tariff rates for the time being in force to be imposed on foreign goods imported by British subjects and a surtax in addition to the export duty on Chinese produce destined for export abroad or coastwise.

It is clearly understood that, after *likin* barriers and other stations for taxing goods in transit have been removed, no attempt shall be made to revive them in any form or under any pretext whatsoever; that in no case shall the surtax on foreign imports exceed the equivalent of one and a half times the import duty leviable in terms of the Final Protocol signed by China and the Powers on the 7th day of September, 1901; that payment of the import duty and surtax shall secure for foreign imports, whether in the hands of Chinese or non-Chinese subjects, in original packages or otherwise, complete immunity from all other taxation, examination or delay; that the total amount of taxation leviable on native produce for export abroad shall under no circumstances, exceed 7½ per cent. *ad valorem*.

Under the terms of this treaty, had China abolished likin, there would have been an appreciable increase in the customs revenue and the way would have been paved for tariff autonomy. The Chinese Government has, however, not been able to abolish likin, which under the Republic, has become the principal source of revenue for the Provinces. If the amount collected ranges between $40,000,000 and $60,000,000, the national government must provide the provincial authorities with an adequate substitute. Although, it is true that most of this *likin* money is witheld from the Government by the local officials, it is also true that the latter use these funds for military and political expenditures and that they will never consent to give up this source of revenue unless some other is placed at their disposal. The result has been that the MacKay Treaty has always been very unpopular with the officials of China and its terms have never been operative.

At the Washington Conference, the tariff question again arose. Dr. Wellington Koo presented a statement of China's case, in which he repeated the tariff history of China in which in its more important implications has here been given. The report of the statement ends with the following:

Chinese Viewpoint

In view of the foregoing reasons, Dr. Koo asked the Powers to agree to the restoration to China of her tariff autonomy. In making this request, the Chinese Government entertained no desire to interfere with the present administration of the maritime customs, which was generally considered to be efficient and satisfactory, nor to interfere with the devotion of the funds of the maritime customs to the liquidation of foreign loans secured thereon. What he had upper-most in mind in asking for the recognition of China's tariff autonomy was the right to fix and differentiate the tariff rates. As the establishment of such a new *regime* would require time, it should come into force only after a period to be agreed upon. Before that period, a maximum rate should be agreed to, and within that maximum rate China should enjoy full freedom of differentiating rates, for example between luxuries and necessaries. But negotiation for the purpose of fixing a maximum rate might take months, and as the present Chinese financial condition needed some immediate relief, it was proposed that on and from January 1, 1922, the Chinese import tariff should be raised to 12½ per cent., a rate mentioned in the Chinese treaties with Great Britain, the United States and Japan.

In the discussion which followed Dr. Koo's statement, attention was constantly called to the question of likin. Elihu Root raised this question to which Wellington Koo dexterously replied that most of the people of China wanted Likin abolished, but such a reply is really meaningless in face of the strong opposition to the abolition or limitation of trade impeding taxation by the militarists of the country.

The specific proposal for an agreement which the Chinese government submitted to the Washington Conference with a view toward the gradual obtaining of tariff autonomy ought here to be given in full:

1. The present import duty of 5 per cent. shall be forthwith increased to 12½ per cent.

2. China agrees to abolish likin on January 1, 1924, and the Powers agree to put in force on the same day the levy of certain surtaxes on import and export duties provided for in the Treaty of 1902 with Great Britain and in that of 1903 with the United States and that of 1903 with Japan; and the Powers further agree to the levy of an additional surtax to be put in force on the same day for articles of luxury over and above the import tariff rate of 12½ effective. In all other respects, the undertakings of China and the Powers herein stipulated are to be carried out in accordance with the terms of the Treaties above mentioned.

3. Within five years from the date of agreement, a new customs *régime* shall be negotiated and concluded by treaty on the basis of a maximum rate of 25 per cent. *ad valorem* for any article imported into China, within which rate China is to be free to regulate and arrange the import tariff schedule. This new *régime* is to be in force until the end of the period referred to in paragraph 5 below.

4. The reductions now applicable to the customs duty collected on goods imported into and exported from China by land shall be abolished.

5. The treaty provisions between China and the Powers by which the levy of customs duties, transit dues and other imposts is regulated shall be abrogated at the end of 10 years from date of agreement..

6. China voluntarily declares that she is not contemplating to effect any fundamental changes in the present system of customs administration, or to disturb the devotion of the customs revenue to the services of the foreign loans secured thereon.

It will be noticed that under clauses 3, 5 and 6 of this proposal, China's tariff autonomy is still limited for a further period of ten years from the date of signing the agreement. Furthermore, no suggestion of a change in administration, that is, the elimination of the British, Inspector-General and the large number of foreigners in the employ of the customs is suggested. This was China's maximum demand at the time of the Washington Conference.

The increased tariff, as proposed by China, would have hurt Japan's economic position, more than any other other nation. For, Japan's principal export market is China, a position which is justified by the propinquity, if for no other reason, of the two nations. Furthermore, much that Japan exports to China, goes directly to the people and goes into the interior. In such places, the question of illegal taxes often arises. Mr. Odagiri, a director of the Yokohama Specie Bank, who is an outstanding authority on conditions in China, presented Japan's statement, which read:

Taking into consideration the views and suggestions made by our colleagues at yesterday's meeting, as well as of the commercial relations between Japan and China, the Japanese sub-committee states its views regarding the increase of tariff as follows:

As the Japanese trade with China covers more than 30 per cent. of China's foreign trade, the country which would suffer most by the revised tariff would be Japan.

Japan supplies those articles which are mostly sold to the lower class of people in China to satisfy their daily need. Those goods imported from Japan represent the production of a large number of comparatively small Japanese manufacturers.

Therefore, this sudden and big increase of tariff would mean on the one hand forcing high prices, to the purchasers in China—the majority of the common people—causing a higher cost of living, and, on the other hand, would mean a serious effect upon the industry of Japan. In consequence it is very important that the tariff revision should follow a gradual process, allowing enough time to enable the people of the countries concerned to adjust their economic life accordingly.

In the foregoing circumstances the Japanese sub-committee declares, much to its regret, that in its opinion the abrupt increase of tariff to an effective 7½ rate—more than doubling duties of the present 3½ per cent. tariff—is impossible to put into practice, and as to a 12½ per cent. tariff, it is absolutely impractical.

The revision which the Japanese sub-committee believes proper is an increase of the present tariff to an effective 5 per cent. in accordance with the agreement between the Chinese Government and the diplomatic bodies in Peking.

But in order to avoid the delay of 6 months to one year required for the establishment of the aforesaid conversion, the Japanese sub-committee would propose the alternative measure which will avoid unnecessary delay and will result in greater advantage to the Chinese Government.

As an alternative measure, it is proposed to levy a surtax, of say 30 per cent., upon export, import and coastwise trade, which should bring in to the Chinese Government an additional revenue of approximately silver $20,000,000.

The fruit of raising the tariff to an effective 5 per cent., on imports would be an increase of revenue of about silver $16,000,000.

This suggested surtax is not an entirely new idea, for this year all the Powers agreed to the imposition of a surtax of 10 per cent., levied on all customs dues for one year, as a measure of temporary famine relief, and it was estimated by the customs authorities that this surtax would produce about taels 5,000,000.

Of course, the Japanese sub-committee would not mean absolutely and permanently to refuse its assent to the proposal to increase the tariff. On the contrary it would say that Japan is ready to assist the Chinese in revising the tariff as is shown in the supplementary Treaty of Commerce and Navigation which was concluded during the year 1903.

There is no objection whatever on the part of Japan to the suggestion to appoint an international committee to proceed to China and study the condition of tariff, the likin, and related matters, in order to solve this difficult question and present to the respective Governments any workable scheme for increasing the tariff.

The Treaty

The Treaty which was finally concluded reads as follows:

The United States of America, Belgium, the British Empire, China, France, Italy, Japan, The Netherlands and Portugal:

With a view to increasing the revenues of the Chinese Government, have resolved to conclude a Treaty relating to the revision of the Chinese customs tariff and cognate matters, and to that end have appointed as their Plenipotentiaries, (*Names identical with those in previous Treaty*) who, having communicated to each other their full powers, found to be in good and due form, have agreed as follows:

Article 1. The representatives of the Contracting Powers having adopted, on the fourth day of February, 1922, in the City of Washington, a Resolution, which is appended as an Annex to this Article, with respect to the revision of Chinese Customs duties, for the purpose of making such duties equivalent to an effective 5 per centum *ad valorem*, in accordance with existing treaties concluded by China with other nations, the Contracting Powers hereby confirm the said Resolution and undertake to accept the tariff rates fixed as a result of such revision. The said tariff rates shall become effective as soon as possible but not earlier than two months after publication thereof.

Annex

With a view to providing additional revenue to meet the needs of the Chinese Government, the Powers represented at this Conference namely the United States of America Belgium, the British Empire, China, France, Italy, Japan, The Netherlands and Portugal agree:

That the customs schedule of duties on imports into China adopted by the Tariff Revision Commission at Shanghai on December 19, 1918, shall forthwith be revised so that the rates of duty shall be equivalent to 5 per cent., effective, as provided for in the several commercial treaties to which China is a party.

A Revision Commission shall meet at Shanghai, at the earliest practicable date, to effect this revision forthwith and on the general lines of the last revision.

This Commission shall be composed of representatives of the Powers above named and of representatives of any additional Powers having Governments at present recognised by the Powers represented at this Conference and who have treaties with China providing for a tariff on imports and exports not to

exceed 5 per cent. *ad valorem* and who desire to participate therein.

The revision shall proceed as rapidly as possible with a view to its completion within four months from the date of the adoption of this Resolution by the Conference on the Limitation of Armament and Pacific and Far Eastern Questions.

The revised tariff shall become effective as soon as possible but not earlier that two months after its publication by the Revision Commission.

The Government of the United States, as convener of the present conference, is requested forthwith to communicate the terms of this Resolution to the Governments of Powers not represented at this Conference but who participated in the Revision of 1918, aforesaid.

Article 11. Immediate steps shall be taken, through a special Conference, to prepare the way for the speedy abolition of likin and for the fulfilment of the other conditions laid down in Article VIII of the Treaty of September 5, 1920, between Great Britain and China, in Articles IV and V of the Treaty of October 8, 1903, between the United States and China, and in Article I of the Supplementary Treaty of October 8, 1903 between Japan and China with a view of levying the surtax provided for in those articles.

The Special Conference shall be composed representatives of the Signatory Powers, and of such other Powers as may desire to participate and may adhere to the present Treaty, in accordance with the provisions of Article VIII, in sufficient time to allow their representatives to take part. It shall meet in China within three months after the coming into force of the present Treaty, on a day and at a place to be designated by the Chinese Government.

Article III. The Special Conference provided for in Article II shall consider the interim provision to be applied prior to the abolition of likin and the fulfillment of the other conditions laid down in the articles of the treaties mentioned in Article II ; and it shall authorize the levying of a surtax on dutiable imports as from such date, for such purposes, and subject to such conditions as it may determine.

The surtax shall be at a uniform rate of 2½ per centum *ad valorem*, provided, that in case of certain articles of luxury which, in the opinion of the Special Conference, can bear a greater increase without unduly impeding trade, the total surtax may be increased but may not exceed 5 per centum *ad valorem*.

Following the immediate revision of the customs schedule of duties on imports into China, mentioned in Article I, there shall be a further revision thereof to take effect at the expiration of four years following the completion of the aforesaid immediate revision, in order to ensure that the customs duties shall correspond to the *ad valorem* rates fixed by the Special Conference provided for in Article II.

Following this further revision there shall be, for the same purpose, periodical revisions of the customs schedule of duties on imports into China every seven years, in lieu of the decennial revision authorized by existing treaties with China.

In order to prevent delay, any revision made in pursuance of this Article shall be effected in accordance with rules to be prescribed by the Special Conference provided for in Article II.

Article V. In all ma ters relating to customs duties there shall be effective equality of treatment and opportunity for all the Contracting Powers.

Article VI. The principle of uniformity in the rates of customs duties levied at all the land and maritime frontiers of China is hereby recognized. The Special Conference provided for in Article II shall make arrangments to give practical effect to this principle and it is authorized to make equitable adjustments in those cases in which a customs privilege to be abolished was granted in return for some local economic advantage.

In the meantime, any increase in the rates of customs duties resulting from tariff revision, or any surtax hereafter imposed in pursuance of the present Treaty shall be levied at a uniform rate *ad valorem* at all land and maritime frontiers of China.

Article VII. The charge for transit passes shall be at the rate of 2½ per centum *ad valorem* until the arrangements provided for by Article II come into force.

Article VIII. Powers not signatory to the present Treaty whose Governments are at present recognized by the Signatory Powers, and whose present treaties with China provide for a tariff on imports and exports not to exceed 5 per centum *ad valorem*, shall be invited to adhere to the present Treaty.

The Government of the United States undertakes to make the necessary communications for this purpose and to inform the governments of the Contracting Powers of the replies received. Adherence by any Power shall become effective on receipt of notice thereof by the Government of the United States.

Article IX. The provision of the present Treaty shall override all stipulations of treaties between China and the respective Contracting Powers which are inconsistent therewith, other than stipulation according to most favoured nation treatment.

Article X. The present Treaty shall be ratified by the Contracting Powers in accordance with their respective constitutional methods and shall take effect on the date of the deposit of all the ratifications, which shall take place at Washington as soon as possible. The Government of the United States will transmit to the other Contracting Powers a certified copy of the proces-verbal of the deposit of ratifications.

The present Treaty, of which the English and French texts are both authentic, shall remain deposited in the archives of the Government of the United States, and duly certified copies thereof shall be transmitted by that Government to the other Contracting Powers.

In faith whereof the above-named Plenipotentiaries have signed the present Treaty.

Done at the City of Washington the sixth day of February, One Thousand Nine Hundred and Twenty-two.

This treaty was not ratified by France, owing to a difference between China and France, known as the Gold Franc Issue. Whichever side was right in that particular case does not concern us in this article. *France's failure to ratify, however, had very important bearings upon subsequent events in China. For the masses of the Chinese people did not understand the importance of ratification. They simply understood that the Powers had met at Washington, had come to an understanding with regard to China's tariff and that nothing further happened. They reached the conclusion that the Powers were insincere and that the Washington Conference was a bluff. They lost faith in the Washington Conference. This impression was prevalent throughout China and is one of the explanations of the extensive levying of illegal taxation by the provincial authorities.*

Illegal Taxation

The provincial governments have been collecting form of likin and various transit and consumption taxes on foreign goods in contravention of the treaties. Their major argument has been that the foreign Powers had made certain promises at Washington which they had failed to keep and that therefore the provincial authorities were justified in taking whatever steps they found suitable to raise additional revenues. This specious argument has led to serious difficulties, as the principal foreign Powers, Great Britain, Japan and the United States were at all times prepared to hold the tariff conference and to make the necessary revisions.

During the student and laborer's movement arising out of the events of May 30 an agitation arose for tariff autonomy although this demand arose simultaneously with the cry for the abolition of all special privileges enjoyed by foreigners, it was aimed specifically at Great Britain, because the Inspector General of Customs is a Britisher and a large number of the foreign staff are Britishers. The demand for tariff autonomy, at the moment, was not so much pronationalistic as it was anti-British, just as the shipping strike differs from other labor movements in that it is a specific and specialized attack on British interests in China. We need not, for the purposes of this article, analyise the reasons behind this attack on Britain ; it is sufficient to record the fact.

The Gold Franc Case having been settled, France was prepared to ratify the treaties and the United States as convenor of the Washington Conference, proposed the holding of the tariff conference in Peking on October 26. This date has been agreed upon and at the moment, the delegates are on their way to Peking.

The views of the various governments with regard to the revision of the tariff are quite clear. Secretary of State Frank B. Kellogg, in a speech before the American Bar Association at Detroit said :

"I believe that the Powers, in concluding the tariff conference, must broaden the scope of their work beyond treaty," he declared.

"America is willing either at this conference or subsequently to consider with China a comprehensive revision of the treaties dealing with the entire subject of the tariff. The tariff schedules were not adopted as a sinister means of controlling the fiscal policies of the Chinese Government, but as a means of remedying the situation, which has become a fertile source of friction between China and the Powers."

Mr. Austin Chamberlain, in his address before the China Association said:

"We are ready to carry out in letter and in spirit the Washington engagement, but for the full fruition of the conference to which our guests are going and of the inquiry into extraterritorial rights two preliminary conditions are desirable. I am not sure, that for the full attainment of our object I ought not to say that they are necessary."

Japanese Viewpoint

The Japanese Government sent a note to China, the gist of which is contained in the following summary:

"The Japanese Government are now prepared to consider the Chinese Government's proposal for the modification of existing treaties in measure as the Chinese authorities demonstrate their willingness and ability to fulfill their obligations and to assume the protection of foreign rights and interests now safeguarded by the exceptional provisions of those treaties. **It is because of a most earnest desire to meet the aspirations of the Chinese Government the necessity of giving concrete evidence of its ability and willingness to enforce respect for the safety of foreign lives and property and to suppress disorders and anti-foreign agitations which embitter feeling and tend to create conditions unfavorable for the carrying of negotiations in regard to the desires which the Chinese Government has presented for the consideration of Treaty Powers.**

"The questions of the conventional tariffs and of the extraterritorial rights upon which nationals of the Treaty Powers reside in China are two of the important questions raised by the Chinese Government's note. Both received consideration at the Washington Conference and it is the belief of the Japanese Government that the most feasible method for dealing with them is by a constant and scrupulous observance of the obligations undertaken at the Conference. To that end the Japanese Government are ready to appoint their delegates to the special conference on tariff matters provided for in the treaty of February 6, 1922, and is furthermore willing either at that Conference or at a subsequent time to consider and to discuss any reasonable proposal that may be made by the Chinese Government for a revision of the treaties on the subject of tariff.

"Before it can form any opinion as to what, if any, steps can be taken to meet the desire of the Chinese Government in regard to the question of extraterritoriality and those special safeguards of the treaties upon which their nationals live and conduct their enterprises in China, my Government desire to have before it more complete information than has heretofore been available and the most feasible way in which the question can be approached and considered is to send to China the commission provided for in the Resolution of the Washington Conference regarding extraterritoriality in China in the expectation that the investigations made by that commission will help to guide the Treaty Powers as to what, if any, steps should be taken as regards the relinquishment by gradual means or otherwise of extraterritorial rights at this time. My Government are now ready to appoint its commissioners to sit with the commissioners of the other interested Governments in accordance with that resolution; it hopes that that commission may be able to begin at an early date its investigation into the existing conditions of the administration of justice in China and to make a report which will serve as a basis for the recommendations to be made in pursuance of the Resolution, for the purpose of enabling Governments concerned to consider what, if any, steps may be taken with a view to the relinquishment of extraterritorial rights."

The *Osaka Mainichi*, which interprets the view of many Japanese interests vitally concerned in China, interprets Japan's position as follows:

"Whereas Japan was determined at one time strictly to stick to the terms of the Washington Treaty, and to deal with the special customs conference as a natural sequence to that treaty, which plainly stipulated the nature and scope of such a conference. It is even understood that Japan has been trying to bring about some sort of a compromise between America and England so as to offer a united front of the Powers towards the Chinese demands. But now that Japan has recognised the Chinese intention to bring up the question of tariff autonomy at the coming conference, it must with fairness be said that the Japanese attitude towards the whole question has been the subject of considerable change since quite recently. Her effort strictly to stick to the Washington Treaty has admittedly failed, or to say the least it was made in vain."

Herein comes the larger question of China's national aspiration, and it is our opinion that the whole problem must be treated henceforth from a much broader point of view. The Chinese demand for the tariff autonomy is part and parcel of her great national movement that cannot be suppressed for long. Should Japan obstinately oppose the sudden increase of Chinese tariff over 7.5 per cent., she will certainly have to receive a cross fire from China and her sympathisers. Any legitimate and reasonable proposal by China to be submitted to the coming conference should meet with Japan's sympathetic consideration, even for the mere reason that China and Japan are the two countries in the Orient that are far more closely related to one another than with any other nations of the world.

This, however, does not at all preclude the universally recognised responsibility on the part of China herself first to fulfil the necessary conditions enabling her to stand on an equal standing with the other Powers in the matter of financial and judicial relations. With all due respect to Chinese national aspirations, it must be said for the interest of China that she should by no means be so rash as to demand things for which she is not yet fully qualified. It is up to China first to reflect whether she has already done what she promised to do in order to have her claims granted.

The willingness of Japan to meet China more than half way, is, in effect a great diplomatic victory for China, if only the Chinese were really prepared to adopt a reconstruction program. Japan's constantly increasing trade in China, her growing vital economic interests in Manchuria and Mongolia her dependence upon China for raw materials, made China the first consideration in Japan's international policies. Japan is more than willing to co-operate with China and to place at China's disposal her enormous experience in the revision of treaties and the reconstruction of government. The difficulty is not that Japan or Great Britain or the United States take a relentless, "strong," attitude toward China. It is that China will do nothing for herself.

China's diplomacy is based upon the assumption of international jealously. It presupposes that the United States, Great Britain, Japan and France can do nothing together, that if they face a serious international problem, demanding the keenest co-operation, selfish interests will triumph and these nations will sacrifice the bigger things in China for trivialities of international "face." In this China has so often been wrong. During the past month, China received a note signed by nine Powers with regard to a Judicial Inquiry into the May 30 affair. It took time to get all the Powers to agree to this note, but in the end it came, leaving China alone in her diplomacy with only Soviet Russia as a sponsor.

China is meeting the tariff problem in the same spirit. The hope is that the United States, Great Britain and Japan, which have the largest interests at stake in China and which are to lose or to gain most from any changes which may take place, will be so jealous of each other, that the tariff conference will become a quarrelsome meeting in which China will really become the mediator, the suggestor of compromises.

Without a constructive program on the part of China, the tariff conference is bound to fail to do any service to China. This is not a matter of high politics; it is business. Property rights and interests are concerned. The right to tax is the right to destroy and Japan, Great Britain and the United States want to be certain that what they have created in China, and all of which is really beneficial to the Chinese people will not be destroyed by predatory militarists and corrupt officials. They want the Chinese Government to show them that it can govern the country, can protect life and property, can curb banditry and can keep a predatory power, like Soviet Russia, from utilizing China as a buffer state for confounding the peace of the world. If China will meet this problem openly, in friendship, with a clear view toward the attainment of equality by reconstruction, Japan, Great Britain and the United States upon whom China must ultimately depend for her place in the sun, will be more than ready to make every concession.

Unification of Administrative Control of the Railroads of China

By H. E. Yeh Kung-cho, Minister of Communications of the Republic of China

[The following memorandum was presented to the Chief Executive of the Republic of China by the Minister of Communications, H. E. Yeh Kung-cho. It is to be hoped that Mr. Yeh will have an opportunity to carry out his plans.—ED.].

Too much emphasis cannot be placed on the importance of development of the means of communications. On it depends the life of modern civilization. It is the forerunner of political, economic, financial and industrial progress. Military organizations depend upon it for mobility and immediacy of information. To accomplish these, a well settled policy should be adopted. In accordance with the various conditions obtaining in different countries, the policies adopted in various parts of the world to answer their respective requirements may be divided into three classifications. They are (1) Indirect Production Policy. To help agricultural and industrial development by means of communications. (2) Direct Production Policy. Communication systems are made to yield revenue for the benefit of the national treasury. (3) Relative Production Policy. A combination of the above two policies, aiming at agricultural, industrial and economical development of the country as well as the gain to national treasury.

In view of the poverty of the government, on the one hand, and the backwardness of our industries and commerce, on the other, the Relative Productive Policy is, therefore, the most suitable for China. Both the Government and popular interests can not be overlooked. But it is one thing to have a good policy and another to put it into effect. Suitable guidance and existence of proper conditions are essential to the successful execution of any policy. An effective policy for the development of communication systems requires Unification of Administrative Control.

China has completed only 6,000 miles of railways, 80,000 miles of telegraph lines, 13 wireless stations and 28 telephone offices, during the last several scores of years since she was first opened to foreign trade. There has been no government navigation enterprise. The total registration of privately owned commercial vessels is approximately only 410,100 tons.

For the development of communications the Government has given little financial aid. Most of the capital required was raised from foreign loans and the enterprises have been, therefore, burdened from the beginning with heavy debts. Yet, prior to the Fifth Year of the Republic (1916), these enterprises were able to maintain themselves and showed steady improvement. Their development contributed also to the progress of agriculture and commerce, which were showing signs of great activity. Military movements at that time were likewise efficiently executed, without confusion and all according to preconceived plans. This was due to the fact that the power and responsibility for the administration of the systems of communications were entirely in the hands of the Central Government, in consequence of which smooth operations were secured in normal times, and orders were effectively carried out in times of emergency.

But since the Sixth Year of the Republic (1917), internal wars have been numerous. High military leaders in the provinces mistake the systems of communications as their own instruments of warfare and place these systems under their own control. They have commandeered railway rolling stock, telegraph lines and vessels. Still worse, they have often operated the official systems of communications for their own profit with great detriment to trade and industry. Even revenues needed by the railways and telegraph offices for their own maintenance have been seized. As a result, wages are not paid, and there is no money to buy the materials urgently required for repairing of equipment. Worst of all, administrative officials and the accountants of the railway and telegraph administrations are appointed directly by the provincial authorities who recklessly exploit the properties and revenues of communications. This state of affairs lends favorably to corruption. The provinces, on the one hand, lack the means of preventing corruption, and the Ministry, on the other, is powerless to check dishonesty. Public funds have been utterly mishandled and Government credit is seriously affected. Because of failure to live up to loan agreements, international control of railways has been proposed and the discontinuation of acceptance of cable messages for dispatch abroad on credit threatened. Our official documents are full of warnings as to what may happen.

It is apparent to all that without rolling stock, telegraph lines and vessels and the proper administrative officials to operate them, no revenues can be produced. With rolling stock, telegraph lines and vessels seized and the appointment of administrative officers interfered with, the railway and telegraph systems will cease to become useful and must collapse as revenue-producing instruments. Indirectly the progress of civilization, or political, economic, financial and industrial development and of military organization and national defence is hindered. To avert the peril, it is imperative that the power of administration of the communication systems shall be centralized.

In the following we beg to submit in great detail the reasons showing the necessity of Unification of Administrative Control and the evils due to the lack of such control during recent years in China.

I. The Power of Appointment

(*a*) Different from the ordinary administrative departments of the Government, the communication systems require, in all ranks, men of technical training and experience. Promotions are made step by step in accordance with merit and seniority. Opportunists are discouraged, and none are dismissed without sufficient reason. With security of position and steady promotion, men are encouraged to do good work and remain in the service. So it is not infrequent to find men who remain loyal and contented in the service of communications for a long period of time. Efficient organization is thus secured. The success of the communications systems in China in former years is a positive proof of the efficacy of this system.

A change has taken place in recent years and the provincial authorities have frequently interfered in the appointment of administrative officers. Men are now being lifted into eminence from relative obscurity, and men of low intelligence are put in positions of responsibility and authority. Even dismissed employees are re-engaged, and sometimes placed in high authority. Such unfair treatment naturally reacts on the honest and deserving members of the staff. Furthermore, the newly appointed officials are either incapable of properly performing their duties because of their lack of experience or ability or have shown themselves to be corrupt and in utter disregard of the traditions and official Rules and Regulations. Enormous losses are frequently caused thereby. Those high provincial officials who interfere in the employment of men in the service of communication systems do not realize the serious consequence resulting from their desire to help their friends, and the men they put in frequently flout the orders of the Ministry, since they know that the Ministry is powerless to enforce its orders. It is said in the Classics that the government shall only be as good as the men in it and that experience should be the first consideration in the appointment of men. Where there is no definite system governing appointments and where there is no central authority to enforce rules and regulations, efficiency and proper selection of men are impossible.

(*b*) Men in the service of communications should be selected by examination or promoted by merit and length of service mentioned above. Their duty is to carry out the policy of the government and obey orders of their superiors as required by the Law of

Civil Service. They are merely fulfilling their duty when they do what they are ordered by the proper authorities and it can not be construed that there are political motives behind their acts. In recent years, the spirit of partisanship has been excessive and many dutiful officers in the service of communications have been dismissed, regardless of their ability and experience, just because their faithfulness toward their duties has been mis-interpreted as acts of loyalty toward some particular party or clique. It shows the lack of appreciation on the part of political leaders of the fact that men in the service of communications have been employed on the basis of their technical training and experience. Since these men can make their living best by being in the service of communications, naturally they would not risk their positions on which their livelihood depends by taking sides in political issues. In times of emergency when the systems of communication are commandeered, it is also quite natural that they can not risk disobedience to the authorities imposed on them. In so doing, they should not be considered as taking sides, nor should they be discharged on this score. If this spirit of discipline and the faithfulness toward service is disregarded, discouragement and bitter feeling will be engendered. Measures of retaliation will be adopted when a change of political power takes place. Communications will be drawn into the whirlpool of politics, and disorder and confusion will follow every change in the Government, there being no time for the administrative officials to learn their business. So in every war, we find disasters resulting from accident, collisions, explosion of munitions trains and congestion of track. Telegraph communication is delayed on account of the breaking down of the line or on account of inefficiency. The cause of all this is the failure to separate the service of communications from politics, thus making of them a toy in the political game. But on the other hand, if a settled policy is followed and the power of carrying out this policy is invested in the Central Government, men of experience and of technical training will be kept in their positions in spite of wars and changes.

(*c*) The first secret in the employment of men is fair treatment in the way of rewards and punishments. This is why in the communications service, where efficiency is of first importance, very strict rules are laid down in regard to the number of men to be employed and the grade of their pay. No departure from the rules should be allowed. Even the raise of a few dollars is fixed by regulations. When necessary, certain employees are required to furnish bonds. But since the breaking down of the central authority, the number of employees as well as their pay exceeds the provisions of the budget. Those who gain their places by unfair means may receive the highest pay right at the start, while others who do their work honestly may not receive their regular promotion. Furthermore, those newly appointed high officials who owe their positions to political influence are most ready to violate the established rules and regulations as well as all laws of ethics, since they know that the Ministry cannot remove them, and the provisional authorities will not know accurately what they are doing. It is usually too late to bring them to task when their corruption comes to light. Efficiency and power to check and punish misdeeds and corruption are lost when appointments are made by the provinces instead of the Central Government.

II. Financial Administration

Of the four branches of communications, railways and the telegraph lines were built largely with foreign capital. The navigation service is mostly in the hands of private concerns. The postal service yields enough revenues to maintain itself. The total amount of foreign loans including interest in this connection has accured to $700,000,000. Not appreciating the heavy burden or indebtedness, the provinces, seeing only the large amount of revenues derived from the communication systems, are accustomed to look upon them as a source of income, appropriating whatever funds they require. From the Kin Han Railway alone $10,000,000 are annually appropriated by the militarists. The amount taken from other railways and the telegraph administration is also enormous. The railways and telegraph administration have even been forced to finance the purchase of warships, aeroplanes and munitions by promissory notes. High military officers sometimes even pledge the incomes of communications to secure loans directly. On the other hand, the railway and the telegraph administrations are frequently without the means to maintain themselves and are forced to borrow money at high rates of interest to pay wages and buy materials for urgent requirements. The total amount of money that has been detained by militarists, up to the end of the 13th Year of the Republic amounts to $180,000,000 or $250,000,000 including interest. It is obvious that the only source of income of communications comes from operation and it is absolutely necessary that the properties pertaining to the different systems shall be properly maintained and the operating funds protected. Moreover, business conditions vary from year to year and from district to district. To have a balanced development, the situation of all branches of communications must be considered as a whole, so that the profit of one may be used to help the development of another, the income of one district may be devoted to the aid of a less fortunate one, and the revenues of good years may be laid aside for the deficit incurred in bad times. By a systematic plan of adjustment and reserve, the enterprises of communication may be promoted and expanded to the advantage of the country as a whole. But if the funds at their disposal are taken away at will and recklessly spent for non-productive projects, leaving the various equipments to deteriorate, the enterprises themselves will suffer and the nation will go down with the decline of communications.

(*b*) To use the revenues of communications for their own development is the policy common to all foreign countries. China did the same thing in former years, and so the communication enterprises were prosperous with funds to maintain themselves in spite of internal troubles. Revenues were on the increase. Due to the fine equipments available as a result of the prosperous conditions, military movements were greatly facilitated. Such a condition no longer exists at present. Heavy losses are sustained, on the one hand, in consequence of military movements and, on the other, due to the detention of rolling stock by military people who use them to transport commercial goods for their own interest and gain. It is estimated that more than $10,000,000 is lost on this score. This is only the direct loss, the indirect loss in consequence of falling off of trade through lack of rolling stock and dull business is a great deal more. The farmers and merchants too suffer for lack of the means of communications, so much so that business had to be greatly curtailed or totally suspended. Panic and uneasiness prevail; shortage of coal, of grain and of cash follows shortage of cars. Peace and order are threatened. It is hard to estimate the enormous losses caused thereby.

(*c*) It has been pointed out in the foregoing that the railway and telegraph systems of China were financed by foreign loans. There are yet a great many more railways to be constructed and telegraph lines to be extended, as called for by the program of construction. In view of the poverty of the Government and the country, foreign loans will be needed to carry the program through. When China is unable to pay the interest and capital of her existing loans, who will risk their money and give her further loans? Most of the materials required for construction come from foreign countries. In view of the repeated delay in payment for such materials already bought, it has become even difficult to get supplies to submit tenders. Those who take orders from the railways often demand payment before delivery or very high prices. The communications authorities are forced to agree to their terms in order to obtain urgently required materials for maintenance. The situation has gone from bad to worse. Two great dangers are before the country in consequence of the use of revenues from the communications to pay for military expenses. First, it is a direct cause of disturbance of the peace and order of the country. Secondly, if no remedy is found to meet the obligations, the threat of international control of railways and suspension of cable credit may actually take place to the great detriment of the country.

(*d*) The most important consideration in every business enterprise is to have proper accounting. On account of the heavy foreign and domestic loans, it is very important that the profit and loss of the Communication enterprises shall be carefully accounted for and made known to the public. This is the only way to establish the credit of the enterprises. Since the Third Year of Hsuan Tung, a system of Independent Accounts has been in existence (the system and the effect thereof are explained in another memorandum). All the accounts are carefully entered and balanced, so that there can be no mistakes or omissions. But since this system was destroyed, the men in charge of funds are free to do what they like with public money and alter the carefully devised system of the Ministry to more simplified forms to suit their own purposes. Dishonesty and corruption are thus made easy. There are even cases of alteration of entries, destruction of books and vouchers and of all documents

which would lead to exposure. At the time, the Ministry is powerless to check corruption and when the deed is done, prosecution is only in name. The destruction of this system benefits no one except the dishonest officials, while the communications enterprises and the country suffer.

All the foregoing statements are the result of personal observations, and incidents of evils are too numerous to be set down one by one in this brief memorandum. The time element has a great deal to do with the income of communications. There are busy seasons and slack seasons. Rolling stocks are needed for commercial transportations, and yet militarists take delight in detaining as many cars and locomotives as they can lay their hands on, irrespective of whether they have any use for them or not. On account of the lack of cars and the inability of the railways to handle the freight offered, or to move the goods promptly, merchants are shipping goods by water wherever possible instead of by rail. With reference to the telegraph, official telegrams are frequently several thousand words in length and sometimes trifling affairs or private persons are sent by first class telegrams, while urgent commercial messages are delayed in spite of the heavy charges paid. Business is lost on this account to foreign cable companies. The communication enterprises have come to the end of their resources. If we do not have any remedy for the situation ourselves, others will offer to remedy it for us. Look at the note of the Diplomatic Corps of February 12, 1925 on railway conditions which says in part.

" They (the Diplomatic Corps) feel, however, greatly concerned to witness the continuance of a state of affairs on the Chinese railways, which, if not promptly checked, may threaten to become permanent and will not only throttle the economic development of the country but inflict lasting injuries on Chinese and foreign trade and interests." and also:

" Foreign interests are closely tied up with the railways themselves. Not only that these railways are indebted to foreign suppliers for equipment supplied and actually in use, to the amount of tens of millions of dollars, but for hundreds of millions of dollars are the foreign bondholders of all nationalities interested in the fate of the Chinese Government railways. Unless the control thereof be taken without delay from the hands of the military commanders, who now exploit them for their own account, and the revenue be allowed again to flow into its proper channels, it is evident that the Chinese Government railways will before long become insolvent."

As regards the similar deplorable condition of the Government telegraph offices, the *North-China Daily News* in a report in its issue of February 10, states:

" The war of words which Chinese militarists indulge in preparatory to the mobilization of their armies is almost as costly as the actual conflict. According to a report recently issued by the Ministry of Communications, no less than $20,000,000 is owed the Telegraph Administration by the various government departments and provincial warlords."

The same writer also refers to the great waste caused by the trivial and unimportant messages sent out by militarists and their staff members in the following words:

" I was told during the war between Chihli and Fengtien last year that Wu Pei-fu's staff had one day despatched over 700 telegrams. When I returned to Tientsin I chanced to receive one of these military telegrams. It read as follows: " My dear Mr........ Why you have not write me since you go away from Chinwangtao. I look forward to one leter from you as soon as you are able to write me. Soon we shall meet again in Peking and then I hope we shall have many meetings and talk about our experiences together Please write me to post office Chinwangtao quickly, yours sincerely." There were a few mis-spellings but if they were included, the message might become almost unintelligible. The writer was a member of Wu's staff, occupying quite an important position. After the receipt of this telegram, I realized why press messages were held up for seven days. I can also appreciate the bill that now fills the debit column of the accounts of the Chinese Telegraph Administration."

When such reports appear in foreign papers, it is most likely that newspapers in foreign countries will quote them to the disgrace of our country. The only solution lies in the centralization of control and we appeal to all the members of the Rehabilitation Conference sitting here to use their best efforts and influence to restore to the Ministry of Communications the control over its different enterprises, the power to administer all affairs and to make appointments without external and illegitimate interferences.

Can Extraterritoriality Be Abolished in China?

MR. Eugene Chen is sometimes vitriolic. His attitude toward foreign nations is often offensive. His antagonism to Japan and Great Britain is incomprehensible in a man of his intellectual calibre. His uncontrolled epigrams, his bitter attacks, his slashing pen bring him a host of personal enemies and there are even some who viewed with a degree of favor his incarceration in a Chinese prison without due process of law. The FAR EASTERN REVIEW cannot join in that point of view. It has to take the attitude that any military interference with the courts of the country, any whimsical arresting of individuals by Chinese militarists is dangerous and can only lead to the perpetuation of extraterritorial jurisdiction in the country.

One often wonders what kinds of brains the Chinese militarists have when they do things of this sort. Just at the time when the attention of the world is being focussed on their country, when foreign commissions of various natures are arriving from abroad, when a commission to study into the possiblities of abolishing extraterritoriality is actually on its way here, a Chinese militarist seizes a journalist in his bed-room, places him under arrest, deprives him of his liberty, transports him to another city, throws him into prison and keeps him there without trial. If Mr. Chen has committed a crime, why was it necessary to take such steps? Why did not the procurator of the Peking district bring a definite charge against him? Why was he not tried in the Peking court? Why was he not given a chance to defend himself? Why was he not informed of the charges against him? Why was there no due process of the law?

Therein lies the crux of the importance of Mr. Chen's arrest. It was without due process of law; just as everything that is being done in China these days is without due process of law. The FAR EASTERN REVIEW is not anti-Chinese just as it honestly believes that the American, Japanese and British governments would do well by China. The FAR EASTERN REVIEW would give China fair play and would heartily support any steps to return to China her full sovereignty, to bring about a situation of full equality for China among the nations of the earth. But no one can ignore China's present unfortunate predicament, when she has everything to gain and because of internal dissensions, because of lack of government, lack of honesty and honor among her officials, the wealth and strength of the country is being rapidly dissipated. It is that that any other nation wants to take possession of China or believes that such a step would be possible. It is rather that the peace of the world is being seriously endangered by the lawlessness of China. The lack of a strong Government, the failure to maintain the law, the division of the country into fedual satrapies, the constant selfish wastage of funds and the appeals to foreign nations for assistance creates a situation wherein anything is liable to happen. The Bolsheviks are already taking advantage of this chaos to stir up further trouble in Kwangtung and Mongolia. A nation which attempts to exist without law soon becames a prey to every predatory power on the face of the earth. That is China's position to-day.

On the other hand, China and the Powers are actually considering a revision of the treaty relations so that foreigners might at some time in not the too distant future become subject to the laws of China. How can one become subject the laws of a country where there is only lawlessness? For instance, Mr. Eugene Chen was born a British subject. Adhering to the Chinese race, having a strong sense of racial pride, he denounced his British citizenship and became a Chinese citizen. He sacrificed the rights to which he was entitled under the operations of extraterritoriality and submitted to Chinese law. Then he manages to disagree with a military commander and they throw him into prison. Had he remained a British subject he would have been entitled to the protection of the British crown. As it is, he has no protection for his life or liberty, because the Chinese Government, Chinese law and Chinese constitution are inoperative against even the smallest and least important militarists. Imagine what it is with so great and puffed-up a figure as the Tupan of Chihli. This sort of thing would have been alright in the Middle Ages. It is a very dangerous precedent in modern times when most human beings have opinions and like to express them, irrespective as to whether they please the high and mighty or not.

In a recent issue, we published the details of the Ostroumoff Case in Harbin. That case is now closed. In spite of the long detention of Mr. Ostroumoff, the case was not closed by a vindicative decision. It was not closed by any decision at all. The judge simply said that it was all over. The Peking Government had been notified that a Commission of the Signatories of the Washington Agreements were on their way to China to investigate into the courts of the country and they hurriedly notified all courts and judicial officials to get busy and clear the dockets. The Ostroumoff Case was one of those into which it was not desired that there should be too much investigation. Therefore, it was taken off the docket. It was settled. Mr. Ostroumoff has no redress for his long detention There is nothing he can do about it all. He has been under arrest, under a protracted trial, under the mental strain of such a situation. He has lost time, health and money and there is nothing further to do about it.

Cases such as that of Mr. Eugene Chen and Mr. Ostroumoff do China no good. They simply create a feeling of distrust the world over. They frighten the foreigner living in China. They lead the foreign nations to believe that nothing good can come out of China. But more serious still: they frighten large masses of the Chinese people who live in the foreign concessions and who have experienced a more equitable system of law.

Mr. Bywater's Frightfulness

An Indirect War Scare Camouflage by Very Fictitious Fiction

MR. Hector C. Bywater, an American, who apparently has some interest in naval matters has written a book. Mr. Bywater's book is meant to be fiction but the wrapper contains photographs of two very real men-of-war—American, it is to be presumed. His fictitious book is called, "The Great Pacific War,"—a history of the American-Japanese War of 1931-33." Dealing almost entirely in futurities, Mr. Bywater predicts the improvable plausible. His book makes interesting reading for those who have nothing better to do.

In his preface, Mr. Bywater says:

"Although this book portrays the course of an imaginary war between the United States and Japan, it has not been written to support the view that such a conflict is either close at hand or inevitable. No doubt there are elements of danger in the immigration controversy, while further causes of friction may attend the growth of American commercial enterprise in the Far East. For the moment, however, the Pacific horizon is fairly free from clouds. But if war between the two nations is happily improbable, it remains a contingency that cannot be dismissed as wholly impossible."

If the war is so happily improbable, why write some 300 pages describing all its harrowing details. If there is to be no blowing up of cities, no destruction of peoples, then why give the morons a chance to get scared, to suffer sleepless nights and to develop a complex of hatefulness from which they never can recover. It is this sort of indirect propaganda which does more mischief than a direct anti-Japanese campaign, honesty and frankly so labelled. The latter is really not a menace, for he soon enough destroys himself by the bitterness of his argument and the acidity of his view of other human beings. The propagandist of Mr. Bywater's type is more skillful; he hides his bitterness beneath a sugared smile and coats his frightfulness with the angelic wings of brotherly love.

Further in his preface, Mr. Bywater says:

"Particulars of the American and Japanese combatant forces are based upon the latest and most reliable information from both countries. Japanese submarines are designated in accordance with the new system promulgated by the Imperial Navy Department in November, 1924. The descriptions of islands, harbours, and channels, in common with all other topographical details, have been carefully checked, nor has the influence of weather conditions in certain regions of the Pacific escaped attention. Most names of merchant ships appearing in the text are actually borne by vessels now afloat. The account of cruiser and submarine raids on commerce has been compiled with due regard to existing trade routes and sea traffic. In fine, no effort has been spared to ensure technical accuracy throughout the narrative.

Why all these exact details in a work of fiction, why the correct names, the exactness of description and the trouble taken to insure exactness? Does not Mr. Bywater spoil the fictitiousness of the fiction by the realism of his war talk? Is not Mr. Bywater pushing his point a little too hard, when he is so careful to avoid a single error in his naval information while he makes so many stupid misstatements of facts with regard to Far Eastern Countries.

One of Mr. Bywaters most curious errors of omission is the failure to record the Japanese earthquake, although his book was written in April, 1925. He takes no account of the political effect of the destruction of Tokyo and Yokohama, nor the relationship of this disaster with any program of agression which Japan may have had, at any time in her recent history. He pictures a Japan puffed up by war profits, without giving any importance to the other side of the ledger; to the damages of the earthquake, to losses entailed in the Siberian expedition which came to nothing, to the economic losses due to the interference with trade arising out of the disturbed state of China. Mr. Bywater's picture of Japan's economic strength is as unfair as it is untrue, for the person who is seeking a cause for fright in Japan's rapid development can easily find it in the only country, except the United States, which made money of the Great War, as Mr. Bywater says. In a word, whatever the author's intentions might have been, his book succeeds in creating a scare.

To an American living in the Far East, it often appears curious that men of responsibility should allow their minds to keep stirring up the fear psychology of the people.

If the inherent purpose is to create a sentiment favorable to the passage of army and navy bills through Congress, are there not other methods which might be utilized without stooping to a campaign which in its final analysis must make for hard-feeling and war? It is bad enough that nations have to resort to warfare to settle their troubles; need we predict this mischievous device, need we egg nations on to this iniquity, need we foretell the miseries of defeat? What is accomplished by all this warlike propaganda that is beneficial to neither the United States or Japan or to humanity at large. It leads one to believe that men who resort to such devices are lacking in a self-control, are willing to make every sacrifice for the sensation of being outstanding.

War between the United States and Japan has never been a more remote possibility than at the present time. The two nations are becoming economically so closely related that war would be unthinkable. In China, the United States and Japan are at present in harmony. The only outstanding question is one of pride and honor with Japan and can easily be settled if the Japannese immigrants are put on a quota basis just as the immigrants of other countries are. This will probably be done before long as there is a growing sentiment in the United States for such a solution of the problem. In the Pacific there is no outstanding question between the two nations. There is nothing that either nation has that the other wants. Mr. Bywater attempts to build up a strong case on the basis of a rejuvenated China; yet, he could not have foretold when he wrote his book that at the height of the recent troubles, the boycott and strike, a Sino-Japanese friendship Association should have been organized in Shanghai of which the most prominent Chinese in the city are members. Mr. Bywater could not have foretold that because he did not desire that such a contingency should have arisen. For in friendship lies the seed for the end of all wars.

The Reconstruction Number of THE FAR EASTERN REVIEW, devoted to the rebuilding of Tokyo and Yokohama may be purchased at THE FAR EASTERN REVIEW, 16 Jinkee Road, Shanghai, or through bookshops at $5.00 per copy,

Modern Crane Facilities on Dairen Wharves

Modern Warehouses to Handle Perishable Goods

The Development of the Port of Dairen

THE efforts of the administration of the Kwantung Leased Territory and the South Manchuria Railway to make Dairen the premier port of the mainland of Asia continues uninterrupted, in spite of the general depression of trade in the Orient and the burden the Japanese Government carries in the reconstruction of Tokyo and Yokohama. Dairen has not been permitted to suffer because of other economic programs of the Japanese government. As a matter of fact, a plan of improvements has been entered upon which will not be completed until 1937.

Among the improvements are the Fifth and Sixth Wharves which are expected to be completed in the fiscal year 1931, by which time the cargo-working capacity of the Port of Dairen will be twice as large as at present. Prior to that, the Fourth Wharf now under construction will be finished in the fiscal year 1928, thereby increasing the cargo-handling power by about 30 per cent. over the present status.

With double the existing capacity, all possible increase in the cargo-working requirements will be fully met 7 or 8 years later, that is, till about 1937.

As regards the loading of coal for export purposes, the loading capacity at the Dairen Wharves has scarcely kept pace with the steady increase in export.

A few years hence, a coal pier of extensive proportions is to be constructed at Kanchingtzu, on the other side of the Dairen Bay. The car-dumper now under installation at the First Wharf is to be used exclusively for loading bunkers.

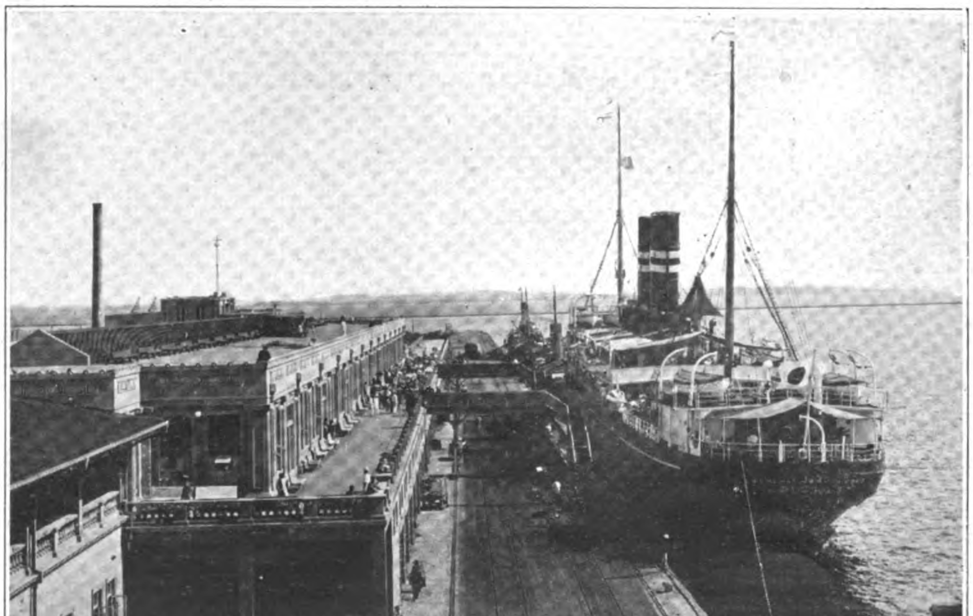
Next, the Port of Dairen will be enlarged eastward although on a limited scale, and then to be expanded westwards to the shores of Shokoshi (Chinese Quarter of Dairen) and even beyond.

The new wharf Pavilion, which was completed a year ago, together with the new Viaduct, was opened on December, 1. By means of this viaduct which constitutes a safe, pleasant passageway from the entrance to the Wharf Compound direct to the handsome porch of the new magnificent Pavilion, all people having access to a regular passenger liner at berth in Dairen. All interruption of traffic, attendant on a level crossing, has been done away with. In the second place, any one may reach the pavilion on foot, or in a vehicle, including the trams, in rainy, stormy, cold, and hot weather, so being saved the necessary trudging between the vehicle and the steamer, not to mention the risks of a possible accident. In the third place, the port of Dairen will give a much better impression to a visitor of any nationality landing fresh from a steamer. At any rate, to our best knowledge, the combination of a viaduct and a pavilion with the latter's movable staging stairs connecting the pavilion with the steamer is certainly a happy and, at the same time, novel one that is quite original and has no peer at least under Japanese management. This is one of the most notable improvements to the Port of Dairen, and their completion was appropriately celebrated on December, 1.

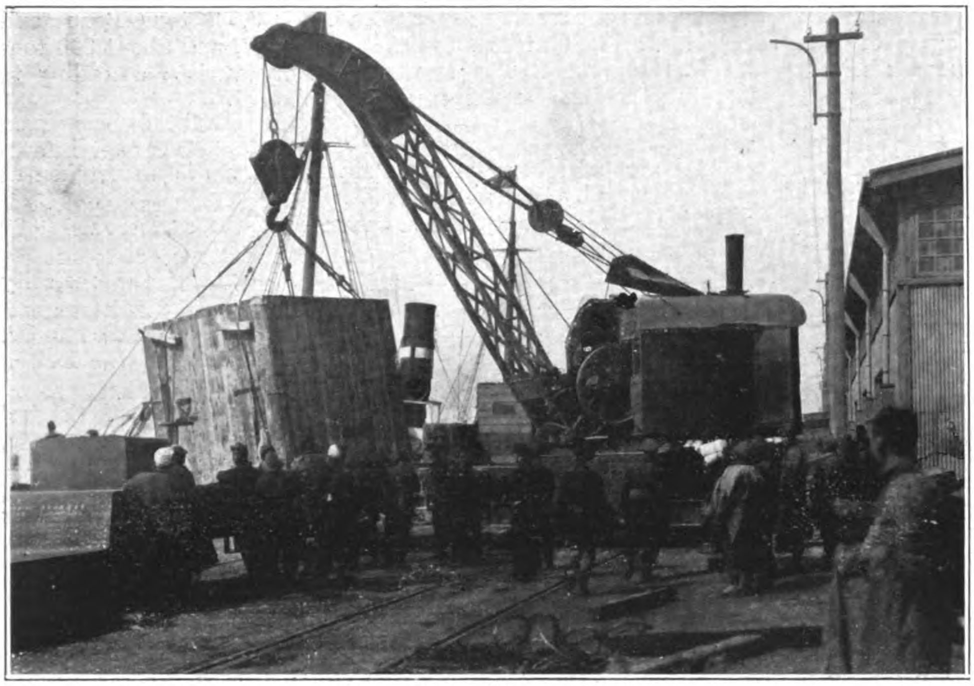
At the opening ceremonies, President Yasuhiro, of the South Manchuria Railway, explained the plans of the railway administration in connection with Dairen :

Now that the Port of Dairen has grown into one of the first gateways of commerce in the Orient, handling hundreds of millions of yen worth of goods annually, the South Manchuria Railway Company has been spending an enormous sum of money for perfecting its equipments to the one end of raising its capacity of transport and communications.

The railway company, keeping in view its noble mission, pledged itself not to relax its effort to improve the public facilities attached to the wharves of Dairen for promoting the welfare of mankind, and to this end, hints and suggestions are cordially welcomed.



Dairen Wharf Pavilions



Steam Crane, Dairen Wharf

The growth of the Dairen wharves was on this occasion described by Mr. Ichikawa, superintendent-General of the Railway Wharf Office. He said : that, in 1908, the exports and imports for Dairen combined amounted to only 770,000 tons. He then continued :

Last year, altogether 3,200 vessels, totalling 8,000,000 tons gross and carrying 6,000,000 tons net of goods, put in the port, making it one of the leading ports in the world.

Since the port of Dairen has taken such long strides the South Manchuria Railway Company has found the best part of its attention engrossed with the equipment for berthing steamers, the storage of ships' cargoes and railway freights and the general cargo-working.

Again, the thoroughfare at the entrance to the Wharf Compound being a level-crossing, traffic had to be necessarily blocked too often much to the inconvenience of the general public. This inconvenience and those discomforts alluded to above have been removed on the completion of the new Pavilion and the Viaduct, not to speak of the safety of traffic ensured.

Minato (Harbour) Bridge, by which appellation the major portion of the Viaduct is known, is 1,242-ft. long and 144-ft. wide, having a gradient of 1/26 on the southern side an 1/25 on the Wharf Office side. It has cost about Y.620,000 in construction, work being started in August, 1923. It was finished in November, 1924.

The Pavilion is built in reinforced concrete and is two-storied. The lower floor is used as a warehouse. The roof garden is about 1,000 tsubo in area, affording an excellent promenade in the warmer months, commanding an unobstructed view of the entire Harbour. The total floor space is 1,522 tsubo. It is 84-ft. by 480-ft., with a verandah, 18-ft. by 804-ft. The Pavilion can accommodate 5,000 people at a time, and has cost about Y.480,000, the per tsubo cost being Y.158. The work was commenced in July, 1912, and was finished in October, 1924.

There is a covered corridor, 48-ft , by 402-ft It is also made in reinforced concrete.

Underneath the corridor, there are the Customs Examiners' Office (528 tsubo) and the place of rendezvous for the foremen and coolies making up the cargo-working gangs, who belong to the Shipping Office of the Railway Wharf Office (984 tsubo).

The construction has cost about Y.180,000 and was commenced in August, 1923, being finished in October, 1924.

Shore & Marine Installations & Trade

Wharf Installations

A detailed report on the development of shore and marine installations at Dairen is indicative of the tremendous work done by the Japanese government and the South Manchuria Railway. It will be difficult to identify the present Dairen by what was left by the Russians to the Japanese, except for part of the general outline, as designed originally by the Russians.

Already the sum of Y.45,000,000 has been expended for all the improvements.

Marine Installations

The Marine installations are as under :

Breakwaters	13,000-ft.
Water area sheltered by breakwaters	950,000 tsubo
Berthing quay line :	
First Wharf	2,525-ft.
Wharf A.	1,144-ft.
Second Wharf	4,424-ft.
Wharf B.	900-ft.
Third Wharf	4,400-ft.
Total	13,399-ft.

Wharf C and the Fourth Wharf are now under construction. On their completion, the quay line will be increased by 5,500-ft.

Berthing Sections ; from I to XXXIV, capable of berthing 34 vessels of 3,000 ton class at a time.

Inflammable Goods Pier (also used for loading Bean Oil) ; it had 1,000-ft. of berthing space, but was destroyed in a recent storm and swept away. A new one under construction.

Depths in Basin : 30-ft. below L. W. O. S. T. on an average, with 36-ft. and 23-ft. for the maximum and minimum depths respectively.

Steam tenders (for berthing and unberthing and towing steamers, for ice-breaking, and for life saving purposes) 16.

Lighters (made of steel) 28, with the total loading capacity of 6,100 tons.

Junk Wharf (in Russia-Machi west of Basin) 2,000-ft.

Shore Installations

Area of Wharf Compound, about 500,000 tsubo.
Warehouses & Goods Sheds, 76 having 100,000 tsubo in area.
Open Storage Ground, about 65,000 tsubo.
Storing Capacity of Wharf Compound, 800,000 tons.
Maximum Storage Record, 620,000 tons.

Passengers' Pavilion : It is on the Second Wharf, with the total floor area of 1,500 tsubo, and is for the use of incoming and outgoing passengers on the Japan and Shanghai regular lines.

Cargo Shifting in Wharf Compound. Officials and labour gang, put together, 5,000 people ; total length of shifting sidings, 60 miles ; shifting engines, 15 ; shifting goods cars (of 33 tons each) 250 ; motor trucks and electricity driven motor trucks, dozens of them ; daily working hours, 10 ; daily cargo-working capacity, about 20,000 tons.

Export of staple products in 1924 :

	Piculs
Beans	34,395,883
Bean Cake	44,978,568
Bean Oil	13,557,591
Other cereals	13,203

Trade Returns in Value in 1924 :

	Hk. Tls.
Imports	107,914,098
Exports	141,304,757
Total	Hk. Tls. 249,218,855

Both exports and imports combined amounted to Hk. Tls. 240,000,000 equivalent to G.Y.400,000,000.

Among the China ports, the port of Dairen ranked the fifth in 1908 after Shanghai, Hankow, Canton and Tientsin in trade volume. In 1922, Dairen rose to the third place after Shanghai and Tientsin, coming down to the fourth in 1924 after Shanghai, Tientsin and Hankow.

The Port of Dairen, compared with the port of Kobe, in regard to its foreign trade, exported 5,200,000 tons as against 4,800,000 tons for Kobe in 1923.

How such a disparity of value divides the trade totals of the two ports is because exports from Dairen consist chiefly of such minerals and agricultural produce, comparatively cheaper priced, as Coal, Bean Cake, Beans and other cereals.

Future Installations

The installations constructed in the past and existing at present are as roughly tabulated above.

The increase rate of the exports and imports of the port of Dairen has been figured by the past records at about 300,000 tons a year.

Ten years hence, the increase by 3,000,000 tons may be expected, and according to the present plan, this port may be exporting and importing 30,000,000 tons of goods a year.

Cargo-working Conditions

The chief business of the Wharf Office, Dairen, consists of handling steamers and their cargoes, together with the handling of railway goods and warehousing business, including all auxiliary business appertaining thereto.

All these business are being carried on exclusively by the Wharf Office.

In the port of Dairen, all steamers above 1,000 tons gross each, must be berthed and unberthed by obtaining the services of one of the authorized pilots. In other words, a compulsory pilotage system is in operation.

As matters stand, Sections 1—4 are set aside for coaling exclusively ; Sections 5—9 for imports ; Sections 10—11 for use of the passengers on the Japan and the Shanghai Liners ; Sections 12—23 are used both for exports and imports ; and Sections 24—34 are for exports exclusively.

The Wharf Compound is roughly divided between the goods sheds zones and the warehouse zones.

The goods sheds zones are for temporary storage of goods landed from steamers and to be loaded into steamers.

The warehouse zones are for storage of goods for a considerable period.

Ships' cargoes, when landed in the goods zones, will be delivered to the consignees. Such as are not taken delivery of at once are shifted into the warehouse zones, so as to make room in the goods sheds zones for future arrivals.

Goods arriving by railway at the Dairen Wharves from the interior are unloaded from the goods cars in the warehouse zones.

Among goods, Beans are mostly taken delivery of by the local Bean Mills to be made into Bean Oil and Bean Cake. Bean Cake is carried into the Wharf Compound for storage in the warehouse zones.

In 1923, Beans that arrived at the Dairen Wharves by train, amounted to about 1,700,000 tons, of which about 1,000,000 tons were handed over to the local Bean Mills, that turned out from these Beans about 33,000,000 pieces of Bean Cake in the same year.

In loading into steamer goods kept in storage in the warehouse zones, they are first shifted into the goods sheds zones, according to the order of the applications.

Thus, the goods are being shifted about constantly between the goods sheds and the warehouse zones, so as to make most of the warehouse zones or the quay line available.

The shiftings of the goods in the Wharf Compound may be likened to the blood circulation in the human body. The more regularly and quickly the shifting operations are effected, the higher will be the rate of the efficiency in cargo-work, so much the more raising the utility of the quay line.

These shifting operations are executed mainly by means of shifting engines, but, in addition, motor trucks, electricity-driven lorries, carts, etc., are used.

On this account, the area adjoining the Wharf Compound available for storing goods is kept as spacious as possible, in order to facilitate the shiting operations.

The daily cargo-working capacity of the Dairen Wharves is 30,000 tons with the daily shifting capacity of 20,000 tons. The daily cargo-working capacity for a steamer is 3,000 tons Beans and other cereals, 2,000 tons Bean Cake and Coal, and about 800 tons of imported cargo. The figures naturally variate according to the ship's size, but one with 4 holds is spoken of.

Coolie Force

The manual labour on the Dairen Wharves is undertaken at present wholly by Chinese coolies.

They number about 6,000 in summer months, and about 14,000 in winter months.

These coolies come principally from Shantung, the majority of them being unmarried.

Supply of these coolies is contracted for with the Fukusho Co. (Mr. Y. Aioi, Proprietor, who has been Chairman of the Dairen Chamber of Commerce from the very beginning).

These coolies are grouped together in the Wharf Coolies' Quarter at Jijiko (above the Wharves) inclosed with brick walls, and containing rows of brick dwellings.

The Chinese coolie is, as a rule, strong physically, and can carry 4 pieces of Bean Cake at the same time. The strongest of them can manage even 8 pieces at the same time, and such instances are by no means rare.

In hiring coolies, the Fukusho Co., put them first through the strength test. Of the army of 14,000 coolies, the majority have been at work on the Wharves over a dozen years, and have acquired a high degree of skill in the lines of their trades.

The Fukusho Co., pays these coolies according to kinds of work at so much per ton.

These coolies earn about 80 cents a day on an average.

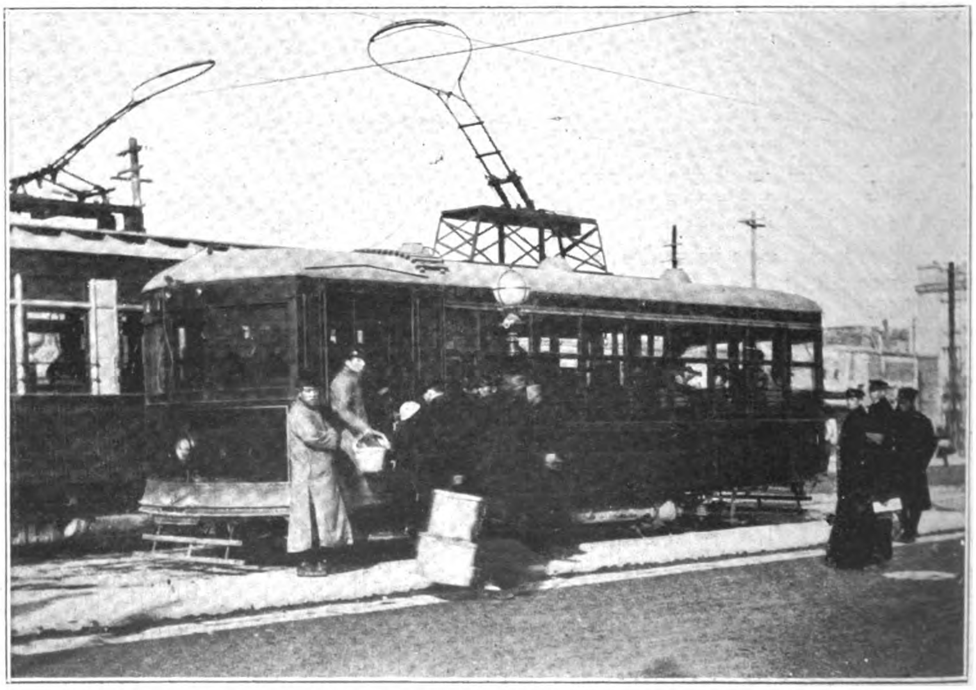
The Chinese coolies are very simple and live a very simple life. They are on a very low level intellectually, and some of them can not tell their own ages or even names, much less write their names. They are, however, faithful and best suited to working collectively.

Mechanical Installations

As already reported, most of the work at the Dairen Wharves being done by the Chinese coolies, there are only a few mechanical installations worth mentioning. The cranes, motor trucks, electricity-driven lorries, conveyors, and other machinery may be appraised at about Y.1,000,000.

As noted already, the exports from the port of Dairen consist of Coal, Bean Cake, Bean Oil, and other cereals, that are shipped in large quantities. Accordingly, mechanical appliances may be employed to advantage.

For the immediate purpose, a coaling vessel has been purchased, and is expected here in October. She has a capacity for 200 tons bunkers per hour. Again, three bunker loaders of the Michener system are now under installation, each having a 100 ton capacity per hour. Besides, car-dumpers, each capable of loading 1,400 tons per hour into steamer, are to be fitted up during the current year.



Berny Type Electric Car, Dairen

Petroleum in the Philippines

By Warren D. Smith

PETROLEUM gives some promise of proving to be an asset. The drilling operations now in progress on Bondoc Peninsula, Tayabas Province, Luzon, are of great interest in this connection. Here the Richmond Petroleum Company, a subsidiary of the Standard Oil Company of California, is drilling on the most favorable-looking structure I have yet seen in the Archipelago. If its borings are not successful on this structure after three or four holes are put down, further boring in the Philippines would seem to be a doubtful venture. The first hole in which only a very slight " show " of oil or gas was obtained was abandoned at 400 meters (approximately) owing to caving. A second well on Amuguis No. 2 is now (July, 1922) over 800 meters deep. Some water and gas have been encountered but no oil.

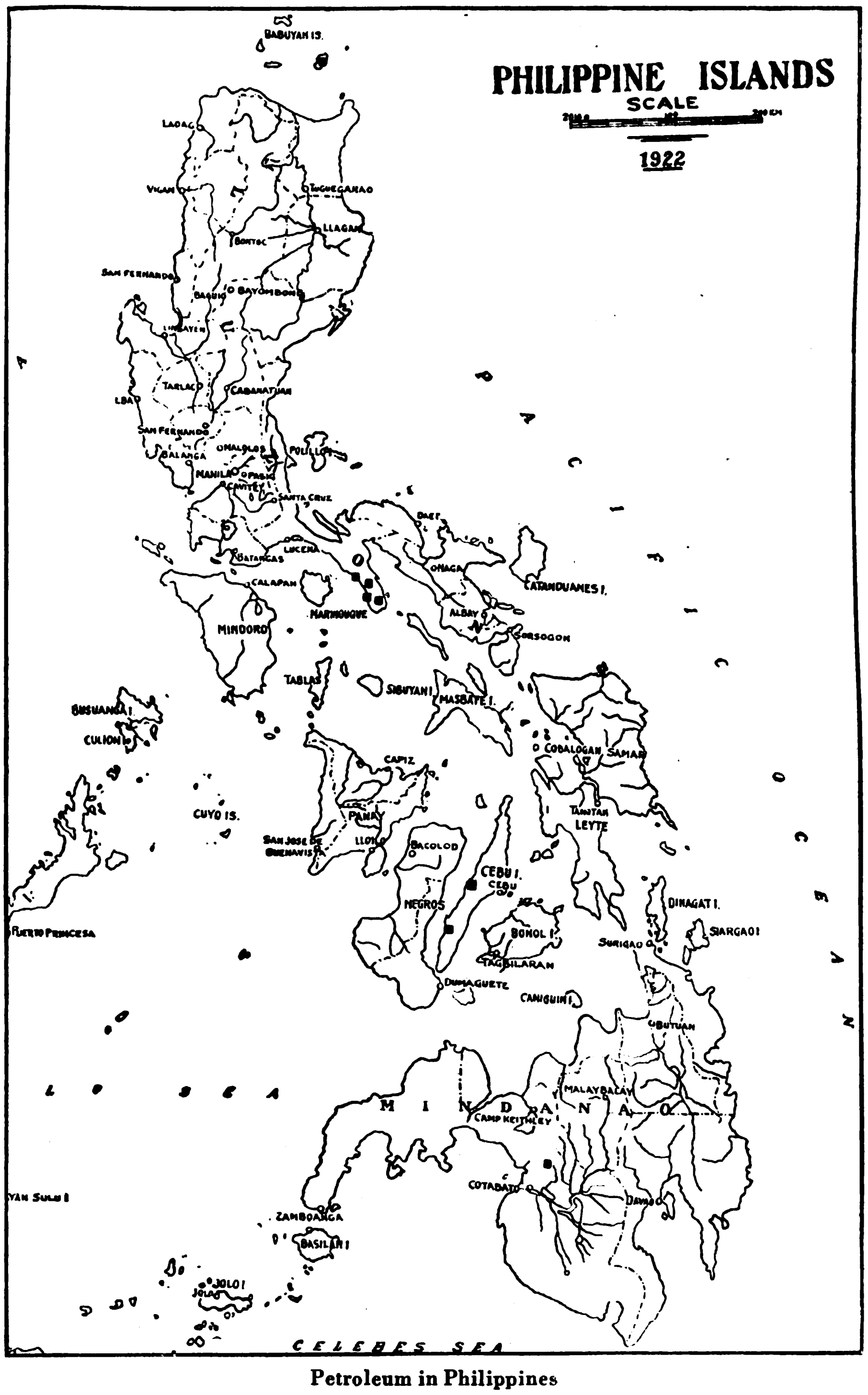
Petroleum seeps in the Philippines have been known for many years. In view of the presence of petroleum in commercial quantities in Borneo to the southwest, and Formosa (though in much smaller quantities) to the north, and the worldwide demand for petroleum and its products, great interest in the Philippines as a possible producer is natural. The result of the present operations of the Richmond Petroleum Company on Bondoc Peninsula is of more than local interest. Should a commercial supply of oil in the Philippine Islands be secured the effect upon political, military, and commercial problems will be profound.

The principal source of oil in the Philippines is the group of shales, with intercalated limestone beds, to which has been given the name Vigo, from the type locality on Vigo River in Bondoc Peninsula.

The typical oil shale on Bondoc Peninsula may be described, quoting from a report of Pratt and Smith, (506) as consisting—

. . . of fine-grained shale and sandy shale interstratified in thin regular beds from 5 to 10 centimeters in thickness. Occasional beds of sandstone occur varying from 10 centimeters to 1 meter in thickness. The fine-grained shale is gray, blue, or black, and is made up almost entirely of clay. . . .

The blue or black, fine-grained shale in the Vigo formation usually emits a slight odor of light oils upon fresh fracture, and in some outcrops is highly petroliferous. The material loses this odor and assumes a light gray color after it has been exposed to the air and has become thoroughly dry.



Petroleum in Philippines

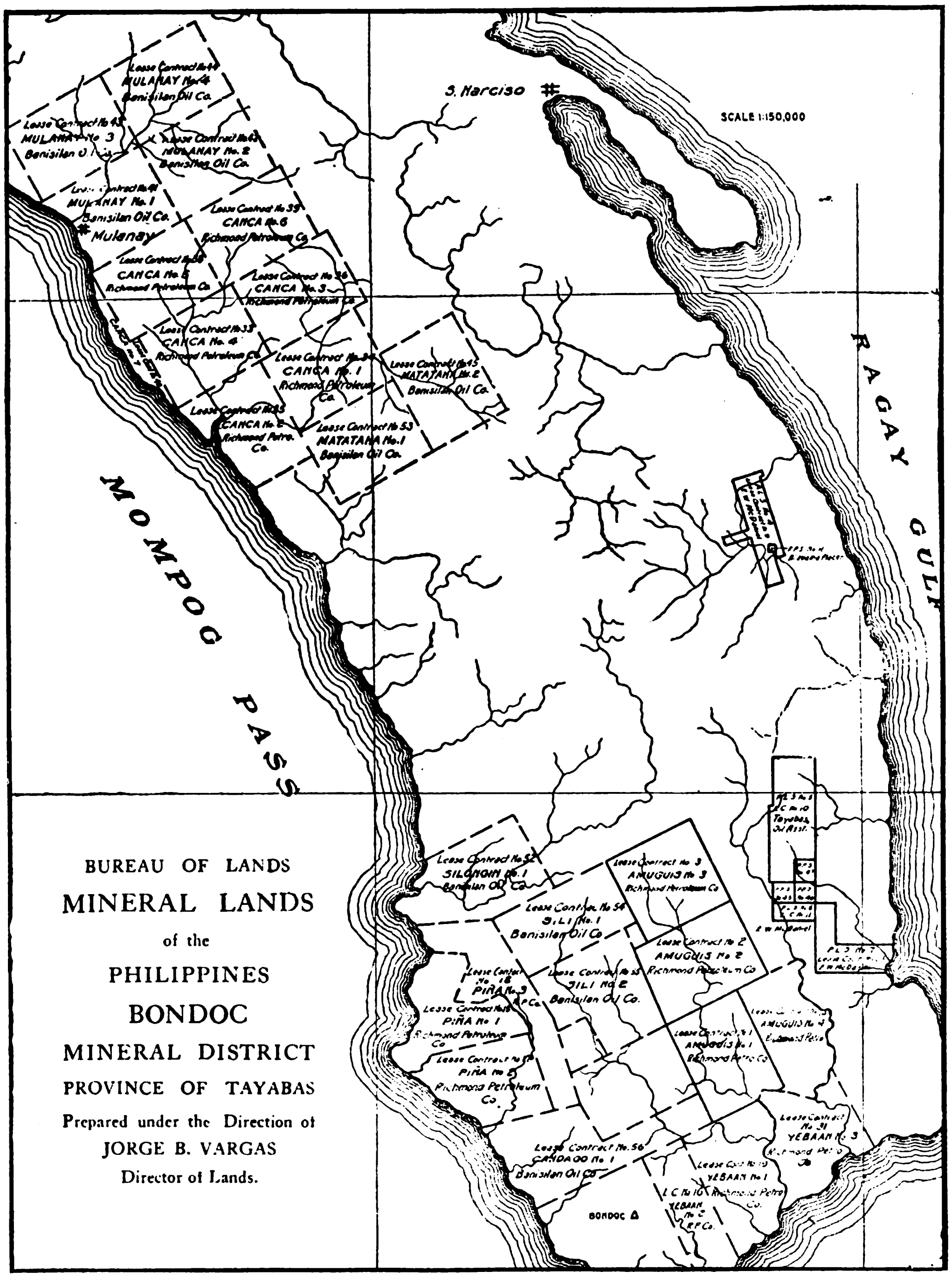
These shales contained numerous Foraminifera of the genus *Globigerina,* which may be the source of the oil. Although they are numerous, these organisms did not appear to comprise a large percentage of the volume of the shales. However, shales from Leyte and Mindanao contain them in large numbers.

The Vigo shales are found to be hundreds of meters in thickness in several parts of the Islands and much thinner in others. The age of the shales is middle Miocene ; they are easily recognized by certain index fossils which have been determined by paleontologists. Some of the most characteristic are the round, globular protozoan, known as *Globigerina* ; a small bivalve shell, *Corbula socialis* : a flat-topped cone shell, *Conus ornatissimus* ; another gastropod, or snail, with a high spire and very much tuberculated, *Cerithium jenkinsi* ; and a much-coiled cast of a worm borer, *Vermetus javanus.* These fossils are well known in connection with the oil shales of Java. Specimens of them may be seen in the Bureau of Science collection.

The Canguinsa sandstone, a buff-colored, very porous, and somewhat tuffaceous formation above the Vigo, may prove to be the reservoir for holding the oil.

Structure.—It has long been known that an important condition for the accumulation of commercial supplies of oil is the anticline, or arched flexure, of the rock strata. In southern Sumatra, according to one authority, no oil has been obtained in commercial supplies except by boring on the crests of these anticlines. The double flexure, where the anticline plunges at btoh ends, forming a dome, affords ideal conditions. By no means all of the productive wells in the world are located on anticlines, but in a new country it is desirable to locate the most favorable structures for " wildcatting."

Location of prospects.—The chief seeps and most promising prospects are located as follows : Bondoc Peninsula (lower



end), Tayabas Province, southeastern Luzon ; the ozocerite veins near Villaba and the asphaltic tuff near Baliti, both in the northwestern part of Leyte ; Pidatan district, in central Mindanao ; the west coast of Cebu, from Alegria north, to and perhaps beyond Toledo ; natural gas from some deep wells in Tertiary shale on the eastern flank of the cordillera and the low country to the east on Panay. Other seeps have been reported from the southern end of Mindoro and from Siasi Island.

All the known oil seeps, petroleum residues, and natural-gas emanations in the Philippines are associated with Tertiary or later sediments.

Special localities.—In Bondoc Peninsula, the seeps are in highly inclined strata which are probably in all cases part of anticlinal and fault structures. From this association it is believed that the petroleum in this field has, in accordance with the general law of petroleum accumulation, tended to collect in the crests of anticlines.

The petroleum occurs, associated with certain horizons, in an extensive series of beds of sandstone and shale (Vigo shale), which is similar in character to the oil-bearing rocks of productive fields, notably those of Japan. The principal seeps are found in the upper part of this series in a zone designated by Pratt as the Bacau stage, which is predominantly shale but which contains subordinate beds of sandstone. In its seepage, the petroleum is associated with the shale rather than with the sandstone, and may be observed in some cases to come directly from the shale. Beneath the surface, where closed lenses of sandstone probably exist, one would expect to find the principal accumulation of petrol eum in the more open, sandy zones. At the surface the light oil appears to have escaped readily from the coarse-grained beds, and to have been retained only in the fine-grained shale.

The structure of Bondoc Peninusla includes a number of anticlinal folds ; the conditions along some of these anticlines are considered favorable for the accumulation and retention of petroleum, whether it occurs in all or in any one of the horizons at which it is suspected to occur.

The localities enumerated below are considered some of the more promising as sites for the location of " wild-cat " wells in exploring the petroleum bearing rocks of Bondoc Peninsula. However, owing to conditions discussed in Pratt and Smith's report, cited above, it is possible that oil may be encountered at any one of the sites, even though it be absent elsewhere. There are many places other than those listed which would be considered as favorable, in case exploration of any of the sites herein recommended prove successful.

1. The Maglihi anticline in the southeastern part of the peninsula, near Mount Morabi.
2. The Maglihi anticline in the valley of Bahay River.
3. The central anticline in the vicinity of Balinsog or Bacau. Recent work shows that earlier reports of the structure of this need modification ; parts do not appear to be altogether suitable. The Richmond Petroleum Company of California has drilled one hole to a depth of about 400 meters, which caved, on the Amuguis anticline just south of the central anticline. The rig has been moved about 3 kilometers farther north, higher on the structure, and the hole is now over 800 meters deep without any results (July, 1922).
4. The Ayoni anticline, about 1,500 meters inland from the mouth of Ayoni River on the west coast.
5. The Malipa anticline, near Cabongahan.

Leyte

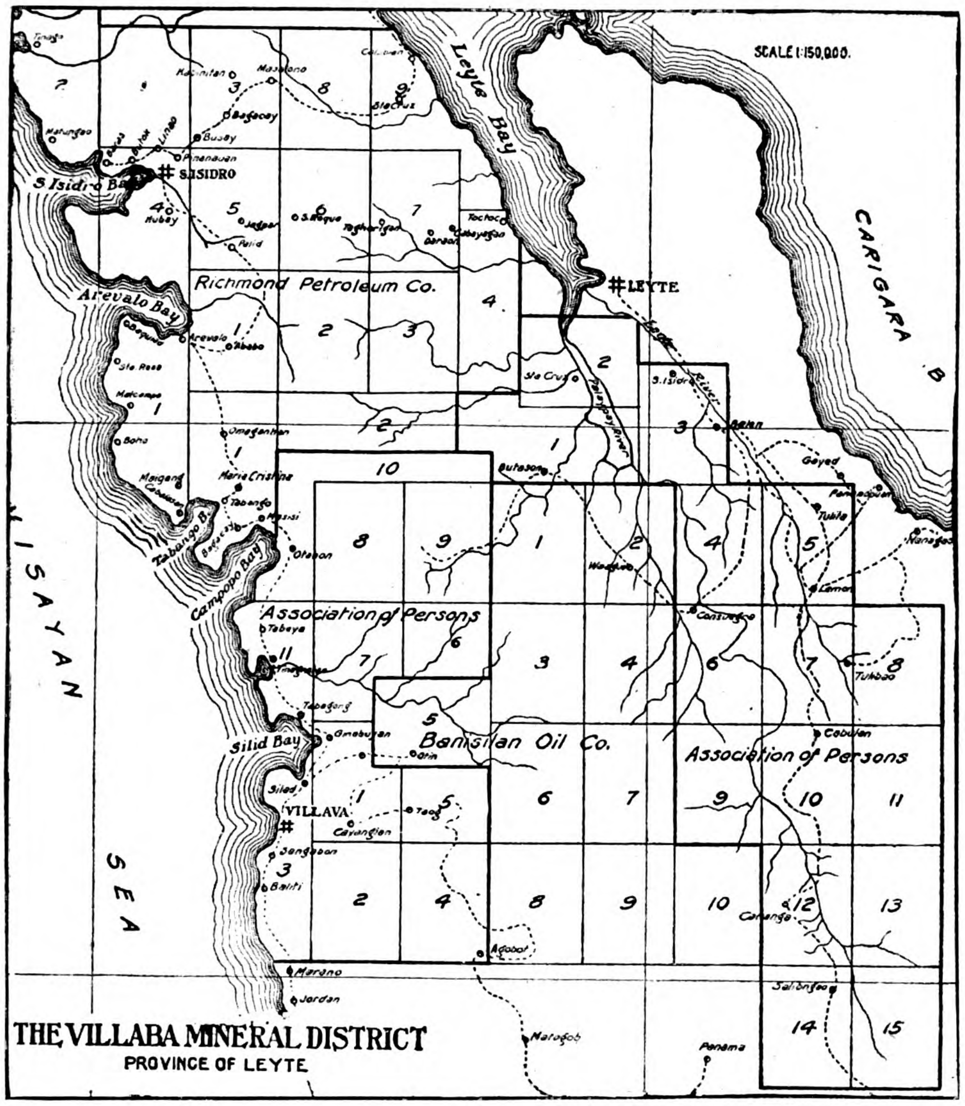
It has been known since 1890, at least, that petroleum existed near Villaba, Leyte.

Rock " asphalt " was discovered in 1913 by a Filipino forest ranger, and a period of active claim staking followed. Not until 1918, however, was the deposit opened commercially.

The extreme northwestern peninsular portion of Leyte, as far south as Baliti, is worthy of careful exploration. The geologic formations here, according to Pratt, (494) are a continuation of those on Bondoc Peninsula.

Petroleum is encountered at two places in Leyte ; it seeps from the upturned edges of the Vigo shale, and oozes from the base of a hill which consists of a clayey tuff-sandstone belonging to the Canguinsa. Residual bitumens occur in the Canguinsa and in the Malumbang series ; one questionable outcrop of solid bitumen was observed, in loose débris, which appears to overlie the Vigo shale ; and a heavy, black oil, or viscous bitumen, was found in sandstone near the base of the Vigo.

The bitumens in the Canguinsa are encountered in five types of deposits as follows : (*a*) Solid bitumens, in lenses or pockets which tend to follow bedding planes, but which also cross the bedding irregularly along fractures and cavities ; (*b*) solid bitumens, in regular fissures, which penetrate the clay-tuff independently of bedding planes; (*c*) non-uniform mixtures of bitumen-impregnated.



clay-tuff fragments and subordinate solid bitumen ; (*d*) viscous, or semi-liquid, bitumen-cementing breccias of flintlike limestone, small domes of which protrude from the surface of the clay-tuff formation ; and (*e*) viscous or semi-solid bitumen, filling the centers of hollow, cylindrical concretions, which occur in the clay tuff, with their longer axes nearly vertical and at right angles to bedding planes.

The bitumen in the Malumbang series has impregnated porous limestone and sandstone, forming what is known commercially as rock asphalt. It is this material impregnating the porous limestones of that region which the Leyte Asphalt and Mineral Company is developing. To me there appeared several million tons of this material available; Dalburg estimates about ten million tons. The best deposit known at present is on the Lucio claim.

Mindanao

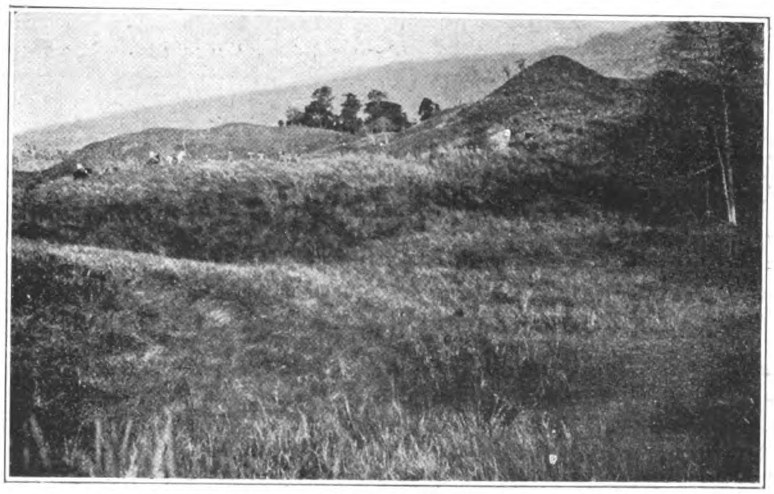
The Pidatan field was investigated by me late in February, 1921, in company with Pittsburgh (Pa.) oil men and geologists. About one week was spent on the ground in the vicinity of the petroleum seep. It was the consensus of the entire party that the immediate vicinity of the seep did not show sufficient favorable indications to encourage drilling in that particular region, but it did seem justifiable to consider further geologic exploration in the surrounding territory in Cotabato Province.

The field investigated is situated about 60 kilometers due north of Fort Pikit, Cotabato Province, which in turn is situated some 70 kilometers up the Rio Grande de Cotabato and, therefore, is very nearly in the heart of the great southern island. To the north of the field lies the volcanic range containing the active volcano of Mount Ragang, which in turn lies just south of Lake Lanao. To the west runs the line of hills and mountains known as the Babuy Mountains. To the east there are some moderately high hills and mountains of limestone, of which Mount Kitubud is the outstanding feature. The principal stream through the field is the Malitabug, which flows almost due south. This is a swift and almost unfordable tributary of the Rio Grande.

Transportation to the seep is first by launch from Cotabato to Fort Pikit, thence by horse and cargadores up Malitabug River, thence across country to within about 1.5 kilometers of the oil seep. The rest of the way is made on foot. The trail as far as the forks, close to Banisilan, is a fairly good one; from there it ascends gradually to an elevation of between 750 and 900 meters, and is exceedingly rough in places. The country is practically uninhabited, and side trails are few. Tall grass (cogon and talahib) runs riot, and much of the country is fairly deforested. With the exception of Banisilan, where there are a Constabulary outpost and a Moro farm school under the able supervision of Mr. Manion, there is no settlement worthy of the name. The country is exceedingly wild and beautiful and capable of great development. There is a Government herd of cattle here, the only one in hundreds of square kilometers of country.

The geology of the region, briefly stated, is as follows : The principal formation as indicated on an early map published by the division of mines of the Bureau of Science consists of Tertiray sediments, limestones, sandstones, and shales. These are intruded on the edges of the field by igneous rocks, principally basalts and andesites. There is considerable agglomerate in the region. Owing to these intrusions, and also to more-widespread regional earth movements, the sediments have been folded and faulted, as in other parts of the Archipelago—some of them, especially the lower series, including the Vigo shales, very profoundly. In the region adjacent to the seep the formations which might be counted upon to contain oil are so badly disturbed that no regular structures could be made out ; and, as knowledge of the geologic structure is necessary in locating an oil field, a favorable consideration of this locality cannot be entertained. I do not mean to say that no oil exists there : it might even be there in fair quantity ; but with other difficulties, already referred to and which must be considered, it does not promise to be an economic undertaking. This is a feature which many would-be oil producers do not adequately consider.

The seep under discussion is located in a small ravine, the headwaters of Kirusoy Creek, a tributary of the Malitabug, on the side of a partially wooded range of igneous rock and on the south side of an east and west dike extending from the main igneous mass. Apparently, there is a fault at this point, as the oil is seeping out along a considerably slickensided surface. On the hanging wall there is a much broken mass of material which may be either agglomerate, locally brecciated igneuso rock, or merely


Topography in the vicinity of Pidatan oil seep, Mindanao

talus. Little oil or gas is issuing at this point. The location and the composition of the oil (which has none of the light fractions and very little either of paraffine or of asphalt) indicate local and abnormal conditions. Compared with other seeps seen in other parts of the world by members of our party, this one was disappointing.

Cebu

Just prior to the outbreak of the insurrection of 1896 an English company had started drilling on the Smith Bell Estate near Toledo, Cebu ; but with the coming of hostilities work was abandoned when the bore had reached about 400 meters. A small amount of oil had been tapped, and it can now be baled from the old well.

Although there are several strong seeps on the west coast of Cebu, the geologic conditions are not so favorable as are those on Bondoc Peninsula. At Alegria, on the southwestern coast, the seep is located near a fault, and the topography is such that drilling operations would be expensive. Farther north, at the old Smith Bell well near Toledo, the rocks are found in a monoclinal attitude in which there are minor folds. Detailed work in that region has revealed some unfavorable structural features. However, between these two localities, or farther to the north of Toledo, favorable structures might be located.

Mindoro

Two seeps are reported on Mindoro, one near Mangarin, and the other farther back in the foothills to the northeast of this place. I know nothing at first hand of either of these localities and, as far as I know, no published information is available.*

Panay

On Panay Tertiary shales that yield natural gas are found on the eastern flanks of the main cordillera, generally monoclinal ; that is, dipping in one direction, to the east. From work already done in that region it is known that there is at least one well-defined local anticline, known as the Maasin anticline, which might be a favorable location for a test well. However, some comparatively deep artesian wells in that region, which have reached a depth of 527 meters, have shown only small amounts of natural gas and salt water.

Sulu Group

A petroleum seep is reported by observers of the Coast and Geodetic Survey, on Siasi Island, between Jolo and Tawitawi, in the Sulu group. I doubt the genuineness of this seep since there is a great amount of volcanic veneer on those islands. However, this does not preclude the possibility of finding Tertiary sediments beneath.

Chemical and Physical Properties of Philippine Petroleum and Natural Bitumens

Philippine petroleum has a paraffine base and is usually reddish to violet in color. It is clear, and closely resembles oil from Burma and Sumatra. Table 36 gives a fairly complete analysis made by Richmond and other former chemists of the Bureau of Science. Table 36*a* shows the physical and chemical properties of petroleum from Pidatan, Mindanao. Table 37 gives an analysis of the petroleum residues from Leyte Island. The paraffine content of Philippine petroleum is very high ; a bottle full of oil collected in 1908 from the Toledo well and put, imperfectly sealed, into one of my saddle bags, was found, on unpacking three days later, to contain no oil ; but it was half full of solid paraffine.

*Geologists of the Richmond Petroleum Company and of the Dutch Shell Company have made examinations here, but the results have not been made public.

TABLE 36*a*.—*Physical and chemical properties of a sample of petroleum from Pidatan, Mindanao.*

Specific gravity at 15.6° C	0.9297
Distillation :	
Light oils (below 150° C.)	None.
Burning oils (150°—300° C.)	45 per cent by volume.
Heavy oils (300°—400° C.)	49.5 per cent by volume.
Residue	5.5 per cent.
Sediment	Large amount.
Water	Trace.
Base	Paraffine.
Main calories, or gross heating value	12,495
Available heating value	11,189
Sulphur	1.56 per cent.

TABLE 37.—*Physical properties of natural bitumens from outcrop A and B, Villaba, Leyte.*

Property.	
Specific gravity	1.05
Hardness	2.00
Color	Jet black.
Streak	Black.
Luster	Brilliant.
Structure	Columnar.
Fracture	Conchoidal.

Intumesces, softens, and flows imperfectly at 150° C.

Although Mr. Warren D. Smith's article was published in 1924, it undoubtedly was prepared a year or so earlier and could not therefore have included the failure of the Standard Oil Company of California to find oil in commercial quantities. In a statement issued during July 1924 by the Standard Oil Company of California, the reasons for the failure are made clear.

" The Philippines expedition furnishes a striking example of the hazards of the oil industry." states the Standard oil Co. of California in pointing out the sort of conditions referred to. " The search for hidden deposits of petroleum is uncertain—the industry seeks and sometimes finds and sometimes doesn't. In either case the expense is great, requiring resources of vast size. There is compensation, however, for where many wildcat ventures may fail one may succeed with profitable results. Such is the history of oil.

" The Bondoc adventure proves, too, that there is something more to the oil industry than merely the manufacture and sale of petroleum products. Back of the gasoline pump, which is the public's principal point of contact with this vital industry, there is a stupendous activity of which the public is little aware—an activity

TABLE 36.—*Physical and Chemical Properties of Philippine Petroleum.*

Sample.	Crude oil.		Distillation products.						Residue above 400° C.	Remarks.
	Color by transmitted light.	Specific gravity.	Gasoline, to 150° C.		Kerosene, 150° to 300° C.		Heavy oils, 300° to 400° C.			
			Volume	Specific gravity.	Volume.	Specific gravity.	Volume.	Specific gravity.		
Tayabas, Bahay well I.*	Brown to wine red.	0.8325	39	0.770	44.5	0.850	16.5	—	—	Flash point, 0° C. (32° F.); sulphur absent; initial boiling point, 91° C., paraffine, 8.1 per cent. ; specific gravity at 15° C.
Well at Toledo, Cebu	Dark brown	0.885	6.2	0.762	42.32	0.832	38.3	0.901	+3.17	Residue above 375° C. specific gravity at 15° C.
Oil seep at Alegria, Cebu	do	--	17.5	--	30.5	—	35	—	—	Residue contained foreign sediment.
Leyte	—	0.926	—	—	—	—	—	—	—	Flash point, 74° C. (166° F.).

*Depth, 40 metres. Sampled by division of mines twenty-four hours after well had been drained.

which leads to the ends of the earth in a quest for new oil. The public hears much of successes, of wells gushing quantities of 'black gold.' Of the failures, of the great financial risks, of the great losses which often must be borne, it knows very little. The world moves on oil, and it is the obligation of those engaged in the industry never to permit the supply to fail. Hence the unceasing search, which nowadays goes far afield. This company to-day has drilling parties in Alaska, Colombia, Ecuador and Argentina, as well as in several states at home, while its geologists are scouring the earth for likely looking territory."

Its Own Survey

The Bondoc venture of the Standard Oil Co. of California was started in 1919, when that company initiated its own geological survey. In 1920 there was a shortage of oil on the Pacific coast (although later there was over-production) and the company decided to drill in the Philippines to insure future supplies. In December, 1920, an expedition sailed from San Francisco for Manila with a a thousand tons of material, which included rigs, all machinery, road-building apparatus and even a supply of ropes, also a field hospital equipment. Twenty-five California oil field workers composed the party.

The field operations were in a wild, scarcely inhabited region of southern Luzon, well away from civilization, a tropical land of great heat and torrential rain, an area of typhoons, of fetid humidity and lurking disease. Men and materials were lightered ashore at the mouth of the Pagsanghan River, and the first camp was built several miles from the sea. There were no roads ; the area was covered with head-high nipa grass. Bunkhouses were built, California style and design, and after weeks of labor drilling was begun and a well was " spudded in " on March 20, 1921.

" For more than three years the work proceeded steadily," says the company's statement, "but with climatic interruptions. The rains brought floods ; the typhoons were destructive. The first hole went to 1,200 feet and was abandoned because of mechanical trouble. No oil. The second was drilled to 3,750 feet. No oil. The third, the final great effort, went down to a depth of 5,120 feet, almost a mile. No oil—and the end.

The company gives its men much credit for their work under hazardous conditions. Disease, particularly malaria and dysentery, was an always present menace, and some became ill, but as a whole health was good, due to proper sanitation. Once the camp was completely isolated for a month—the radio went out of commission, the telephone wire stretching for nine miles between the two camps was blown down, and the road was an impasable mire.

The company concludes its story with the statement : " The failure to find oil at Bondoc does not prove there is no oil in the islands. It means that there is none in the area prospected."

The Problem of Trade Mark Protection in China

" Handbook on the Protection of Trade Marks, Patents, Copyrights and Trade Names in China." By Norwood F. Allman. Shanghai: Kelly & Walsh. November, 1924.

THIS book, as its title suggests, is intended as a practical guide to this most important problem of foreign commerce in China. As the author states in his preface : " All consular and diplomatic officers in China can testify that there is great confusion and obscurity about the protection of industry and intellectual property in China. . . The aim of this book is to focus attention on these important subjects, and endeavor to arouse sufficient interest therein to ensure that a practical and satisfactory solution will be found whereby adequate protection will be afforded to trade-marks, trade names, patents, and copyrights."

This aim, we feel, has been well attained, for the clear, concise style of the work makes it of interest and value to the ordinary resident in China who wishes to be well informed as well as to the legal practitioner who has hitherto had nothing to guide him in dealing with this problem.

Mr. Allman is exceptionally well acquainted with his subject, having formerly served as American Consul and Assessor in the International Mixed Court, deciding there severalno table trade-mark cases, as well as conducting the Trade-mark Office of the Consulate-General. He is now engaged in private law practice in Shanghai, and specializing in trade-mark cases. His knowledge of Chinese has enabled him to effect his own translation of the Trade-mark Law, a translation which was made before the official one, and is distinctly clearer and nearer the original than the latter in several details.

This book is divided into four chapters, each relating to one of the subjects mentioned in the title of the book. Most attention is, of course, given to trade-marks, as that is the only subject in which the Chinese Government has made definite legislation available for foreigners. The value of the book is much enhanced by the diplomatic correspondence included, and a good index also adds much to its scholarliness.

The timeliness of such a work cannot be over-emphasized, as anyone reading Mr. Allman's description of the provisional registration hitherto in use will perceive. The opposition of the diplomatic body to the new Trade-mark Law has caused the owners of many trade-marks to become unduly confused as to the best procedure to adopt, and this work will certainly be of value in clarifying the situation for them.

There is no attempt at criticism or arbitrary statements in regard to the legal effect of the situation, but a brief and interesting history of how the present situation arose, and practical suggestions for meeting it. The outline for registration procedure is most helpful to firms resident abroad, and it is to be hoped, in the interests of foreign trade, that this book will fall into the hands of such. It cannot fail to be of use and interest to anyone having connection with China.

Large Turbine Furnace Contracts

The Federated Malay States, India, and Burmah, as well as New Zealand, South Africa, Canada, and Chile, have placed large orders for turbine furnaces with the Turbine Furnace Co., Ltd., of London. The furnaces are for a variety of different kinds of work. They are to be installed in many of the Indian textile mills, as well as in some of the mines and electrical stations ; in locomotives in the Burmah service, and in tin mines in the Federated Malay States. In Chile they are in use in the navy and in privately-owned steamers.

The boilers are so fitted as to include all the regular recognized types, both vertical and horizontal. In Great Britain the number of these furnaces installed of late has been very large and they are also so much in favor in Continental Europe that it has been found necessary to form an independent company to carry out the orders. This is located in Brussels, Belgium, and is the headquarters for the whole of the Continent.

New Motor Vessel for Far Eastern Trade

The new steel screw motor vessel *Silveray* has just been launched by Messrs. Joseph L. Thompson & Sons, Ltd., from the North Sands Shipyard, Sunderland. She has been specially built for the Way Shipping Company, Ltd. (Messrs. Stanley & John Thompson, Ltd., London, Managers), and is intended for a special line between America and the Far East.

The dimensions of the vessel are 412-ft. long by 57-ft. beam, and 30-ft. 5-in. depth to the shelter deck. She has been constructed to Lloyd's highest class on the latest single deck rules, with open shelter deck. She is designed to carry about 8,000 tons on a moderate draught of water. The engines, which are being supplied by Messrs. William Doxford & Sons, Ltd., Pallion, are of the Doxford opposed piston type, with three cylinders, 580 bore, 1,160 stroke, and giving 2,650 horsepower at 90 revolutions. This is estimated to drive the vessel a good eleven knots. The auxiliary machinery will be driven electrically, and the equipment has been supplied by the Sunderland Forge & Engineering Company, Ltd. The christening ceremony was performed by Mrs. Robert Thompson, of Over Dinsdale Hall, near Darlington.

Petroleum in West China

THE exploration of the petroleum fields in western China, in Shansi, Shensi, Szechuen, Kansu and Sinkiang naturally attracts the attention of the western nations who are constantly seeking additional supplies of this all-important mineral. Thus far the Chinese government has done nothing either to find oil or to exploit the wells found. There was at one time considerable talk of the founding a Petroleum Bureau in the government, but nothing has come of it. Meanwhile, the Russians are active in Sinkiang and Kansu which border on Russian territory. Chinese efforts in Shansi and Shensi are extremely rudimentary and the developments thus far are of little importance.

Oil in Shansi

Shansi provincial authorities have recently outlined a program for the development of the oil refining industry in the province on a large scale. The program covers a period of ten years, during which a yearly appropriation of $300,000 is to be made from the provincial treasury for the undertaking. According to the estimate, in ten years the Shansi authorities will be able to establish 44 oil refineries with funds from both the yearly appropriations and the profits accruing from the industry. In the opinion of the Shansi authorities, the province ought to be able to produce enough oil not only for the local market but also for other provinces and even for foreign countries ; yet at present Shansi imports about 14,000 tons of kerosene from foreign countries yearly at a total valuation of over $3,000,000. Shansi authorities plan to obtain oil from the extensive shale deposits and their present opinion is that an oil refinery could be established profitably in any locality in the province, if labor and means of transportation were available.

According to the prospectus issued by the Shansi authorities, each refinery is to consist of one distillation plant, one refining plant and a machine repairing shop. Attached to these, there will be a plant for collecting and manufacturing such by-products as carbolic acid and so forth. The total initial outlay for establishing a unit refinery plant is estimated at approximately $200,000, consisting of the following items :

(*a*)	Machinery for the distillation and refining plants and the machine repairing shop and building for the establishment (not including the land) ..	$95,000
(*b*)	Machinery for the byproducts manufacturing plant	31,237
(*c*)	Building for the business department, etc. ..	15,000
(*d*)	Cost of land (about 50 mow)	1,500
(*e*)	Purchase of mining area (10 square li)	30,000
(*f*)	Cost of transportation and installation of machinery	20,000
	Total	$192,737

Each refinery is to be capable of turning out six tons of crude oil a day, or 1,800 tons a year, counting 300 working days. From this quantity, 20 per cent or 360 tons of kerosene and an equal percentage of gasoline could be obtained it is said. In addition, there would be 20 per cent. or 360 tons of lubricating oil. The remaining 40 per cent. of coal tar could also be utilised for making different kinds of by-products. The items of the yearly net receipts from the sale of the output of each refinery, after deducting the sales and transportation expenses, are estimated as follows :

(*a*)	360 tons of kerosene oil ($150 per ton, net.) ..	$54,000
(*b*)	360 tons of gasoline ($230 per ton, net.) ..	82,800
(*c*)	360 tons of lubricating oil ($134 per ton, net) ..	48,240
(*d*)	720 tons of coal tar ($30 per ton, net)	21,600
(*e*)	7,200 tons of coke ($0.50 per ton, net) ..	3,600
	Total	$210,240

The yearly running expenses of a refinery are estimated at $86,595 to which must be added two yearly appropriations of $20,000 for repayment of one-tenth of the initial outlay (which is to be repaid in ten yearly instalments) and $33,645 against plant depreciation and other incidental expenses. After deducting these items from the business receipts of $210,240, the net profit would be $70,000, details being shown by the following figures :—

(*a*)	60 tons of bituminous coal per diem or 18,000 tons per annum of 300 working days, at an estimated cost of $1 a ton..	$18,000
(*b*)	Wages for operatives per annum (365 days) ..	37,595
(*c*)	Cost of making oil cases and tins	13,500
(*d*)	Salaries for the managing department	12,500
(*e*)	For losses and repairs	5,000
(*f*)	Appropriation for repayment of initial outlays..	20,000
(*g*)	Appropriation against plant depreciation and other incidental expenses	33,645
	Total	$140,240
	Net profit	$70,000

Thus in ten years the number of oil refineries would be increased to 44, the scheme being explained in detail as follows. If the Shansi provincial treasury appropriates a yearly sum of $300,000 for this undertaking for 10 years, during the first year, one oil oil refinery at a round figure of $200,000 would be established, leaving a surplus of $100,000 to be carried over to the next year for further expansion of the undertaking. In the second year $400,000 ($300,000 being regular yearly appropriation and $100,000, surplus carried forward from the previous year) would be available for expansion hence in the second year, two refineries could be established. By the end of the second year, a net profit of $70,000 made by the refinery established during the first year would be available for the expansion of the scheme, and this sum would be carried over to the third year for establishing more oil refineries. In this manner the number of refineries would increase to 44 in the tenth year. Detailed figures are shown in the following table :—

Year	Funds Available for Expansion, including yearly appropriations, surplus and profits	Number of Refineries to be established	Funds expended for establishing new refineries	Net Profits	Surplus to be carried over to next year	Profits to be carried over to next year
1st Year	$ 300,000	1	$ 200,000	nil.	$ 100,000	nil.
2nd ,,	400,000	2	400,000	$ 70,000	nil.	$ 70,000
3rd ,,	370,000	1	200,000	210,000	170,000	210,000
4th ,,	680,000	3	600,000	280,000	80,000	280,000
5th ,,	660,000	3	600,000	490,000	60,000	490,000
6th ,,	850,000	4	800,000	700,000	50,000	700,000
7th ,,	1,050,000	5	1,000,000	980,000	50,000	980,000
8th ,,	1,330,000	6	1,200,000	1,330,000	130,000	1,330,000
9th ,,	1,760,000	8	1,600,000	1,750,000	160,000	1,750,000
10th ,,	2,210,000	11	2,200,000	2,310,000	10,000	2,310,000

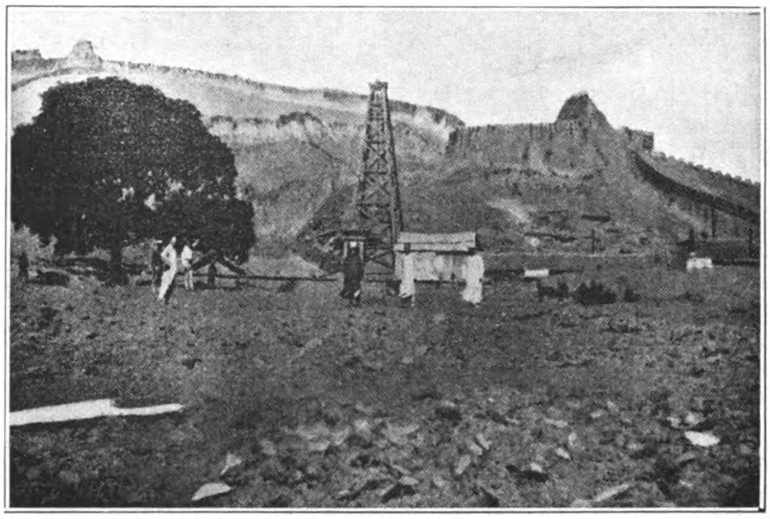
By the end of the 10th year, 44 oil refineries would be operating, leaving a surplus of $10,000 and a net profit of $2,310,000, according to these plans.

Oil in Northern Shensi

Mr. Brouyard, chief engineer of the Chengting-Taiyuan Railway, in making a survey for a proposed line from Taiyuan to Sianfu, has explored the petroliferous region of Yenan, Northern Shensi. The seepages are east of Yenan along the Fuho River and in the ravines above and below Yenchang. At Likiawa, there are two seepages in the river bed, near the banks. In front of Kiaokiachekow, on the right bank of the Fuho, there is another seepage, but the oil is lost by permeation through the surrounding rock. Below Yenchang, on the left bank of the Fuho, there is a plentiful seepage. In a ravine west of Yenchang, oil is also found oozing out from fissures in sandstone. Three kilometers from Hukiachwang in a village east of Yenchang, there is the heaviest seepage, from cracks in the sandstone. The water in the ravine about the village, locally known as " Petroleum Ravine," is undrinkable, on account of its oil content. The soil in the vicinity must also have been soaked with petroleum, judging by the burning appearance of the plants. In the ravine of Lochiameng, 10 kilometers east of Yenchang, only a small seepage is located.

An oil plant has been established in Yenchang, outside the West Gate. It is equipped with a 12 h.p. engine. A well has been sunk to a depth of 260 feet connected with two pipes, 75 millimeters in diameter. Upon being pumped, only water is drawn up during

the first two days, water mingled with more and more oil during the third and the fourth day, and oil alone during the fifth day. After two days pumping the engine is cleaned before work can be resumed. The plant has been operated for about a year, during which 1,550 catties of refined oil have been put on the market with 1,000 catties of petroleum ether, and 3,000 catties of vaseline and paraffine. Refined petroleum is sold retail on the spot at 12 cash a catty. Practically the whole production is sent to Sian, only 35 catties being consumed on the local market. The cost of transportation has been increased during recent years. In 1908, a donkey bearing a load of 230 catties for a distance of 80 li per day cost only 700 cash. But the cost is now much higher, and has prohibited any further growth of the industry.


Oil Well at Yenchang

The oil deposits at Yenchang, in northern Shensi, cover a total area of over 6,000,000 square feet, according to the estimate of a Japanese expert. Yenchang, a hsien district, formerly under the prefecture of Yenan, Shensi province, is situated on the right bank of the Yellow River. The oil field extends from the city to the northwest and is bisected by the Yen River, a tributary to the Yellow River. The larger portion is found on the northern bank of the Yen River. Oil works in these regions date back to the Ming dynasty (1368-1661), but only a limited quantity of impure oil was obtained formerly, as primitive methods were used. The poor yield apparently did not encourage the local capitalists, and the greater part of the field has been left undisturbed up to the present time. Attempts were made by a German and a Japanese firm to work the oil fields some thirty years ago, but little was accomplished in either case. Operations under Chinese auspices were resumed about twenty years ago after the discovery of an oil well outside the east gate of the City, which yielded large quantities of crude oil. In 1906 the Yenchang Petroleum Company, a private and Government joint enterprise organised by the Shensi officials and members of the local gentry, was formed to work the oil wells under the direction of some Japanese experts. In the winter of the following year, drilling to an average depth of about 250 feet had to be carried out before the oil bearing sand was reached. The crude oil at first was found to contain a rather high percentage of brine. The daily output averaged 8,000 catties of crude oil, from which about 2,500 catties of refined oil were obtained. Several years later two or three new oil wells were drilled.

The company experienced a chequered career during and immediately after the Revolution of 1911. Operations were suspended during the first two years of the Republican regime, but were resumed in 1914. American interests representing the Standard Oil Company were admitted into the enterprise, but the joint Sino-American undertaking did not prove a success because of the poor prospects of the wells. The company is now a purely Government financed enterprise.

The geological position of the Yenchang oil deposits bears a resemblance to those at Fushun and Kiating, in Szechuen province, both being of mesozoic formation. The crude oil obtained from the Yenchang wells is of dark brown color and, after fractional distillation, is found to contain: benzine, 16.5 per cent.; kerosene, 62 per cent.; heavy oil, 10 per cent.; paraffin, 2 per cent.; residue, 9.5 per cent.

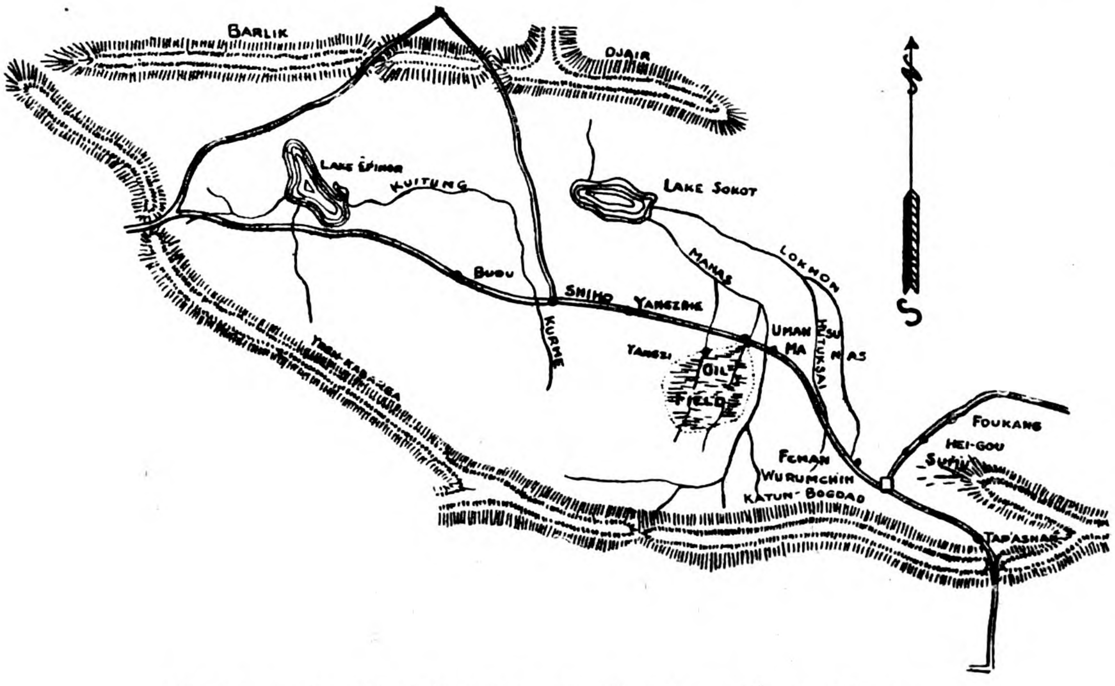
The company is rather poorly equipped. Sets of modern drilling machinery ordered from abroad during the first few years of the Republic are now left rusting at Ichun, Shensi province, and it is reported that certain component parts of the machinery have been removed for other uses by the local militarists. Even the number of pumping outfits is not sufficient to work the oil wells, form which oil is sometimes obtained by means of water pails. Poor equipment has been responsible for the present limited output.

The company's head office is at Yenchang with a sales department at Nanyuanmen Sian, Shensi provincial capital. The most important product of the company is kerosene, which is sold under the "Yenchang" brand. Only a very limited quantity is consumed on the local market, the bulk being sold at Sian. High transportation cost, however, prevents the oil from seeking a market further than Sian. Among the company's by-products are candles made of paraffin, benzene, lubricating oil, gasoline, heavy oil and rhigolene, the last named being for surgical use. The candles are sold under two brands, the "Swan and Pagoda" and the "Pheasant;" benzine, under the "Horse" brand and lubricating oil, under the "Double Gun" brand.

Oil in Sinkiang

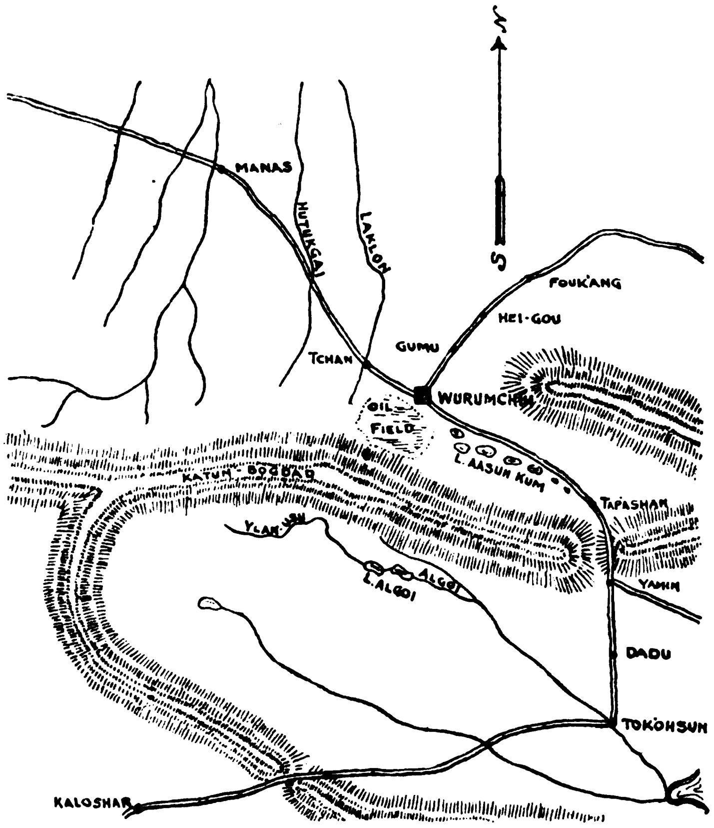
The following notes are taken from "Mongolia and Western China" by W. Karamisheff.

Petroleum can be found in the province of Sinkiang in two places. The first field is within 30 kilometers from the river Manas on an area bordered on the south by the Yren - Kabargo mountains, on the north by the mountains Barlik and Djair.



The Scheme of the First Oil-field near the River Mauas, Sinkiang Province

The oil bearing field is situated to the south of the road that leads from Urumchi to Djarkent. The field is vast and is situated between the river Hargos on the west, the river Manas on the east, the mountain range Uren-Kabarg to the south and the Shiho-Manas to the north.



The Scheme of Second Oil Field near Urumchi, Sinking Province

The number of seepages is considerable ; there are supposed to be about 78. We shall discuss only those groups which have been more or less investigated and about which detailed information exists.

In the indicated area, about 35 kilometers from the river Manas, lies the first group consisting of seven seepages that are situated close to one another and form a rough circle. Each of them is in the shape of a small hill, about 14 feet high, the breadth of which is considerably larger than its height. Through the center of this hill passes a vertical channel out of which the petroleum is constantly oozing to the surface.

In the opinion of Russian mining engineers those hillocks were formed in the following way : The petroleum which spread over the ground was covered with sand, by strong winds, the ground in this region being sandy. Mingling with the sand the petroleum gradually formed a crust which, during a long period, grew to the size of a hill. Due to contact with the air, the volatile parts of the petroleum evaporated, the heavy substances remaining. Within 10 kilometres from this group one petroleum seepage is found and a few kilometres further there are 15 more.

All of them are of the same shape and origin as the preceding seven. None of these seepages has ever been properly worked. A few years ago a mixed Chinese-Mohammedan-Russian Company was founded, with which became incorporated the South Siberian Association at Semipalatinsk, a rich merchant Ismailbaieff, at Chugoutchak, Risseff and others. The concession for the working of this oil bearing area was obtained by the son of the governor of Chugoutchak, Hsuchow, from the Tuchun of Urumchi ; but the political events in Russia on one hand, and the dismissal of the governor of Chugoutchak, on the other, prevented the company from developing their concession and the oil wells remained almost intact. There now exists a very primitive way of working these wells that cannot be called exploitation. The local inhabitants gather the petroleum on the surface and sell it in crude form, as a lubricating substance for cart wheels.

Two samples of this petroleum were sent in 1919 by the South Siberian Association to the laboratory of the Tomsk university for analysing purposes. The analysis was made by Professor Povarnin and gave the following results :

The Analysis

1. *The physical properties.* Outwardly both samples represent a thick fluid of black-green-brownish color, resembling mazoot crude petroleum.

The specific gravity at 15° C.

Sample No. 1	0.924
„ „ 2	0.926

The constituents were defined by means of a double process. The first process : Fractional distillation at 200°, 300-350° A residue was obtained.

Second process. Distillation of the first two fractions at 150°, 150—270°, 270—300°, 300—350°. A residue was obtained.

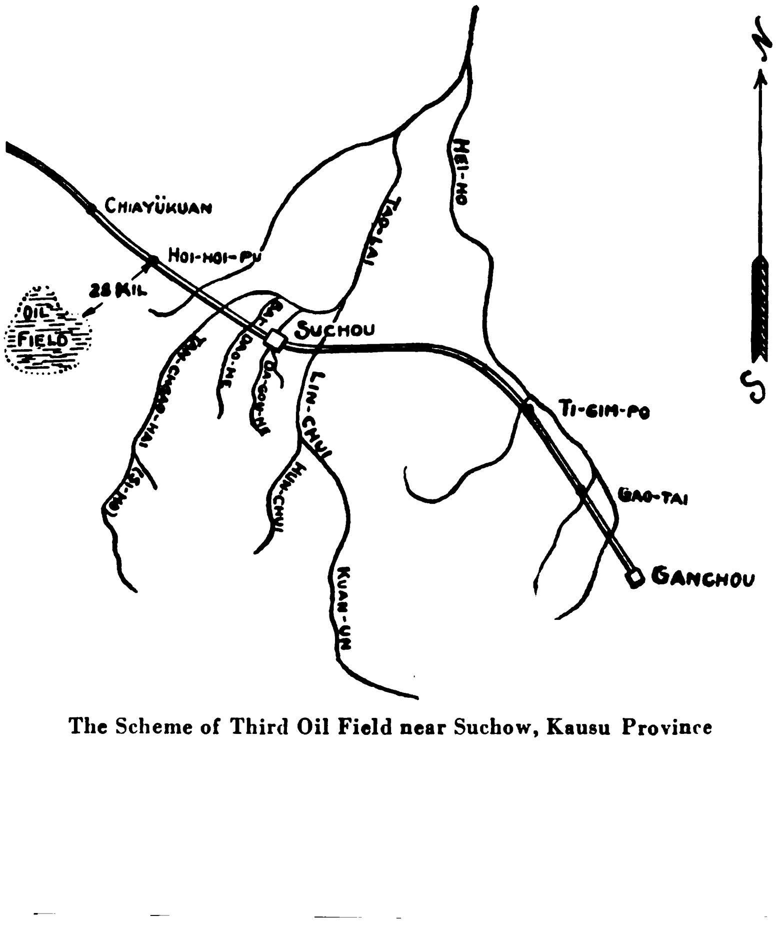
At the same time the boiling point of the fractions that boil at a temperature over 300° fell under normal and the output of illuminating oils increased.

The fractional distillation up to 300° was made with a powerful dephlegmator. Besides, another fractional distillation was made parallelly without superheating, which for sample No. 2, yielded 10 per cent. less of light oils.

Sample No. 1		
Benzene (up to 150°)	2.9%	
Kerosene (from 150 to 270°)	36.0%	48.5%
Pyronaphtha (from 270 to 300°) ..	12.5%	
Total Kerosene ..	48.5%	
Light Oleonaphtha (from 300 to 350°)..	15.9%	48.6%
Heavy „ (above 350°) ..	12.0%	
Tar	20.7%	
Total Mazoot ..	48.6%	
Sample No. 2		
Benzene (up to 150°)	6.0%	
Kerosene (from 150 to 270°)	33.6%	45.8%
Pyronaphtha (from 270 to 300°) ..	12.2%	
Total kerosene ..	45.8%	
Light oleonaphtha (from 300 to 350°) ..	13.7%	
Heavy „ (above 350°) ..	11.1%	
Tar	9.5%	23.4%
Coke and loss	13.9%	
Total Mazoot ..	48.2%	

The quantity of these liquid samples that boil at a temperature below 80 per cent. does not exceed ½—1 per cent. It was difficult to fix this amount precisely, owing to the small quantity of samples. The figure of the percentage of benzene might also be inexact, due to the fact that the water contained in the thick liquid had been weighed simultaneously. It would be more accurate to define in sample No. 2, the quantity of benzene less than 6 per cent. and of the kerosene more than 33.6 per cent.

The fractions of distillation were purified with sulphuric acid, water, sodium hydroxide and again with water. All fractions, except the one boiling at a temperature above 350 per cent. were colorless. The fraction above 350° was of greenish, yellowish color. The specific gravity of the unfractionated kerosene was 0,815. Tar



The Scheme of Third Oil Field near Suchow, Kausu Province

represents a thick sticky substance, unsoluble in alcohol and soluble in ether, when it gives a sediment of coal. The crude fractions being exposed to the air soon become brown. The fractions purified with sulphuric acid being poured into water produced sulpho-acids easily emulsifying in water, and emulsifying oils. The sulpho-acids of the heaviest fraction, when poured into water, produce a green-brownish powder, heavier than water. This powder was not subject to closer examination.

These general properties entitle one to affirm that :

(1) Both samples are very much alike as regards their constitution.

(2) Both are of the lowest kind, poor in oils, boiling at a low temperature, but being superior even to the Baku petroleum as regards the percentage of kerosene (the petroleum of Baku containing up to 55 per cent. of mazoot).

(3) The quantity of unfrationed kerosene in them can be brought to 45-58 per cent., and of lubricating oils to 25-28 per cent., while there will be benezene not less than 3 per cent.

(4) If suitable conditions of transportation be established, these fields, being very rich in oil with relatively favorable geological conditions, their exploitation is worth while.

The Oil Field at Urumchi

The second oil-field is situated to the southwest of Urumchi, the capital of Sinkiang, in a hilly country on the slopes of the Tien-Shan range, within about 30 kilometres from that town.

There are two petroleum and water springs lying close to a lake, the whole valley of which is strongly saturated with petroleum. In this region one sees a great number of spots that are distinctly visible on the secondary alluvial deposits and the sand stone. The characteristic smell of these spots indicates at once that there is petroleum. Besides, petroleum and water, these two springs emit also lighting gas that ignites when a burning match is approached. These springs are not worked and it is therefore impossible to say how much naphtha they could produce. In the opinion of Russian mining engineers both these springs might yield only a very small quantity of petroleum. It seems more profitable to extract petroleum from the clay taken from the surroundings of these springs. The clay is sandy. Within five kilometres of the valley a primitive factory has been established with three vertical boilers. The clay is put into these boilers and heated by direct fire while superheated steam, which extracts the oil, is passed through the boilers. Such a primitive method of producing petroleum results in a miniature production.

The petroleum thus obtained is submitted to fractional distillation, the daily yield not exceeding 100 lbs. of kerosene. This quantity is about a half of the quantity of petroleum produced daily. The kerosene is of a yellowish color and produces considerable soot when being burned. This can be explained by the fact that there is no dephlegmator at the factory and the kerosene is not refined with sulphuric acid, water, sodium hydroxide and again with water.

Aspects of Sinkiang Oil-fields

Such are the oil-fields of Sinkiang, the proper working of which might be of great importance not only for that province but for the whole of China. Our description of these resources has been taken from materials of Russian industrialists who have, naturally, only noted those fields which they have come across by pure chance. We do not know whether regularly organised geological prospecting might not discover new oil-fields, but nevertheless, considering the quoted analysis, those we have described most undoubtedly ought to be of great industrial interest.

Some light has already been thrown in the press on the oil-flelds in Sinkiang.

Kansu Oil-fields; A Revelation

But, we have not yet met with any description of oil-fileds in the province of Kansu and we believe that what we have to say on this subject will be a revelation to most of our readers. Yet the oil-fields of Kansu, as regards their size, reserves and quality, of oil are not inferior to those of Sinkiang. This oil-field is situated in a hilly country within 100 kilometres to the southwest of the town of Suchow and about as many kilometres to the north of the mountain range Yi-shan. Its general aspect is as follows : In the valley of a rivulet on its right bank, in gravelled and sandy ground, seven holes are dug out, and on the eastern wall of each, petroleum oozes. The holes are in a straight line, are parallel to the sides of the valley and about 3½-ft. deep. The distance between them is a few yards.

The valley of the rivulet is more like a ravine ; its breadth is 280-ft. and its depth 350-ft. The right bank of this rivulet has sandy and gravelly deposits, while further down the river there are layers of sand stone and clay slate that have a declivity towards the south forming an angle of 50 per cent. These layers have crevices filled with thin slices of tar-solidified naphtha—with a characteristic naphtha smell.

To the south of the seventh hole the sandy and gravelly deposits of the right bank of the rivulet in the ravine equally change into layers of sand-stone and clay slate sloping to the east. These layers have also crevices with thin slices of tar. This oil-field is not exploited. The local inhabitants gather the petroleum for lubricating purposes. About 185-lbs. of naphtha are extracted daily from each hole. This field is also of great interest from the industrial point of view.

Collosal Electrical Equipment

The largest steam turbine generator unit ever built will be constructed by the Westinghouse Electric & Manufacturing Company East Pittsburgh, Pa. U.S.A. and placed in service in the Hudson Avenue Station of the Brooklyn Edison Company, New York U.S.A.

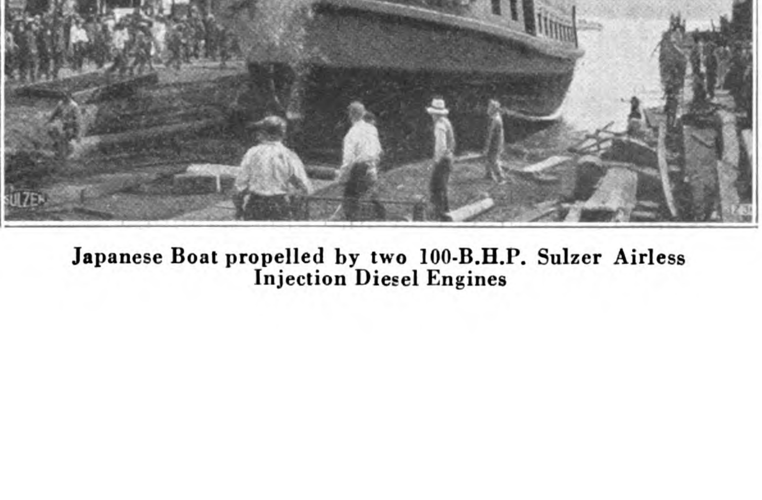
This huge piece of electrical machinery will have a capacity of 80,000 kilowatts and will develop approximately 110,000 horse power.

The placing of this order by the Brooklyn Edison Company will make the third Westinghouse Generating unit to be placed in service by this company. The other two are both 50,000 kw. units.

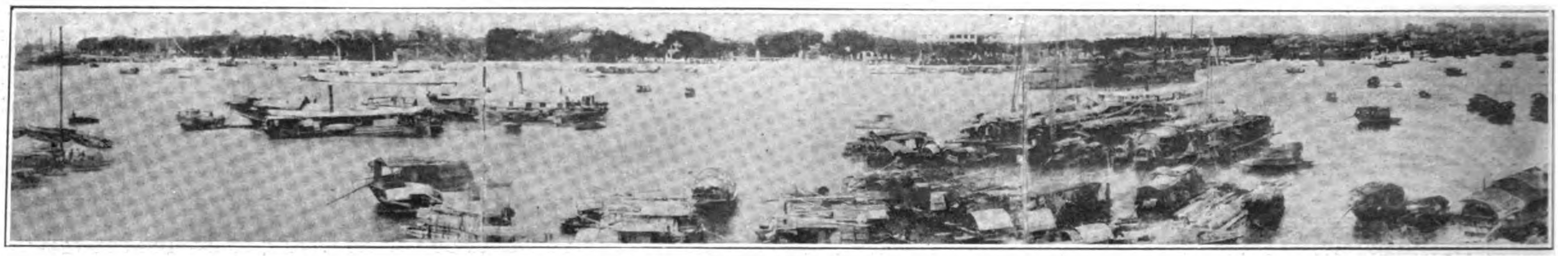
The complete unit will weigh nearly two million pounds. Its design will include all the latest improvements that the engineers of the Westinghouse Company have perfected upon this type of equipment.

Japanese Boat Equipped with Sulzer Airless Injection Diesel Engine

The Military Traffic Office at Ujina, Japan, has recently put a new passenger boat into service. This boat, built in the Ujina Dockyards, has the upper structure in aluminium, and is propelled by two 100-b.h.p. Sulzer airless injection Diesel engines running at 300 revs. per min. and giving the boat a speed of about 10 knots. For going astern, reversing gear is provided for altering the direction of rotation of the propellers. A third Sulzer airless injection engine, a single-cylinder engine developing 20 b.h.p., drives a 10 k.w. dynamo to supply electricity for lighting the boat.



Japanese Boat propelled by two 100-B.H.P. Sulzer Airless Injection Diesel Engines



THE SHAMEEN

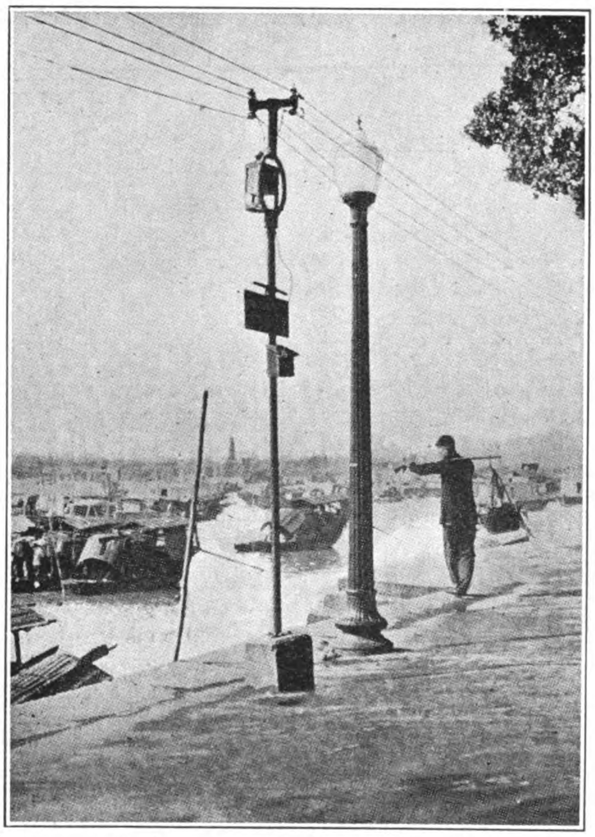
Lighting the Bund of Shameen

GRAHAM KEARNEY, Manager, Andersen, Meyer & Company, Canton

I AM enclosing a set of photographs illustrating the lighting which we recently installed on the Shameen Bund and which may be of interest to you and to readers of the DIGEST.

Shameen is a small island, a part of Canton about five-eighths of a mile long by about a quarter of a mile across, and is leased jointly by the British and French governments. The British occupy approximately two-thirds of the island, and the French approximately one-third, each having its own separate municipal council, police force, etc.

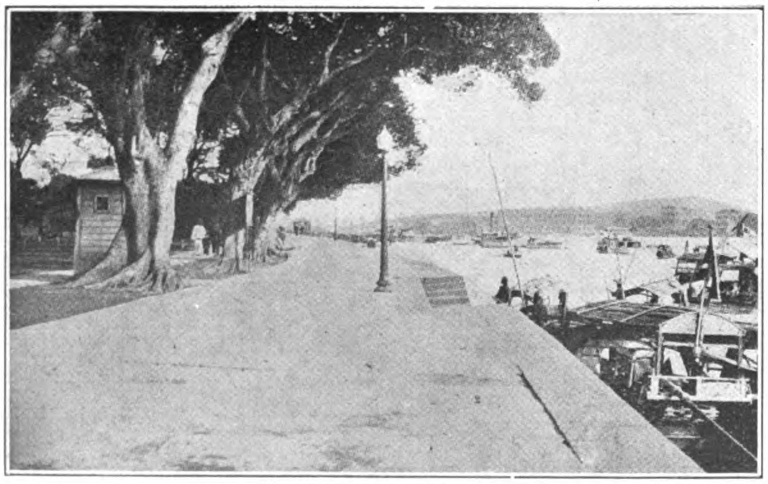
These ten lighting standards were purchased by the British Municipal Council and are installed on the southern side of their end of the island. They are so pleased with the effect that they are now considering extending these fixtures over the rest of the island, and the French Municipal Council are also contemplating a similar change.



The New Lighting Unit and the Old

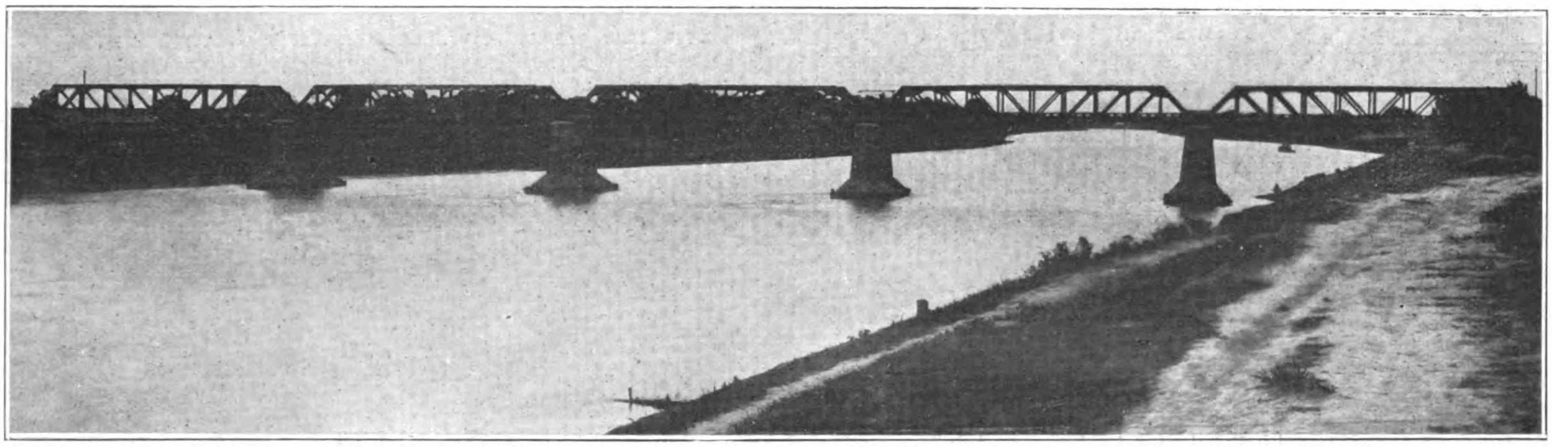
The old fixture was originally a kerosene standard, a small kerosene lantern, we understand, having been hung in the circle which was then the top of the pole. I have been unable to find out how long they have been there, but the oldest inhabitant of Shameen, who came here way back in the 70's, tells me they have been there as long as he can remember. You will note that one of the pictures shows an old standard still in the foreground—this photograph having been taken before the new installation was entirely complete.

Quite a little interest has been created locally by the fact that the Union Metal lamp standards bear the name plate "Canton, Ohio," thus forming a direct link between two cities of the same name in China and the United States.



General View of the Bund

Starting a Trench for the Underground Cable



Bridge over the Grand Canal 5 spans of 100-ft. each

The Lunghai Railway Eastern Extension

By E. R. Hondelink, Engineer-in-Chief, Lunghai Railway, Eastern Division

On June 11, 1925 the last rail was laid, which completed the track of the railway from Hsuchowfu, the junction on the Tientsin-Pukow railway, to the sea the eastern section of the Lunghai Railway.

The construction of this section was undertaken by the Netherlands Syndicate for China in 1921. Before that year *The Compagnie Générale des Chemins de Fer et des Tramways en Chine*, a Belgian company had constructed since 1912 the sections of the Lunghai Railway, which joined in the east Kaifeng, the existing terminus of the Pienlo Railway with Hsuchowfu, and in the west Loyang, the other terminus of the Pienlo line with the hinterland beyond as far as Kawnyintang.

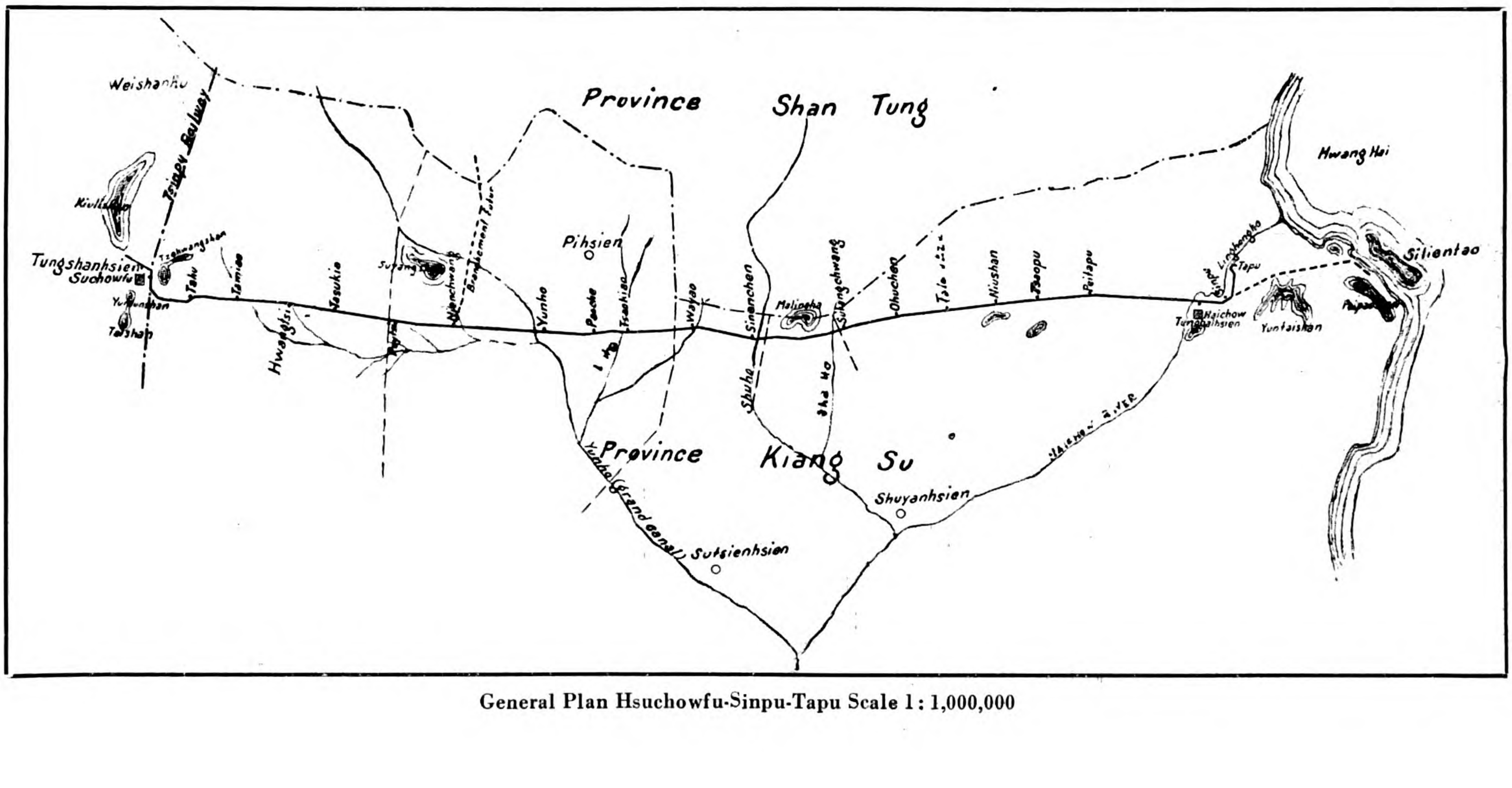
The work on the eastern section was started early in 1921 at the Hsuchowfu end ; in February 1923 the first section, Hsuchowfu—Yunho, 73 Kilometers (45 miles) was opened for traffic.

At Yunho the Grand Canal is joined and a small riverdock has been constructed there for the trans-shipping of goods.

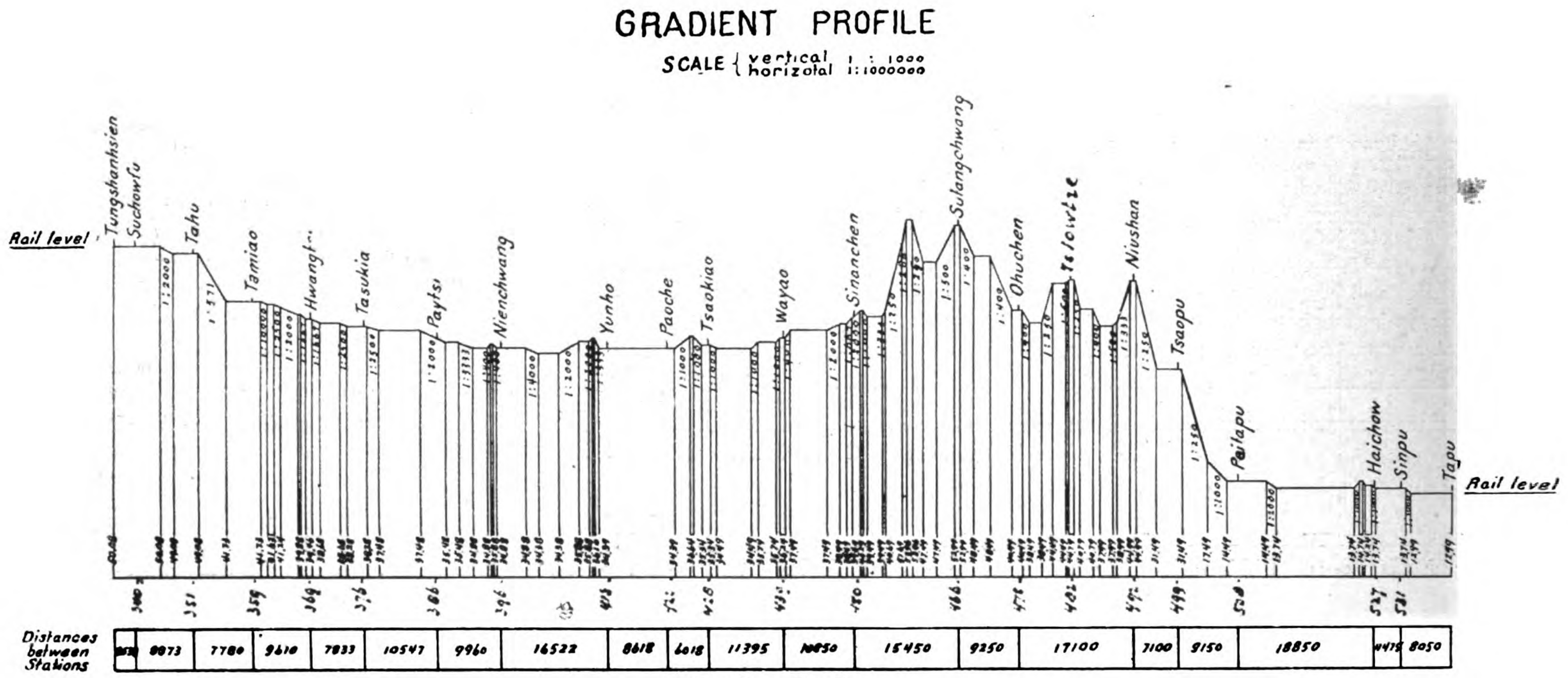
The line from Hsuchowfu is following the northern embankment along the old Yellow River for about 8 miles till where the river turns southeastwards ; from this point on the line is laid practically due-East. The country is flat, yet numerous bridges had to be built to provide enough flood-openings for the water that nearly every summer rain season covers the country. When reaching the Grand Canal the railway is laid on a 10-ft. embankment fortified by stone-defenses. The early construction period was considerably hampered by the exceptionally high floods of the 1921 summer.

In July 1923 the construction of the two remaining sections between Yunho and the sea was started from both ends. The headquarters on the Yunho end were at Yunho, those at the sea end were established at Haichow, a city about 20 miles from the actual seacoast. At this Haichow end the main line terminates at Sinpu station to be continued in the future to an up-to-date seaport, which is to be built east of Sinpu on the coastline. For the present a branch line from Sinpu to Tapu on the Haichow river will provide the communication with the sea traffic. After dredging the Haichow river from Tapu to beyond the bar which is actually blocking the river entrance, Tapu may be reached by sea-going vessels up to a thousand tons or so.

The materials for the construction of the railway from the Haichow end were shipped by small boats from Tsingtao. Among the materials shipped were a small 9-6-0 shunting engine, weighing about 40 tons and three flat 20 tons cars. By means of this construction-train were built some 30 miles of track before the construction from the other end was met on June 11, 1925.



General Plan Hsuchowfu-Sinpu-Tapu Scale 1: 1,000,000



Gradient Profile

The line from Hsuchowfu to the Tapu terminus is practically level throughout. No gradients steeper than 1 in 250 were necessary, the longest incline only being just under 2 miles. The highest embankment is 13-ft. the deepest cutting 20-ft. A few of the cuttings are in rock and advantage of this situation has been taken for the ballast supply of the line. No curves under 1,000 meters (3,333-ft.), radius are laid down in the main line, no station is situated in an incline nor in a curve.

The track is laid of flat-bottomed rails, Chinese standard, 42 kilograms per meter (appr. 85 lbs. per yd.) 9 and 12 meters (30 and 40-ft.) lengths, each 30-ft. rail on 12, each 40-ft. rail on 17 wooden sleepers, the rails fastened by screws, two on each rail in every sleeper. No chairs are used. The joints are opposite, unlike the practice on adjoining Chinese lines, our opinion being that better running and easier maintenance is assured.

The 30-ft. rails and fastenings, of which 50 miles have been laid are of Chinese manufacture, ordered at the Hanyang works just after the European war, before the work started. All the other track materials have been imported from Holland, Belgium, France and Luxemburg.

Limestone ballast has been used from one quarry near Hsuchowfu and from the cuttings in the 2nd and 3rd district. About 20-in. are allowed between rail-and formation level, giving a solid ballast foundation in these regions on the extremely soft earth-embankments.

The line which traverses the northernmost plains of Kiangsu province, very near to the Shantung border, is running parallel to extensive mountain ranges in Shantung. Numerous small and large streams are spanned, some of them almost dry in winter but filled up to 20-ft. deep at a width of to 600-ft. during the rain season in summer. The most important of these rivers are mentioned here :

E. R. Hondelink, Chief Engineer, Lunghai Railway

The Grand Canal near Yunho station, where 5 spans of 100-ft. each, carry the line over the river. Abutments and piers are of concrete with a stone facing, on a solid concrete foundation.

The I-Ho, about ten miles further east, spanned by 6 spans of 100-ft. each. Piers and abutments are of stone throughout here, on a concrete foundation.

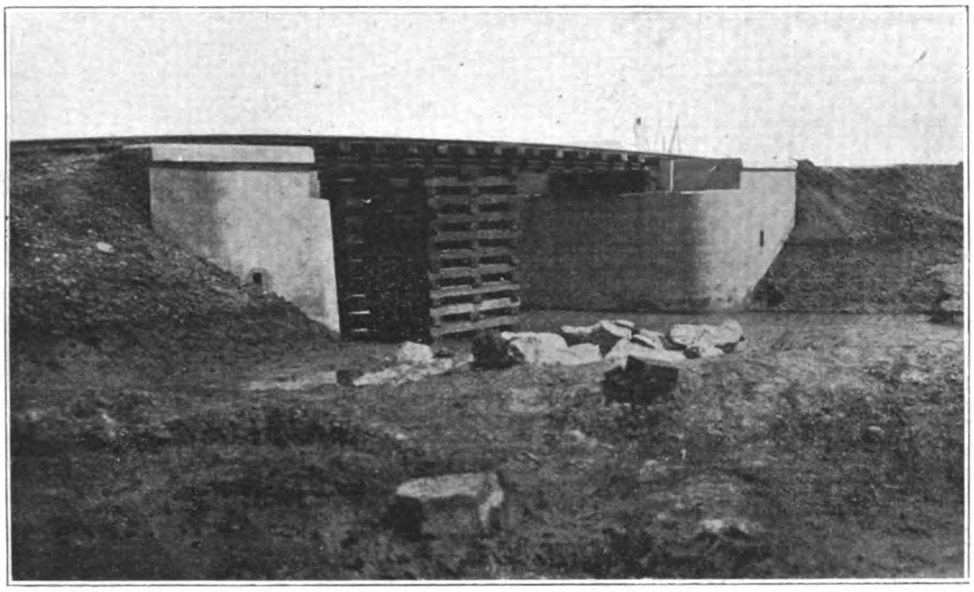
The Shu Ho just east of Sinanchen station, also 6 spans of 100-ft. Here abutments and piers are of concrete throughout. The Shu Ho, some 7 miles further east is a smaller river crossed on 3 spans of 100-ft. each, this bridge is constructed like the Shu Ho bridge.

The last big bridge is the Haichow river bridge just west of Haichow station, a bridge again of 6 spans of 100-ft. similar to the Shu Ho bridge. This bridge was constructed outside the existing river bed, just where it made a double curve. After completion of the bridge a new river bed was cut passing under the bridge; at the same time the old curves were cut off.

Besides these bigger spans, several smaller have been built with one or more spans of 3,5,6,10,15,20 and 30 Meters (10,16,20,33,50,70 and 100-ft.), and combinations of these dimensions such as a span of 100-ft. in the contre and one of 33-ft. on each side. Altogether the bridge openings amount to 2,457 meters (8,000-ft.), being 12 meters per kilometer of line, or 64-ft. per mile.

The steelwork for all these bridges was partly ordered from Holland, and partly taken over from the western section, who had ordered large quantities of bridge steelwork from Belgium and from the Hanyang works in Hankow.

The stations are from 4 to 7 miles apart, as much as possible planned near important towns and villages. The most important stations are ; Yunho at the crossing of the Grand Canal, at the same time an



33-ft. Span Bridge with Temporary Track

engine and watering station. Then Sinanchen at the crossing of the Shu Ho, also a watering station. At the east end three stations, Haichow for the town of that name, an important passenger station, Sinpu, 2 miles from Haichow for the commercial town of Sinpu and Tapu the terminus on the Haichow river. Besides Yunho, Sinanchen and Haichow, already named, water plants are built at Tasukia between Hsuchowfu and Yunho and at Talowtze between Sinanchen and Haichow.

All station buildings are erected in semi-Chinese style, hollow brickwalls on a stone foundation and a Chinese roof, the stations near the cuttings through the limestone are built entirely in stone.

Each station has at least one platform of standard width (30-ft.), and length of 500-ft., 30-in. above rail-level. Each station—one small wayside halt in the Hsuchowfu-Yunho section excepted—has at least one crossing loop and most of the stations have one or more goods sidings.

The line will be completed for regular traffic in September next. It will be worked as one line with the existing western section of the Lunghai Railway and the Pienlo Railway, which runs from Shanchow to Hsuchowfu. The traffic expected consists in agricultural products from the west for export, and coal from the Honan and the Shantung mines along the Tientsin-Pukow railway, north of Hsuchowfu. Further, salt from the important salt regions round Haichow in the return direction.

The rolling stock of the existing Lunghai and Pienlo lines will be used, which has been completed by eight 2-8-2 heavy goods locomotives, and 200 open and covered cars, supplied by Dutch firms.

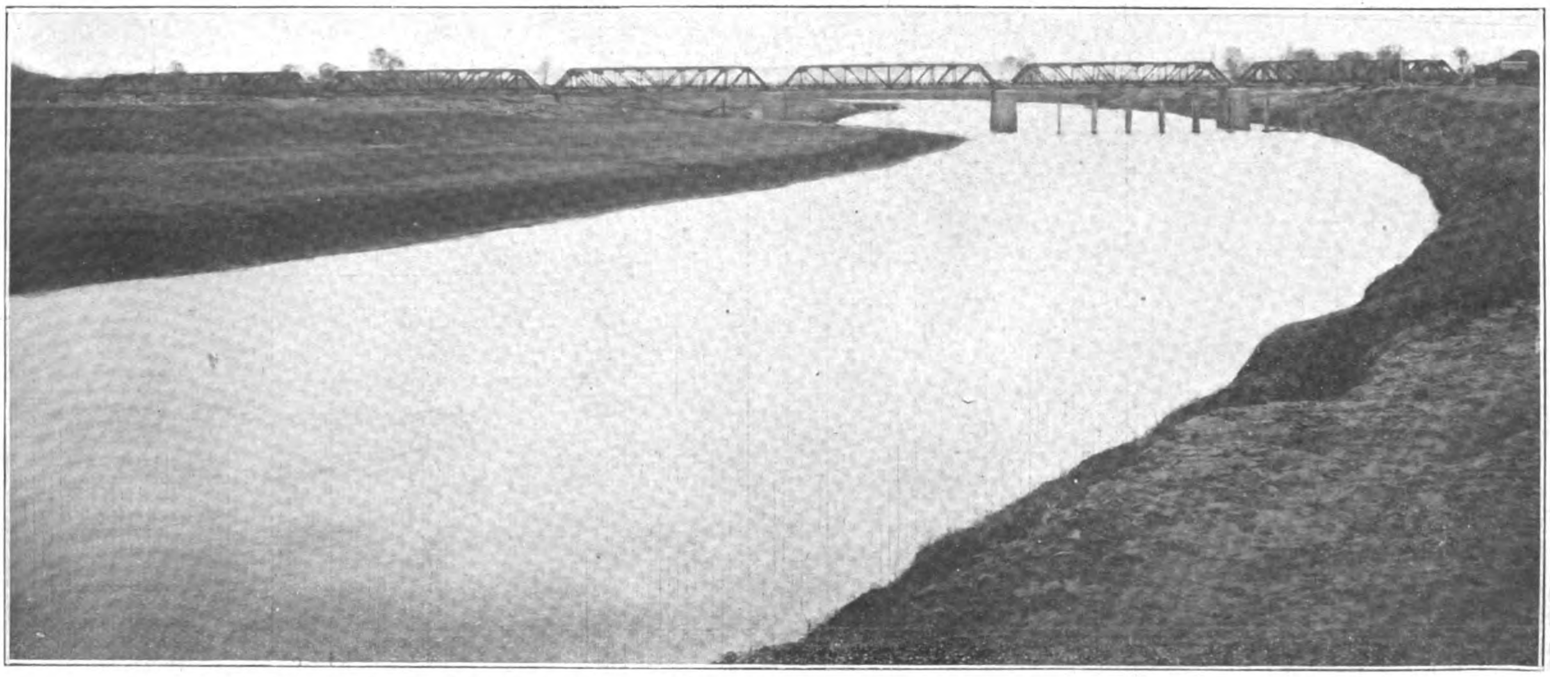
As mentioned already a scheme for a modern seaport is being studied, which ulteriorly must greatly improve the terminus facilities.

The eastern section has been constructed under foreign supervision, with the assistance of Chinese engineers, all works have been let out on contracts to Chinese contractors.

The total cost of the line has been approximately Mex. $8,000,000 which works out at about $40,000 per kilometer or $64,000 per mile.

The work has been hindered by the floods of 1921, 1924 and 1925 as well as by the civil war of 1924-1925, but serious accidents have not been met with.

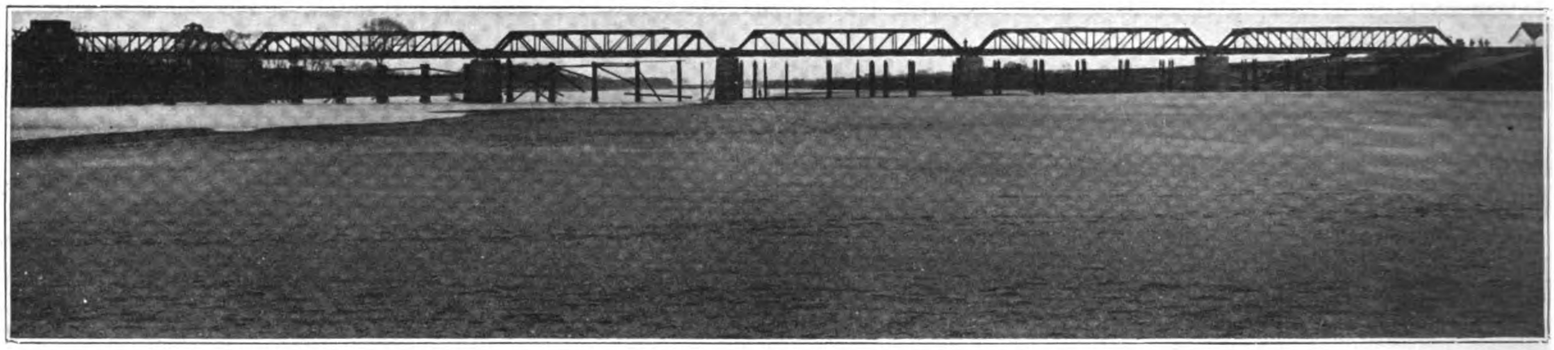
Typical Staff Quarters



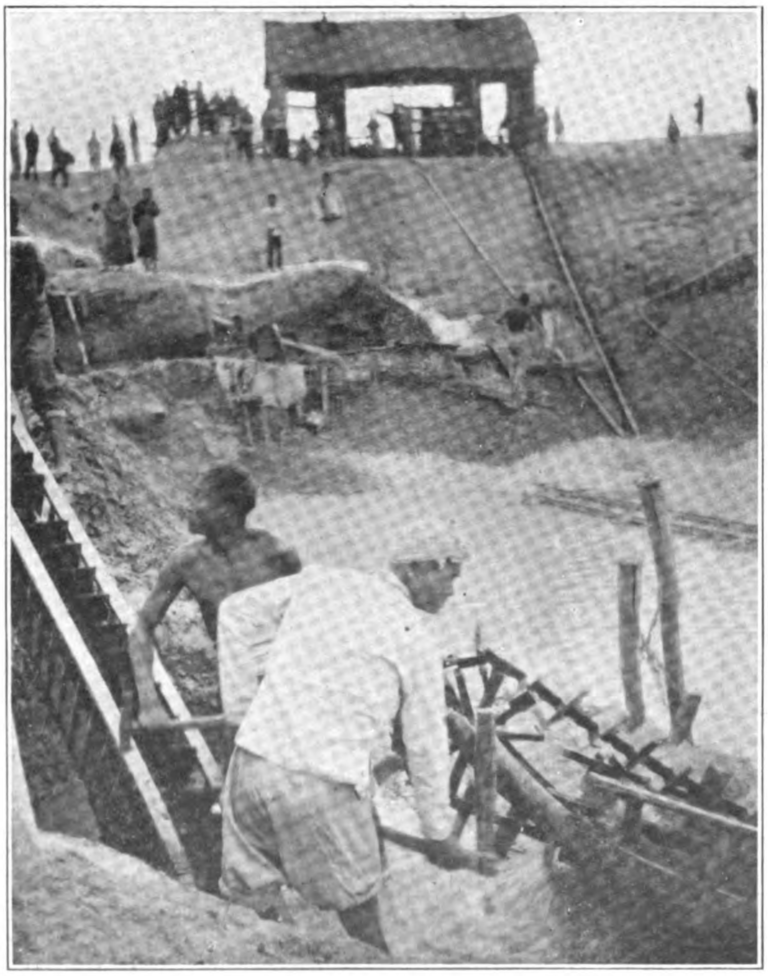
I-Ho Bridge, 54 miles from Hsuchowfu 6 spans 100-ft. each. In summer this river has a very strong current

Pay Tsi, an Important Intermediary Station, 30 miles from Hsuchowfu

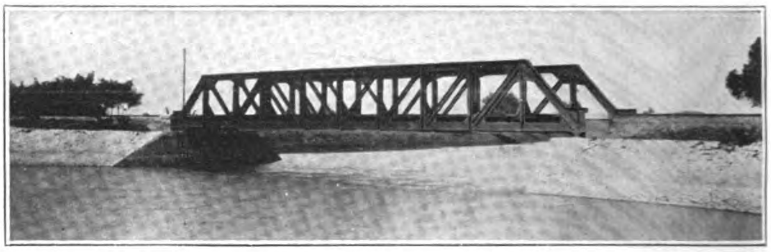
Loading Ballast in the Second Cutting at Malingshan



Shu Ho Bridge, 6 Spans of 100-ft. 70 miles from Hsuchowfu



Excavation Work on the Grand Canal



100-ft. Span Bridge over a Creek

Shu Ho Bridge

Copper in the Philippines

THERE has been practically no production of copper during American occupation, although development work on the old Mankayan properties continues. Many examinations of this deposit have been made which reveal a fairly extensive, low-grade body of enargite. Practically the only economical way to handle this ore is to export it to some neighboring country where there are smelters. The copper market is too uncertain and the local obstacles, such as transportation, lack of timber, cost of smelter, labor, etc., are so great as hardly to be overcome.

Mention is made, in the earliest known records, of the existence of copper in the ancient province of Tuy, now called Mountain Province. When the Spaniards first landed in the Philippines they heard of copper smelting by the "Ugolotes," as the mountain people were then called. It seems very evident that the Chinese or Japanese taught them the art, probably in the days of Limahong, the noted Chinese pirate who invaded the Philippines in the sixteenth century and landed at Laoag, Ilocos Norte Province.

The copper deposits are located in and about the barrio of Mankayan, which is situated on a small plateau in the Cordillera Central of northern Luzon, about 16 kilometers south of Cervantes on Abra River. Mankayan is 264 kilometers due north of Manila, and 64 kilometers southeast of Candon and is reached from Manila by an excellent, graded horse trail from which there is a good trail, passable for bull carts, over the famous Tiela Pass. Mankayan is situated at an elevation of about 1,140 meters above sea level, and is distant from the coast town of Tagudin about 37 kilometers. The plateau is practically treeless, but there is more or less scattered pine timber on the adjacent hills and mountains.

The ore consists largely of arsenate of copper, with some secondary tetrahedrite in a quartz gangue. Secondary enrichment is clearly evident in the deposit at Mankayan. The main mass of the ore is of low grade (less than 2 per cent.), but there is a considerable body that yields 5 per cent. and more. Some very rich spots also exist. The following copper minerals have been found in this deposit: Enargite, luzonite (a special crystallization form of enargite), tetrahedrite, chalcopyrite, chalcocite, chalcanthite, azurite, and malachite.

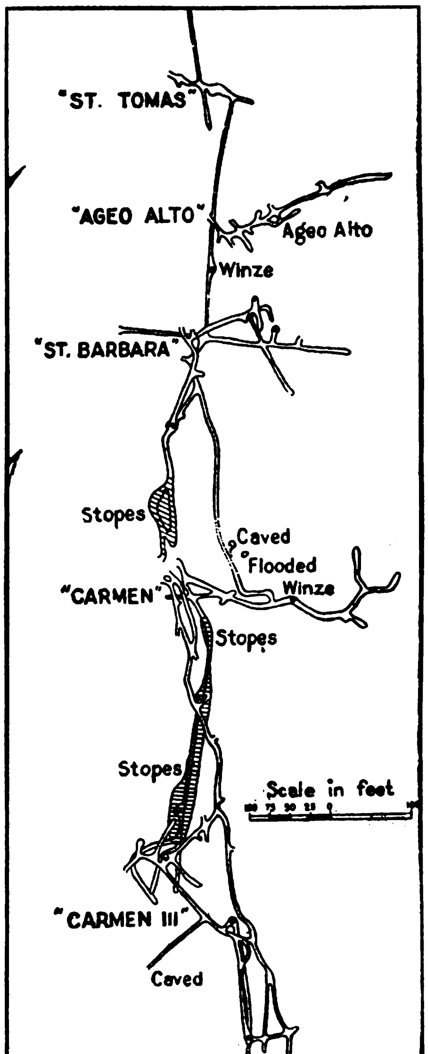
The principal rock mass is diorite. This is capped by a so-called "trachyte" which is really a quartz porphyry. To the west is a great intrusive mass of quartz-diorite, known as the Bagan granite, while a little farther away and to the east is Mount Data, which consists largely of Tertiary andesitic agglomerates.

Eveland, (236) who in 1904 made the only geologic reconnaissance of this region, says of this deposit:

The former attempts to explain the Mankayan deposit have been given and objections to each have been found, and as a mere tentative hypothesis may be suggested a genesis of these ores as yet not considered, that will be determined when further development work is done. It is entirely within the grounds of probability, and not in conflict with any geological evidence so far at hand, to presume that, before the advent of the trachyte flow, ore deposits had been formed in the Mankayan diorite of a type similar to those at Suyoc—quartz veins carrying metallic sulphides and gold values. With the covering of the diorite and its veins by an igneous flow, chemical action was given an added impetus. The trachyte, easily decomposed and altered, was metamorphosed at its contact with the diorite to a hard, flinty, siliceous quartz porphyry, quartz replacing most of the other constituents of the rock. In its cooling and subsequent contraction fissures and crevices were formed, aided possibly by dynamic action, such as shattering shocks, which are a feature of the Islands. The heat of the overlying trachyte furnished a motive power for the process of vein deposition, and the heated waters, assumed to be rising, filled the cavities and cracks with silica and ore minerals obtained from lower or surrounding sources. Enargite is a prominent mineral among those formed by secondary action, and investigation shows that it has been formed later than the other minerals; so that the evidence points to a secondary enrichment of certain portions of the contact, notably at Mankayan, with copper minerals obtained from other sources. Deposition has taken place in all possible directions, leaving the irregular mass of veins of the Mankayan mine.

The influence of the granitic intrusion which cuts the older diorite seems not to have been considered by Eveland in the genesis of this ore deposit, but I am of the opinion that it has had a great deal to do with the mineralization of the region under discussion.

Santos, the eminent Spanish engineer, who was in charge of the Cantabro-Filipino Company in 1860, says of the local method of working and smelting these ores:



Plan of the underground workings of the Santa Barbara copper mine, in Mankayan, Lepanto. Survey by Goodman and Ickis

The mineral after being extracted from the mine is submitted first to a roasting, or, better yet, a crude melting; for this the natives open in the ground a hole one cuarta in diameter by two or three fingers deep, which they cover with some thin sticks forming a gridiron, above which they place a small, compact heap of mineral, held down by a board or piece of tree; and they cover all with thin pine wood, leaving a protected hollow above the board. They ignite this at once, leaving it alone until it has consumed the wood and completely heated the sulphur of the mineral, which takes two or three hours. The products are an impure mass of copper mixed with earthern substances and pieces of coal and scorias of quartz which offer the aspect of a breccia in which the cement has partly disappeared, converting it into a porous mass.

The copper matter then suffers a melting process for black copper, which they execute in the following manner: They make a hole six or eight fingers in diameter which they surround with stones forming a species of hearth or crucible, leaving an open space for the placing of a pipe connecting with a cylinder bellows. This consists of two cylinders made from a hollowed trunk of pine in which run pistons formed by blocks of wood dressed on their circumferences with dry herbs and chicken feathers, which are held down only by the bellows, so they work in the manner of springs against the interior surface of the cylinders. In the lower part there is a hole and in that they place a cane, closing the valve at the beginning of the stroke.

Having formed the oven in this manner they charge it with pine fuel, mixed copper and matter, and put the bellows in motion, taking care to add the fuel in proportion to its consumption, and to agitate little by little with a cane so the copper may fall to the bottom and be cleaned from the foreign substances with which it may be mixed. When they know that the copper has all united into one mass, which should take place after ten or fifteen minutes, they stop the bellows and take out the coal and scorias which overfloat the

metallic bath, leaving it uncovered until it has hardened a little and acquired sufficient consistency so that it may be handled. The product is a cake of black copper of rough and broken surface full of earth and pieces of fuel.

This cake they place at once on a bonfire, where they leave it two or three hours, making it suffer a kind of roasting process which purifies it somewhat, and they afterwards melt it in the same furnace, placing it in a species of crucible or mold of refractory clay. At the end of this they put the crucible in the hole and over it they place the stone cover and surround it with fuel. They then force a blast, and after the copper is melted they uncover the bath, taking out all the impurities. They remove the crucible from the furnace, and later, when the mass has commenced to consolidate, they compress it with a stick. Finally they take the cake from the crucible, bury it in ashes until it has cooled, and smooth its surface a little by striking it with a stone.

The copper obtained in this manner they sell partly in cakes to the Christian people in the lowlands, and partly dedicate to the manufacture of pots and boilers which the Igorots forge with stones ; also making of the same metal bars, tongs, and small pipes for smoking.

The Cantabro-Filipino Company was organized about 1860 with the Spanish engineer Santos in charge of the works. This company undertook to carry on more modern operations and partially succeeded. Between 1860 and 1875 they extracted 2,500,000 pounds of copper. In the latter year Santos died at the mines, and all operations ceased soon after. Since then only desultory smelting has been carried on by Chinese and Igorots, who made considerable profits out of the rich dumps about the old Santa Barbara mine (fig. 20), the scene of the principal activities of the company.

At present (June, 1921) the P. C. Whitaker interests, with Victor Lednicky as mining engineer, are continuing the development of this property by driving two tunnels 32.7 meters and 65.4 meters, respectively, below (in elevation) the old Spanish drainage tunnel. Tunnel No. 1 is now 170 meters long, and No. 2 is 225 meters long, with a 40-meter drift. The vein in the lower tunnel is about 17 meters wide, strike north 45° west, dip 65° northeast, and is said to yield about 2 per cent. copper.

The deposits have been examined by several good engineers, who agree that there is an important body of ore in sight, averaging close to 2 per cent., with some very rich spots. The chief difficulties are transportation ; lack of coke, which would have to be brought in or the ore shipped out ; distance to a flux ; and scarcity of timber and labor.

The only economical solution of this problem seems to be to concentrate the ore and ship it to Japan for smelting.

Other Copper Deposits

Copper in noticeable amounts has been found in at least two other localities in the Archipelago, but in neither has production attained any importance.

At Milagros, on the southwest coast of Masbate, native copper in andesite was worked some years ago, but no production has ever been recorded.

In the Loboo Mountains of Batangas Province I examined some gold- and copper-bearing quartz veins but, as a result of my unfavorable report, work on them ceased in 1905.

Near Sual, Pangasinan, some chalcopyrite deposits have been worked from time to time, but they have never attained any importance.

Some copper-bearing siliceous veins in andesite were prospected in 1913 and 1914, on the headwaters of Pula River, a branch of the Aglao, in the Zambales Mountains of Luzon, but nothing of any moment has resulted from the prospects.

The uncertainty of the copper market, the difficulty of treating the ore, and proximity to the Japanese producers will always make copper mining in the Philippines a doubtful venture that should be undertaken by experienced persons only.

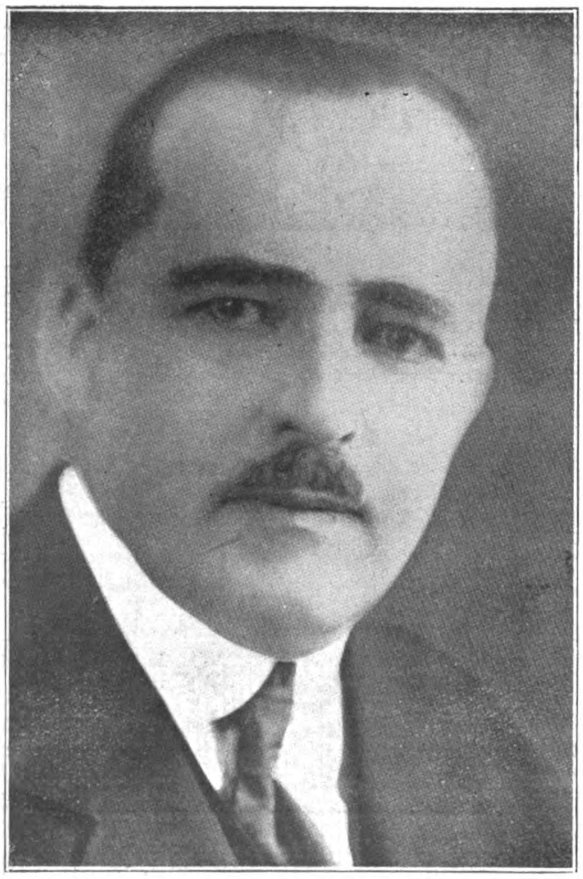
Clark H. Minor New Head of I.G.E.

Announcement has been made by the International General Electric Company that Mr. Clark H. Minor, former vice-president of the company, has been elected president, to succeed Mr. Anson W. Burchard, who has been both president and chairman of the board. Mr. Burchard will continue as chairman, but asked that he be relieved of some of the duties of his double position. Mr. Minor has just returned from Europe, and Mr. Burchard has just left for there.

Mr. Clark. H. Minor, president of the International General Electric Company, entered the employ of the Western Electric Company in the New York office in 1902, following graduation from Hamilton College. In 1909 he was transferred from Kansas City to Antwerp, Belgium, as managing director of the Bell Telephone Company there. He remained in Belgium until after the outbreak of the war in 1914.

Mr. Minor was sent to China in 1918, and while there organized the China Electric Company, Ltd. for the manufacture of telephone apparatus. He was general manager of the company, with headquarters in Peking.

In 1921 Mr. Minor went to London as European commercial manager of the International Western Electric Company. He resigned in 1924, and later was elected a vice-president of the International General Electric Company, in which company he was later made a director. At the meeting of the board of the International General Electric Company in June 1925 he was named president of the Company.



CLARK H. MINOR
President, International General Electric Company, Inc.

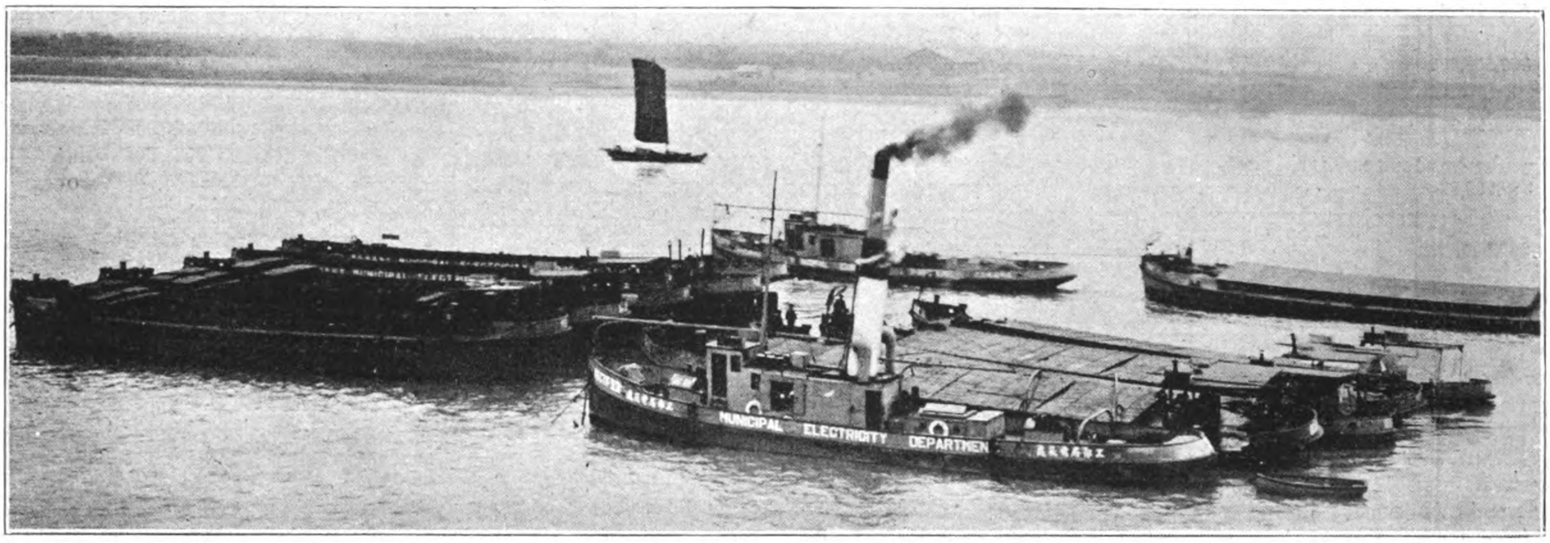
Mr. Loren Emery, former Assistant Merchandising Manager of the International General Electric Company, has been made General Merchandising Manager of the Company.

Mr. R. G. Henderson, who has been in Europe for the past year and a half conducting important negotiations for the International General Electric Company, with particular reference to merchandising lines, has been relieved of the duties of General Merchandising Manager and has been assigned to special work in connection with problems of sales promotion.

Mr. Loren Emery, General Merchandising Manager of the International General Electric Company, entered the employ of the General Electric Company in 1909. After taking the course in supply salesmanship, he handled the sale of incandescent lamps in the foreign department. He was then transferred to the Latin-American section, and became assistant manager of the Latin-American sales.

In 1914 he was sent as special representative in the West Indies, and while there established the Porto Rican and Cuban offices of the company. In 1917 he visited Cuba, Porto Rico, Central America and Colombia for the Company.

Upon his return to the United States in 1920, Mr. Emery was made Manager of the Latin-American Sales. He became Sales Manager of the Department of Americas in 1921, and in 1922 was transferred to the Merchandising Department as Assistant Merchandising Manager, which post he held until his present appointment.



Coaling Fleet Together with Tow Boats "Reactor" and "Rectifier Riverside Power Station

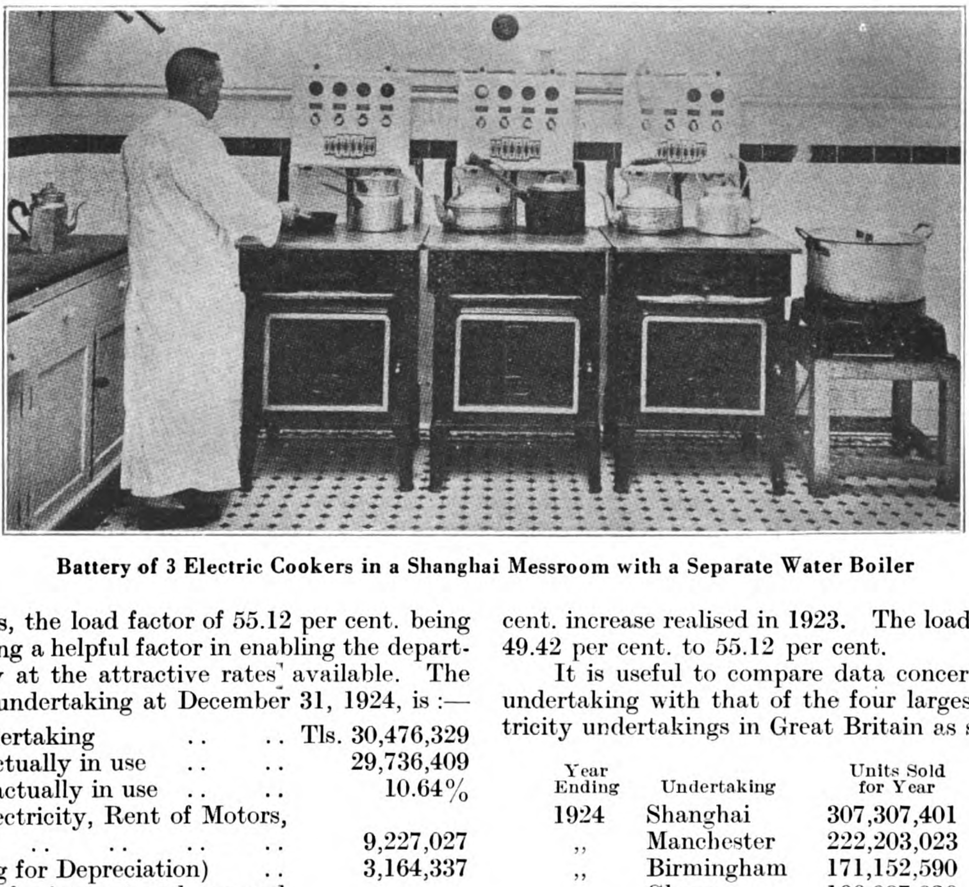
The Electricity Supply of Shanghai

IN his annual report, the Engineer-in-chief and manager of the Shanghai Municipal Electricity Department shows the tremendous progress which has been made in this field. He says:

The year under review has been characterised by acute trade depression and by inter-provincial warfare, having its scene of action in the immediate vicinity of Shanghai, and as a consquence paralysing many business and industrial activities. Nevertheless, the sales of electricity during the period under review have increased from 272,265,861 to 307,307,401 kilowatt-hours, representing an increase of 12.87 per cent. which, although less than the preceding year, may, in the circumstances detailed, be regarded as satisfactory. The result of the year's trading shows a nett profit, after payment of interest and other nett revenue charges, of Tls. 1,464,162. The estimated nett profit for the year was Tls. 1,354,800.

Due to a continuance of depressed conditions, aggravated by local warfare, the increase recorded in industrial supply demand is disappointing, as will be evidenced by the relatively small increase in the maximum demand. On the other hand the increase in the sale of electricity in relation to the connected demand indicates a very satisfactory state of affairs, the load factor of 55.12 per cent. being exceptionally high and being a helpful factor in enabling the department to supply electricity at the attractive rates available. The financial standing of the undertaking at December 31, 1924, is:—

Capital Outlay of the Undertaking	Tls. 30,476,329
,, ,, on plant actually in use	29,736,409
Return on capital outlay actually in use	10.64%
Revenue from sales of Electricity, Rent of Motors, etc.	9,227,027
Gross Profit (after allowing for Depreciation) ..	3,164,337
Nett Profit after provision for interest on loans and other nett revenue Expenditure..	1,464,162



Battery of 3 Electric Cookers in a Shanghai Messroom with a Separate Water Boiler

The estimated nett profit for the year 1925 is Tls. 1,015,200. This, it will be noted, is considerably less than the profit for 1924, and is accounted for by the reduction in the charges for lighting (2 cands.) and heating, etc. (5 cands.), which come into effect from the beginning of 1925.

Since 1916, the General Municipal Funds have benefited to the extent of Tls. 4,660,000 consequent upon profits of the working of the department which have been handed over to the Council during that time, the contribution for the year under review being Tls. 900,000.

Results such as these can only be obtained by a full measure of co-operation on the part of every section of the staff.

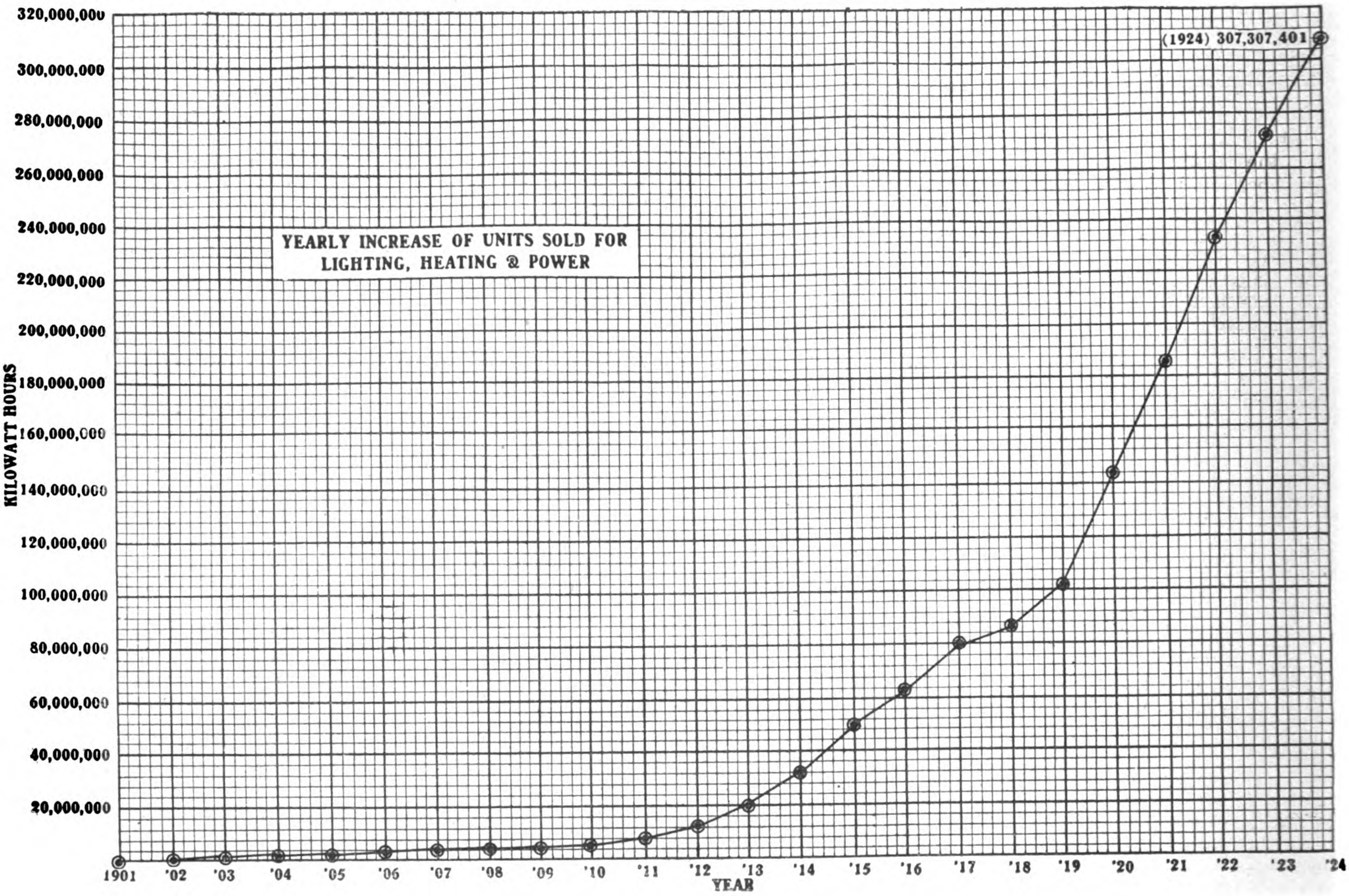
The installed plant capacity of the Riverside Power Station is 121,000 kilowatts, this figure including the 20,000 kilowatt Turbine destroyed at the end of 1923 and now in process of replacement.

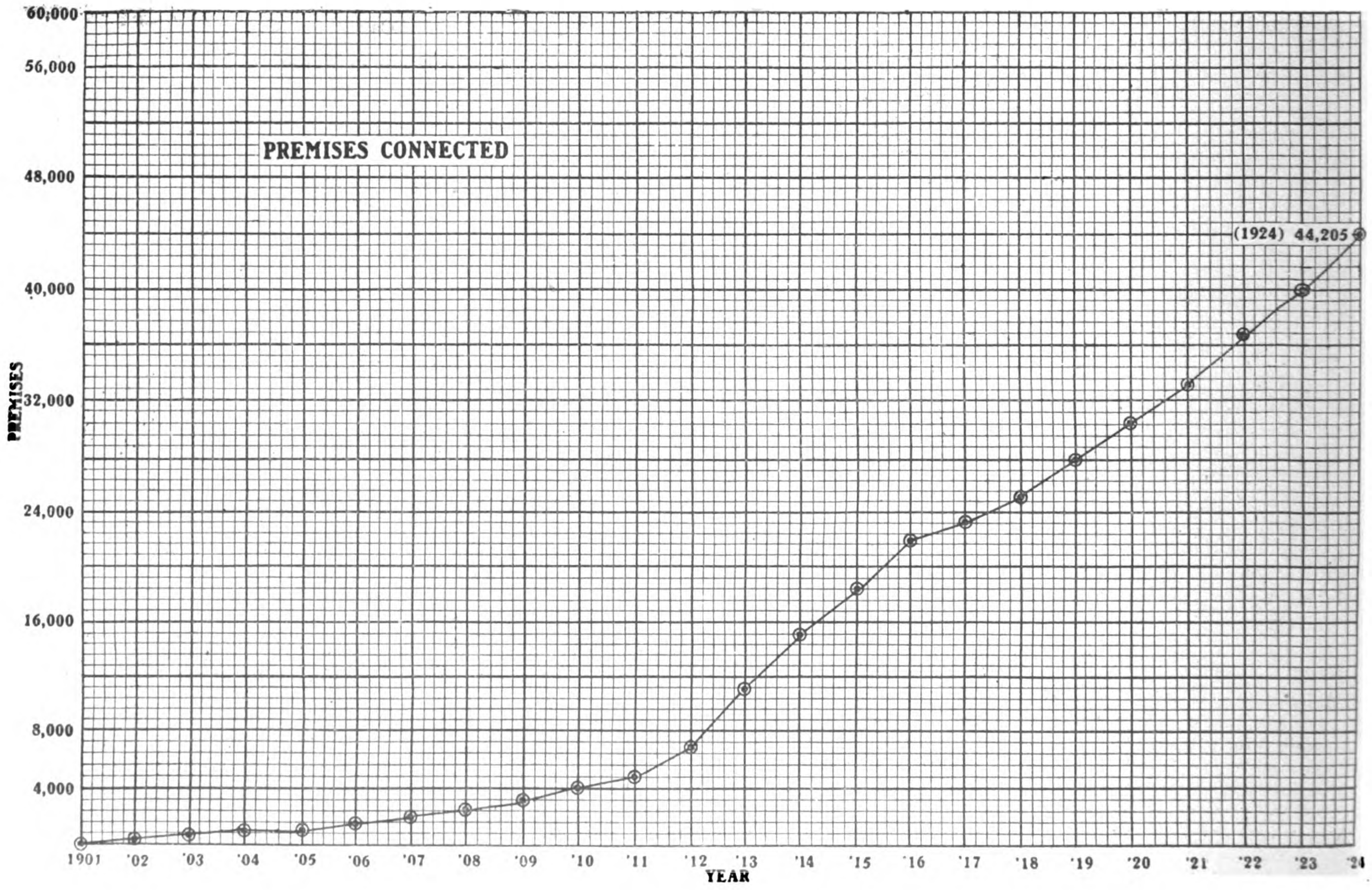
The year has been noteworthy in that it has seen the passing of Fearon Road Generating Station, which has been completely dismantled and is now in process of being converted into central stores premises.

The highest maximum load recorded during the year was 66,200 kilowatts. The maximum load delivered to the distributing feeders at the same time was 63,459 kilowatts, an increase of 0.88 per cent., as compared with a 22.52 per cent. increase realised in 1923. The load factor has increased from 49.42 per cent. to 55.12 per cent.

It is useful to compare data concerning the operation of this undertaking with that of the four largest Municipally owned electricity undertakings in Great Britain as set out below:—

Year Ending	Undertaking	Units Sold for Year	Maximum Demand in Kilowatts	Load Factor %
1924	Shanghai	307,307,401	63,459	55.12
,,	Manchester	222,203,023	108,320	30.79
,,	Birmingham	171,152,590	88,869	26.19
,,	Glasgow	166,087,836	81,700	28.69
,,	Sheffield	151,896,004	72,487	28.69


YEARLY INCREASE OF UNITS SOLD FOR LIGHTING, HEATING & POWER
KILOWATT HOURS
320,000,000
300,000,000
280,000,000
260,000,000
240,000,000
220,000,000
200,000,000
180,000,000
160,000,000
140,000,000
120,000,000
100,000,000
80,000,000
60,000,000
40,000,000
20,000,000
(1924) 307,307,401
1901 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17 '18 '19 '20 '21 '22 '23 '24
YEAR


PREMISES CONNECTED
PREMISES
60,000
56,000
48,000
40,000
32,000
24,000
16,000
8,000
4,000
(1924) 44,205
1901 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17 '18 '19 '20 '21 '22 '23 '24
YEAR

Data concerning comparative economic results will be found elsewhere in this report.

Kilowatt Hours Generated

The total kilowatt hours generated amounted to 361,361,250, of which Riverside generated 359,316,168 and Fearon Road 2,045,-082, the percentage of total kilowatt hours generated by Fearon Road being negligible, namely 0.566 per cent.

The kilowatt hours expended in the operation of auxiliaries required in connection with the generating plant were 26,127,973, or 7.23 per cent. of the total generated, the figures for the three previous years in repect of this usage being 8.44 per cent., 6.86 per cent. and 6.59 per cent. respectively. In considering these figures, however, it is necessary to bear in mind that 4,814,420 kilowatt hours were used in connection with the operation of synchronous condensers which are installed for the purpose of effecting economy in distribution, hence this expenditure of energy cannot be regarded in the same light as the expenditure required in the operation of generating plant auxiliaries, in that a definite gain in working economy results as a consequence of the expenditure of this energy, this gain being evidenced in increased efficiency of distribution. 441,714 kilowatt hours were used for miscellaneous Departmental purposes, such including lighting and heating of depots, godowns, offices and showrooms, together with electrical energy used for testing purposes.

The total kilowatt hours sold amounted to 307,307,401, an increase of 12.87 per cent. over 1923.

Consumers Supplied

There were 36,519 consumers being supplied at the end of the year, compared with 32,921 at the end of 1923, an increase of 3,598. The new connections added during the year amounted to 12,491 kilowatts. As stated in the report for 1923, the connected kilowatts represented by Public Street Lighting and the Tramway Company's demand had not previously been included, but in order to make the totals complete and accurate these are now included, being 361 and 4,013 kilowatts respectively. The total kilowatts connected are now 127,440.

Generation

In matters connected with the generation of supply the year has been mainly noteworthy because of the results achieved in the improvement of efficiency of generation. Comparing these results with those obtained by stations of similar capacity in Great Britain, the average fuel consumption at Riverside is some 1.3 per cent. less. This may be regarded as particularly satisfactory when the adverse factors associated with native labour and relatively poor fuel are taken into consideration.

The overall Thermal efficiency of the Riverside Generating Station was 16.2 per cent., as compared with 14.25 per cent for the previous year, this showing a substantial increase and in this connection it is noteworthy that the average expenditure of British Thermal Units per kilowatt hour generated throughout the year, i.e., 21,047, compares very favourably with the results obtained in other generating stations of similar capacity throughout the world. The best efficiency obtained was 19,271 British Thermal Units per kilowatt hour generated, which may be regarded with very satisfaction. There is every reason to anticipate further increase of the overall efficiency during 1925.

These achievements are of vital interest to the department at the present time, enabling selling rates to be quoted in respect of industrial supply which are such as to discount the alternative method of obtaining the desired supply, namely, the installation of individual plants. The results have also gone far to enable a substantial decrease in the lighting rates to be announced at the close of the year.

Relatively little new work has been initiated at the Generating Station during the year under review, attention being given in the main to the completion of work already in hand, and to the carrying out of minor work having for its purpose increase in efficiency. Of the more important work may be mentioned the completion of the Messroom for the foreign employés and of the Time Office buildings, also the construction of an Ash Wharf now nearing completion. The building and putting into commission of a fleet consisting of two sea going tow boats, twelve coal lighters and four ash hopper lighters, is worthy of mention, in that the results of the commis sioning of these boats have already justified the capital outlay.

Distribution

Whilst the mileage of new cables laid during the year shews a falling off as compared with some previous years, the actual amount of work in connection with jointing shews a considerable increase, due, in part, to putting the new super-substations at Fearon Road and Yangchow Road into commission, and also to work in connection with the new 22,000 volt Switch House at Riverside Power Station.

Work in connection with new extensions, alterations and renewals to the overhead mains shews a general increase of about 20 per cent. over the previous year. An unusually large number of alterations were incurred due to the extensive road widening operations which have been in progress.

The year 1924 was one of exceptional activity for the substation department, as, included amongst the 19 new substations which were commissioned during the year were two super-substations, *i.e.*, Fearon Road and Yangchow Road. The Fearon Road Station was commissioned in the Spring, when all cables were transferred from the old Fearon Road Power Station to the new building. Later in the year the full complement of synchronous motor generators was installed in the new substation and all traction load transferred from the old steam plant, which was then dismantled.

Summary of Underground Work

	Laid during 1924.	*Total laid to 31st December*, 1924.
22,000 Volt Cable ..	0.51 miles	119.11 miles
6,600 „ „ ..	13.75 „	117.85 „
Telephone and Pilot Cable	2.75 „	55.94 „
Public Lighting Cable ..	.21 „	4.19 „
Low Tension Cable ..	2.19 „	26.72 „
	19.41 miles	323.81 miles

Total number of Joints and End Boxes made during 1924 612

Summary of Overhead Work

6,600 Volt Mains extended	12.7 miles
„ „ „ dismantled	5.3 „
L. T. Mains extended	92.4 „
L. T. Mains dismantled	42.4 „
Public and Private Street Lighting mains extended	60.0 „
New Poles Erected	2,357
Poles renewed	1,659
New House Service Connections	5,641
House Service Disconnections	1,699
Nett Increase	3,942

(Continued on page 616).

	1918	1919	1920	1921	1922	1923	1924	Increase	%
Private Lighting	14,444,261	16,378,793	20,298,672	22,458,625	24,793,079	27,626,473	29,418,821	1,792,348	6.49
Public and Private Street Lighting	1,141,973	1,192,650	1,454,812	1,703,212	1,836,419	2,182,615	2,269,795	87,180	3.99
Heating and Cooking	899,852	952,814	1,240,136	1,311,970	1,672,459	2,059,774	2,404,590	344,816	16.74
Power	66,024,895	79,622,548	116,839,147	154,898,657	198,549,509	234,419,732	267,043,809	32,624,077	13.92
Traction	3,764,678	4,191,332	4,706,865	4,992,282	5,605,895	5,977,267	6,170,386	193,119	3.23
	86,275,659	102,338,137	144,539,632	185,364,746	232,457,361	272,265,861	307,307,401	35,041,540	12.87

The Selemdja Alluvial Gold Deposits

Amur Province, Eastern Siberia

By G. T. Eve, O.B.E., M.C., Assoc.Inst.M.M.

THE SELEMDJA REGION.—The total length of the Selemdja River is over 400 miles, of which about 330 miles are navigable. The current is very rapid, and in many places exceeds 12 miles per hour when in flood. There are many rapids, especially in the upper reaches. Up to about the mouth of the Nora River barges can be towed up. Higher up, as far as Ekimchan shallow draft (2-ft.) steamers only can navigate and these not always. The valley of the Selemdja is wide. Even in the upper part, where high hills bound it on both sides, the valley often reaches a width of more than a mile. As the river is swift and broad and has a considerable fall, the volume of alluvials which have been and are still in process of being shifted is very considerable. The surface of erosion, past and present, is very great, considering the river's length. The number of large and small creeks assisting in erosion is very great.

The river flows through a timber country in which larch, fir, and pine are predominant. The river freezes in the middle or end of October, and the break-up usually occurs in the beginning of May.

GEOLOGY.—There are no rocks to be seen on the Zeya River on the way up between Blagoveschensk and the mouth of the Selemdja. The country is covered by recent alluvials, and the exposures of sand hills on the right bank are the most striking feature. The igneous rocks, granite, diorite, and diabase are seen from the mouth of the Selemdja upwards. Near the Ulma there appear gneisses and schist, having a north-west strike, and they disappear at the Nora. Between the Nora and the Myn, granite, porphyrite, and pegmatite are predominant. Between the Myn and Ekimchan the country is composed of schists with north-west strike, slates, sandstones, and limestones. Higher upstream granite is predominant. In the direction of the Kharga the country is composed mostly of schists with large bosses of granite. Further towards the Niman system we cross a granite massif of the Esop range with an extremely poorly developed contact with schists on both sides of the range. The Niman group, again, is composed of schists (with north-west strike), very frequently intersected by dykes of pegmatite, aplite, and diabase (?).

The general impression is that the country is composed of a wide belt of schists and gneisses striking in a north-west direction, intersected, broken through, and flanked chiefly by granite, and also in lesser degree by other igneous rocks which disappear further south under cover of sedimentary rocks. These latter are alluvials in the valleys, and Silurian, Jurassic, and Triassic elsewhere. The same belt stretches undoubtedly further N.W. and S.E. and passes through the central Zeya system on one side and through the lower system of the Amur on the other. In the Zeya system the amphibolite gneisses, and on the lower Amur metamorphosed schists are predominant.

ALLUVIAL GOLD MINING.—The belt referred to in the foregoing is the aurifsrous belt of the Amur Province. Where easiest of access it has been explored and exploited to a certain degree. Where difficult of access (as in the Upper Dep. Unya-Bom, which are left affluents of the Bureya), it has remained scarcely scratched, unless it produced exceptionally rich gravels, as, for instance, in the Niman system. The reason of this lies not in any comparative poverty of the gravels of the districts untouched, but in the past history and in the method of development of Russian and gold-mining in Eastern Siberia.

Gold-bearing placers in Eastern Siberia have been known and worked for the last sixty years. The placers were found, studied, and worked mostly by the people of the country, by " snipers," by escaped convicts, by alcohol runners, and by small merchants. These people grew gradually or suddenly, as sometimes, happened, rich from the produce of their mines. They then formed companies, and thus, except in a very few cases, the mining grew and developed. The development was comparatively slow as is shown by the annual output.

Placer Gold Output, Amur Province and Maritime Province (Officially Registered).

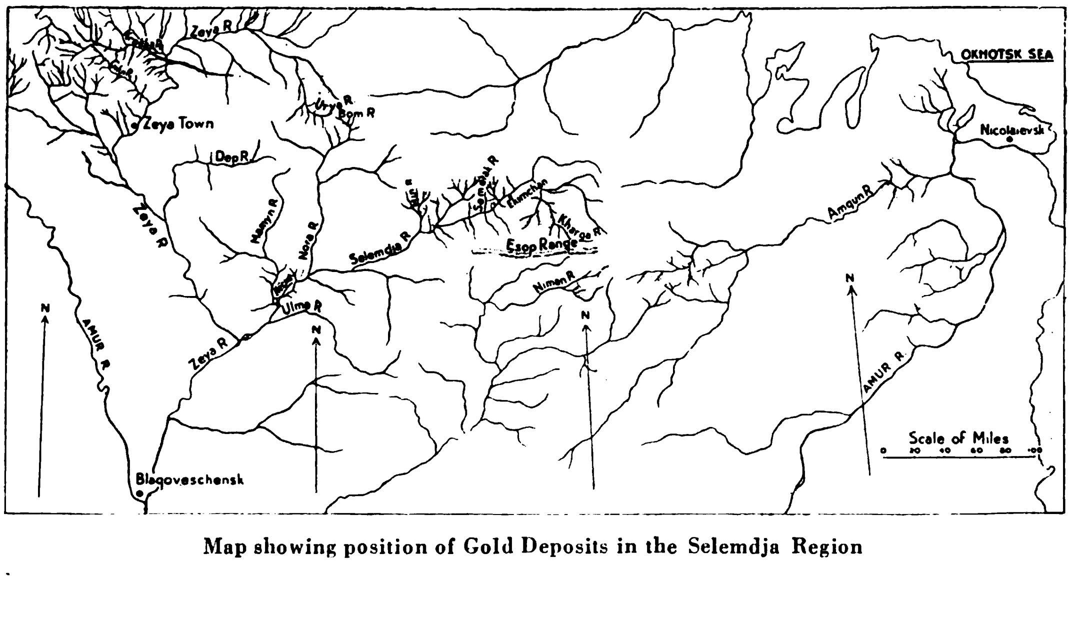
Years.	Oz.	Years.	Oz.
Up to 1868 ..	21,600	1908	.. 245,808
1869-79 ..	49,000	1909	.. 237,168
1880-89 ..	145,000	1910	.. 244,512
1890-1902 ..	216,000	1911	.. 218,160
1903 ..	216,000	1912	.. 289,648
1904 ..	174,528	1913	.. 177,984
1905 ..	197,856	1914	.. 130,032
1906 ..	206,496	1915	.. 100,088
1907 ..	310,608		

It is interesting to note that though the above figures are the official figures of the gold-mining output of Eastern Siberia, the actual amount of gold which passed through all gold-smelting laboratories is quite different and may be given as follows:—

Years. ..	Oz.	Years.	Oz.
1911 ..	.. 459,648	1914 ..	.. 530,064
1912 ..	.. 444,096	1915 ..	.. 422,084
1913 ..	.. 476,064		

The explanation of this is to be found in the concealment of gold by the owners of the mines to avoid payment of royalties, also in the large amount of gold produced by unregistered " Snipers." To these figures must be added the gold smuggled over the frontier into China. In this way we can arrive only approximately at the true figure for gold produced yearly by Eastern Siberia. It was estimated by certain geologists and government officials that the real figure before the war was on an average about 650,000 oz. yearly.

With this figure in mind we can consider another factor, namely the number of mines and the way they worked. The total number of registered prospecting licences in Amur Province in 1915 was 5,742. The number of mining claims was 1,353, out of which number 441 claims only were under exploitation. These 441 claims were worked in the following way: By hydraulicking 2, by dredging 9, by properly run hand-labor 33, by tributers 397, total 441.



Map showing position of Gold Deposits in the Selemdja Region

This figure of 397 shows us exactly what type of mining we are really dealing with. The bulk of the gold was produced by handworking methods based on the tribute system. This was the natural result of the remark made above that the average citizen of the country developed mining by means of the gold taken out of the mines. The government offered very little help to the miners. Roads and means of communication had to be built by the miners themselves. In very many cases these men could neither read nor write. They started their mining without capital. In such a country it is natural to expect the predominant system of mine-development to be the crudest and the simplest. Such was the case in Eastern Siberia.

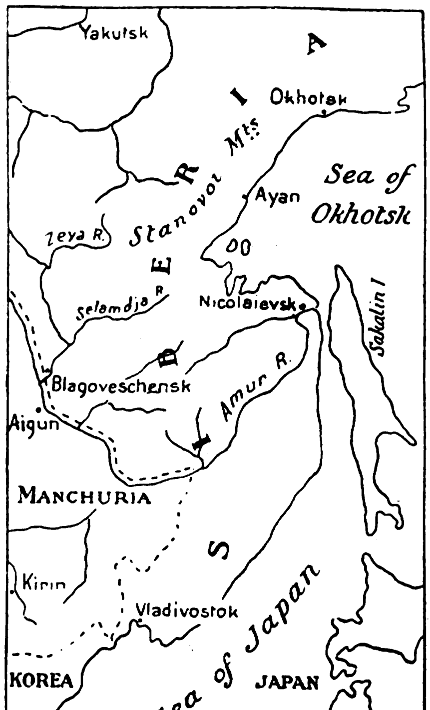
Naturally, also, we can expect to see in such a case only the richest, best situated, and most easily accessible mines tackled first. Such, again, was the case in Siberia.

The Russians in their search for gold naturally went up the creeks first. The creeks, with their shallow gravels and facilities for diversion of water, presented the best mining grounds for the Russian gold-mining in Eastern Siberia remained until it was ended by the revolution. Any ground presenting water difficulties, or generally speaking, any ground unfavorable for hand-working methods was left over, mostly untouched.

The tributing system applied to such ground was an expensive one. The men used to steal from 25 per cent. and upwards of the gold won, and not less than another 25 per cent. of the gold was lost through imperfect means of working the gravel. The following statement shows us what kind of mines could be tackled successfully by the Russian miners of the time. In 1915 0.03 per cent. of the total working mines had gold contents below gold $1.25 per cu. yd.; 15.25 per cent. had gold contents from $1.25 to $2.50; 68.21 per cent. from $2.50 to $5.00; and 16.50 per cent. $5.00 or over.

The Russian statistics give gold values always for the paystreak only, without any reference to the overburden. To our knowledge the overburden of the country in question is on an average from two-thirds to one-third of the total depth. Thus, the minimum average value the Russians could and would work on was about 40 cents per cu. yd. And that minimum according to all available data known to me remained until the revolution.

This figure of 40 cents gold per cu. yd. is naturally very high. It depended on two factors: (1) Imperfect and primitive methods of working the placers: (2) high cost of transport. The imperfect and primitive methods of working were due to the absence of properly trained engineers, a result of the ignorance and want of education prevalent among the owners of the mines. Lack of capital necessary to bring mining beyond the stage of manual labor had something to do with it also. Even such a company as the Upper Amur Co., which employed thousands of men, sometimes had only one engineer in charge, sometimes none at all.



Map of Eastern Siberia, Showing position of the Selemdja Region

I repeat that the methods of working were very primitive and simple. The following was usually the *modus operandi*. After diversion of the creek by means of a newly dug channel, the overburden would be taken off by hand work and carted away on horse or hand-carts. Then the paystreak would be attacked by means of an open-cut, the gravels being carted away in horse or hand-carts down to the washing-plant. The washing-plant consisted of a high platform (this necessitated lifting off the gravel again) from which the gravel was dumped into a huge revolving screen. The oversize was carted to the dump. The undersize was run over short (about 15-ft.), steeply inclined (about 25 per cent.) sluices, and worked through and away to another dump. No riffles were used. As a result most of the dumps contain no less than 10 cents gold per cu. yd.

The above-described plants were used only among (and not on all) the thirty-three claims referred to above. The rest of the 397 claims had not even that. In their case the gravel would be taken away from the open-cut and worked in small short toms, each of which was padlocked and put in charge of a certain number of men. No pumps were used, and everything was done by hand. Such was the general method of placer mining in Eastern Siberia during the summer season.

The winter season was usually used for prospecting (pits, freezing, or thawing through, as the case might be), or underground work if the placers were sufficiently rich and could not be worked for various reasons (water, depth of the gravels, etc.) in summer. The last method of underground mining was simply glorified pig-rooting and nothing else. Even the Czarist Russian government recognized the damage such mining was doing, and tried to stamp it out, for only about 30 per cent. of the gold was taken out of the placers.

Hydraulicking is a new method in the field. It was tried the first time and with great success during the war. Dredging was introduced into the Amur Province in 1909, when an enterprising rich miner and merchant bought two 5 cu. yd. open-connected dredges and navigated them for about two years on the Zeya and Selemdja Rivers, testing the ground now and again on the look out for suitable gravel. Eventually he struck ground which paid the expenses of one dredge in the first year's work. Later, on a saner basis of work, it was proved that dredging costs could be reduced to from 8 to 14 cents gold per cu. yd.

In 1922-3 I saw four of the dredges. Two of them were panting painfully and slowly. They were dirty, half broken down, and an eyesore. Of the other two there was nothing but the pontoons left; nothing else was visible.

The greatest obstacle to Russian mining in Eastern Siberia was transport. Long distances, absence of roads, bad organization of river transport, all had a very bad influence on the development of mining at that time. Those were the conditions before the revolution. Since the revolution matters have become still worse. The usual freights on the Amur river were from about 0.64 cents Mexican per ton per verst (1 verst-⅔ mile) up to 1.05 cents. But on certain affluents of the Upper Selemdja they reached sometimes the formidable figure of 20 cents Mexican per ton per verst. Winter transport on horse sleighs was still more expensive. It started from 20 cents Mexican per ton per verst, and sometimes reached the figure of $1.20.

One of the dredges referred to above cost $100,000 Mexican, landed in Blagoveschensk. But the transport of this dredge up to the mine on the Upper Selemdja, the last stage from Ekimcham upstream, was done during the winter on sleighs, cost about another $100,000.

The Amur merchant fleet was of considerable size. It consisted in 1917 of 252 steamers having a total cargo capacity of about 21,860 tons, and of 277 barges having a total cargo capacity of about 113,000 tons. In 1921 only 156 steamers and 128 barges were left. Adaptation of steamers to the local conditions of rapid shallow streams on the tributaries of the Amur is no easy matter. In this matter the steamers failed very badly.

I see no reason why, with an improved type of steamer such, for instance, as those in use in Alaska, and extensive use of mechanical transport in summer and winter, the transport costs should not be lowered considerably, especially if certain lessons learnt during the war be taken into consideration.

Summing up all the factors affecting mining in East Siberia, it is easy to see why in the past the Russian mines could work only rich and easy ground.

If we now consider the Selemdja alluvial goldfields, we shall find exactly the same picture. Creeks which were rich, shallow, and easy to get at, are mostly worked out. The interior of the basin, away from more or less big tributaries, has been left practically unexplored. The larger creeks and flats of the streams, though known to contain good gold, have been left untouched. Creeks or terraces with 20 to 25 cents gold per cu. yd. were not worked at all.

It is interesting to note that of the total

area of the Amur and Maritime Provinces (amounting to 824,500 sq. versts), 11.80 per cent. has been more or less surveyed by the geologists: 47.08 per cent. were only visited on route marches, 41.12 per cent. were not visited at all.

THE DEPOSITS.—The first mining of alluvial deposits on the Selemdja begins from the mouth of the Mamyn. Here we find quite a number of small creeks, tributaries of the Selemdja, which gave excellent placers, the Neclia and Korolevsky mines, for instance. The peculiarity of the group is the rather unusual depth of the gravels, exceeding sometimes 30-ft. to the bedrock. The result was that extensive flats at the mouth of the creeks were left untouched. The gravels contain little or no clay, no boulders, and are unfrozen. The overburden consists mostly of tundra. The gold is coarse, and heavy, and is mostly concentrated near bedrock (soft, decomposed gneisses and schists), but, on the whole, as everywhere in the Selemdja basin, the gold is pretty evenly though comparatively poorly distributed through the depth of the gravels, with special concentration near bedrock. These phenomena were usually disregarded by the Russian miners.

This first mining field extends upstream to the mouth of the Nora. The yearly output of the group before the revolution was about 19,440 oz. of gold of about 860-880 fineness. The Upper Mamyn, though known to be auriferous, was left untouched. The Upper Nora, extremely difficult of access, is very little investigated, though the rich Unya-Bom system is in evidence there. This last field, situated so far away in the taiga (forests) among high hills, was the scene of many bloody crimes, risings, sudden disappearances, and appallingly arduous conditions of work. The gold, so far as I could ascertain (that system was not visited by me) is of very patchy character, mostly nuggets in shallow coarse gravels.

From Nora upwards, until we get to the Lower Myn, we have apparently a break. Apparently, I say, as nobody has investigated the valley of the Selemdja itself yet.

From the Lower Myn begins the Upper Selemdja mining group, a veritable paradise for the Russian miner. Hundreds of small creeks, rich in heavy gold found in shallow gravels close to the main navigable river, constituted ideal ground, and the Russians made the most of such a golden opportunity. The great majority of the creeks are worked out now, but the valleys of the larger streams and of the Selemdja itself are still little touched. The total output of this field up to 1917 was 604,800 oz. of gold of slightly lower fineness than that of the Lower Selemdja system. Here was a field with creeks of exceptionally high values. The creeks Aldyn and Dagalyn for instance, now worked out, produced from $2 to $4 gold per cu. yd. This was the site of the first successful attempt to start dredging in Eastern Siberia.

I have mentioned these dredges already, and the state to which they are reduced now. Since the revolution one new dredge was added. It is a small (2½ cu. ft.), close-connected American dredge, which belongs to an American-Belgian-British company. They have worked for the last two years, with apparent success, in the valley of the River Semertack, a right affluent of the Upper Selemdja. The depth of the placers is that usual for the Upper Selemdja, about 14 to 15-ft. The values were, so I was told, from 30 to 70 cents gold per cu. yd. The company is conducted and backed apparently by plucky pioneers of the old sort, who defied all adverse opinions. They have my sincere wishes for success.

Two of the features of the mining fields of the Upper Selemdja are worth mentioning. One is the presence of patches of frozen ground; another is the presence of extensive alluvial terraces. The influence of the first is known to any miner who has worked up North. The second is worth looking into, especially in a country like the Upper Selemdja, where water and timber are abundant and grade is good.

After the Upper Selemdja comes the Niman system separated from the first by the high and wild Esop range. This group is situated on the Upper Bureya, an affluent of the Amur. It is worked out and is now of no interest. It was rich and produced about 800,000 oz. of gold.

CONCLUSION.—The present state of mining is not difficult to describe. The larger companies are gone and no large-scale mining is in progress. A few small enterprises are at work, some conducted by individuals, some by the workmen themselves. No new system of work has been introduced, no new placer field has been discovered. Quite a number of " snipers " are working all over the country.

The country has to start afresh, and there is no capital available in the country to conduct mining. It was comparatively easy to start before; there were so many rich and accessible mines. There are only few such now left. The country will have to start work on poorer deposits, but that will mean a revolution in the mining methods. It will mean the introduction of mechanical appliances, of skill, of up-to-date knowledge of mining. And that will mean the introduction of extensive foreign capital also, for there is little money in the country itself.

One more important feature in connexion with the Selemdja placers is to be noted. I have visited many placers situated on the creeks of the region in question. Practically all of them are undoubtedly detrital placers. Therefore, a question immediately arises: what about reefs? The Russians were aware of this problem. They thought about it, they spoke about it, they wrote about it, and did practically nothing. It required capital, skill, patience, knowledge. Why should people waste all that, even if they had it, when gold was so easy to be won without it? Nevertheless, there are reefs, there are quite pronounced zones of impregnations which give good values. There are large areas containing them. But all that belongs to the future.

The Electricity Supply of Shanghai

(Continued from page 613).

Summary of Substation Work

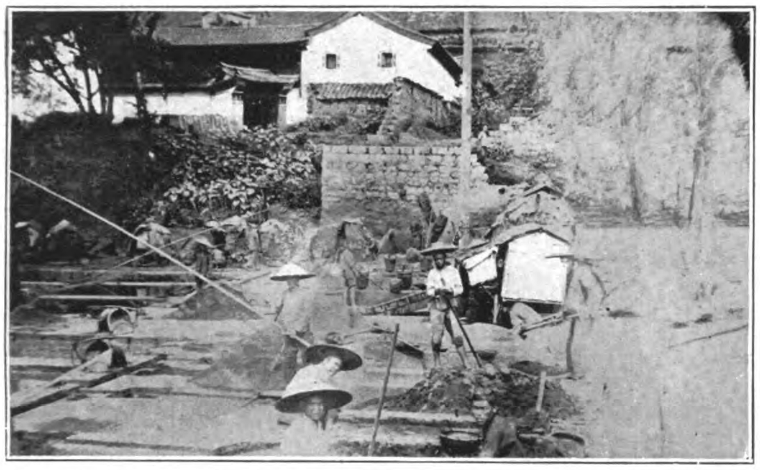
	Number.	*Capacity K.V.A.*
Transformers installed in 1924	82	105,237
„ dismantled in 1924 ..	24	35,275
Nett increase for year	58	69,962
Substations commissioned in 1924 ..	19	
„ dismantled in 1924 ..	3	
Nett increase for year	16	
Pole Transformers erected in 1924 ..	20	
„ „ dismantled in 1924	0	
Nett increase for year	20	

Power

	Number.	*Horse power.*
Hired Motors disconnected during 1924	59	62
Consumers' Motors connected during 1924	536	8,326
Nett total increase for year after deductions in respect of disconnections	477	8,388
Total Hired Motors connected at December 1924	781	17,436
Total Consumers Motors connected at December 1924	4,172	85,761
Total Lift and other Direct Current Motors connected at December 1924	327	6,596
	5,280	109,793

The industrial outlook at the commencement of the year covered by this Report did not justify optimism, and the subsequent fighting in the vicinity of Shanghai further dimmed any hope of the maintenance of past records so far as increase in motors connected was concerned. This state of affairs is indicated by the addition of 7,293 horse power in motors connected during the year, which does not approach the increases recorded during the two preceding years.

The decrease in the number of Direct Current Motors connected seems to indicate that the advantages of Alternating Current supply for the operation of hoists and lifts have at last been recognised, such advantages including supply at one third of the cost of Direct Current, and also frequently lower capital and maintenance costs.



Washing Tin Ore in the Compound of the Kochiu Tin Trading Co.

Washing Tin Ore

China's Tin Industry

By Philip R. Wolff

THE chief sources of tin production in China are :—

		Tons.
Yunnan, approx. annual output	..	8,000
Kwangsi ,, ,, ,,	..	5/600
Hunan ,, ,, ,,	..	150/200

Kochiu is the principal place in Yunnan where tin is mined, the metal being obtained in a very primitive manner, no machinery being employed. There is in the vicinity one fairly modern smelting plant which was erected by a European firm at a cost of over $1,000,000, but it is reported that the output averages only about 500 tons per annum.

The tin is smelted in Yunnan in slabs of about 55 catties each (1 catty equals 1 1-3 lbs) and contains anything from 50 per cent. to 90 per cent. tin, according to the mine from which it is produced.

Refining

Practically the whole of the output comes to Hongkong, where there are about six refineries. The slabs are remelted in open circular saucer-shaped iron pans 39-in. in diameter by $12\frac{1}{2}$-in. at the deepest part. In the centre of the pan is placed a cylinder 12-in. high, 15-in. diameter, made of $\frac{5}{16}$-in. iron, so that at the actual point of contact the cylinder rests on a knife edge only. This, apparently, is a most important factor in the melting process.

Wood is used as fuel; some slag from previous melting is left around the cylinder, the various grades of slab tin are placed on end around the cylinder, and as it gradually melts the pure tin finds its way by gravity into the cylinder via the knife edge, and thence the molten liquid is ladled out into either iron or loam moulds. The scum on the molten metal outside the cylinder is skimmed off at frequent intervals and removed to separate moulds. This slag, which contains as much as 70 per cent. of tin, is made into rough bricks and is reserved for further refining with charcoal by forced draft during periods of slackness. The residue from these "bricks" is called "iron tailings," and contains as much as 30-35 per cent. of tin. These tailings are disposed of to Europe and North China principally, no attempt being made in Hongkong to recover the tin contents.

Purity Tests

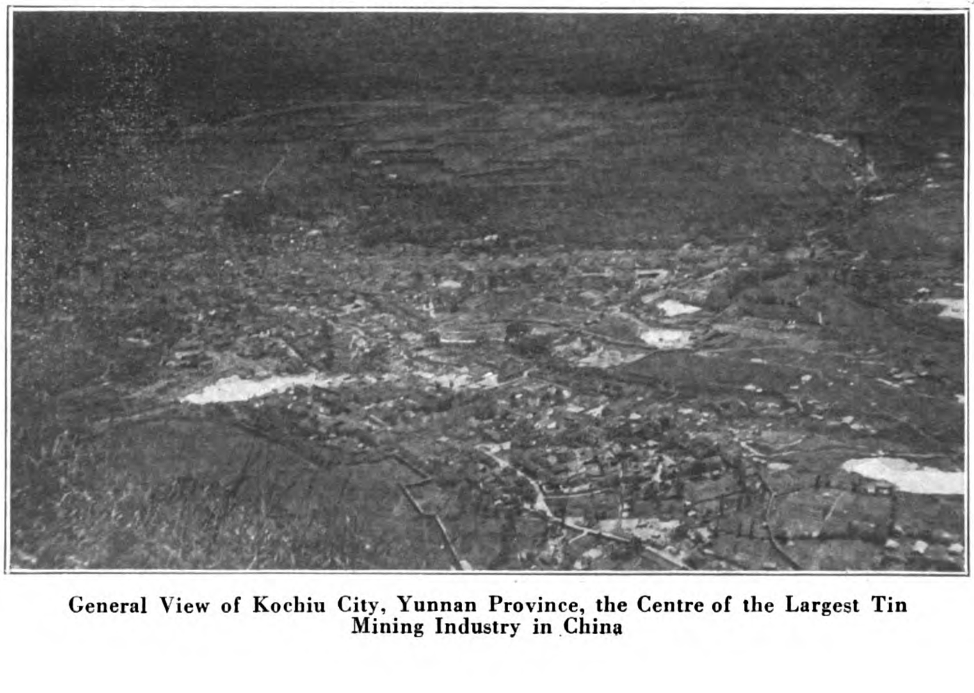
During the melting of the metal, frequent tests are made to ascertain that the standard of purity desired is being maintained. This is done by pouring a little of the molten metal, about the size of a crown, on to a sheet of paper placed on the bottom of an inverted earthenware pot. The "sheen" and the pattern of the surface of the disc so obtained afford the requisite guide for the purity test. Should the charge show signs of falling below the required purity, more slabs of tin of high purity, such as Straits, Banca, or Ho Yuen (Kwangsi) 99.8 per cent. to 100 per cent., are added to "sweeten" or improve the quality.

The capacity of each refinery, for a working day of 16 hours, is about 25 tons.

The method of arriving at the prices at which the various grades may be sold is based on the prices of the various grades of rough, plus melting charges. These charges depend greatly upon the cost of fuel and vary between $8.20 and $3.50 per picul (1 picul equals $133\frac{1}{3}$ lbs).

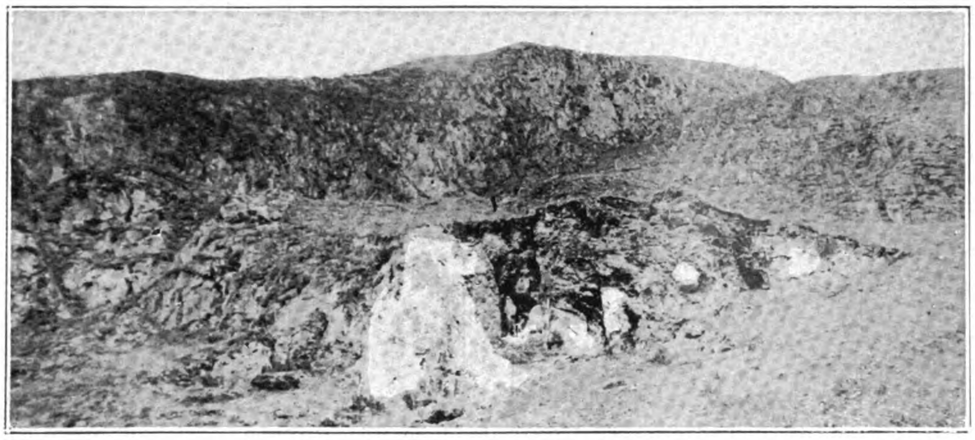
The tin from Kwangsi and Southern Hunan, being of exceptional purity (sometimes as high as 99.9 per cent.), is used principally for "sweetening" the Yunnan tin which is being refined.

In addition to the mined tin a fair quantity is recovered from burnt joss-paper ashes, cigarette and other tinfoil wrappers. No detinning works exist in China.



General View of Kochiu City, Yunnan Province, the Centre of the Largest Tin Mining Industry in China

Accurate Grading



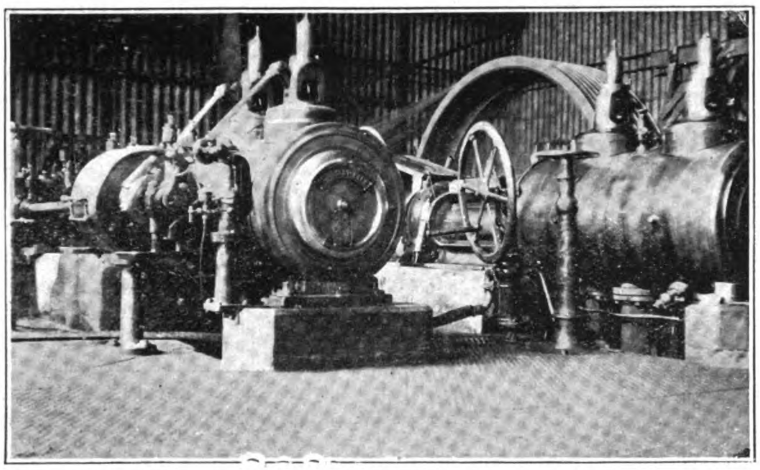
One of the Tin Mines Located 10 Miles from Kochiu

The refining is in charge of foremen who must have had many years' experience before being entrusted with the work, because upon their acuteness, keen observation and judgment depend the correct grading of the tin. From long experience and intimate knowledge of the different grades (the percentage of tin in slabs from each Yunnan smelter, whose brand or "chop" is on each slab, being more or less known) these smelters know how much of each grade is necessary to produce refined tin of 96 per cent., 98 per cent. and 99 per cent. respectively. No assayers or analysts are employed in these refineries, all results being judged solely by observation. The foremen claim that while an analyst may be wrong at times, when analysing No. 1 grade, they never are. But they admit that occasionally, when they have been overworked, mistakes occur with the No. 3 or 96 per cent. grade, more especially when their margin of profit is infinitesimal, and they endeavour to cut the percentage too fine in order to save mixing too much high grade tin. With the No. 1 they can almost invariably tell, to a decimal point, the purity of the metal they are turning out.

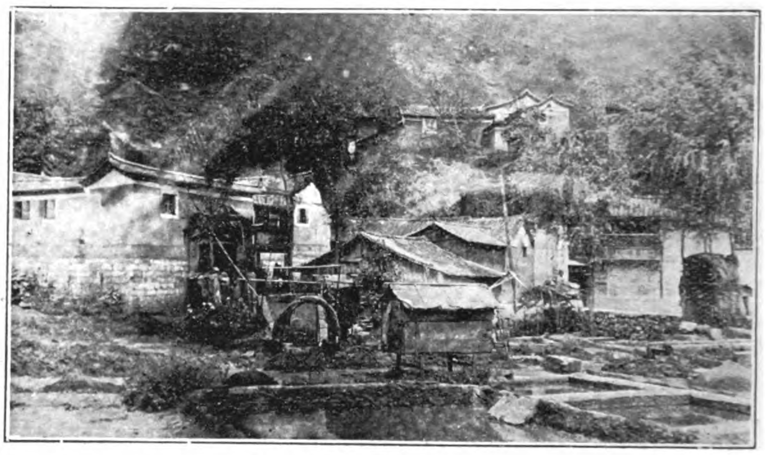
The chief places to which the various grades are exported are as follows :—

No. 1 minimum ...	... 99%	To foreign countries, the bulk going to the United States.
No. 2 ,, ...	... 98%	
No. 3 ,, ...	... 96%	
"Kap" slabs ...	... 99.5%	To Swatow.
"Dow" ingots ...	... 99.5%	
"Dow" slabs ...	... 98%	—To Amoy and Foochow.

"Kwa Hung" No. 3 pigs, slightly under 96%—To Shanghai and North China.



German Power Plant at the Kochiu Smelter



Tin Ore Washing Troughs

New British Launchings for the Oriental Trade

On February 6 there was launched from the Cartsburn Dockyard of Messrs. Scotts' Shipbuilding & Engineering Co., Ltd., the single-screw geared turbine passenger and cargo steamer *Anking*, which has been built to the order of the China Navigation Company for their Bangkok, Hongkong and Swatow service. The dimensions of the vessel are :—350-ft. long overall, by 49-ft. breadth, by 34-ft. deep ; and the gross tonnage will be about 3,700 tons.

The vessel is of the awning deck type, with two complete 'tween decks for third-class passengers, while a large deck has been arranged under the promenade deck suitable for 25 first-class Chinese passengers. Accommodation for six European passengers as well as the officers has been provided on the promenade deck. The ship is up to the highest British standard for passenger carrying, including turning-out gear, boat davits, etc. The boilers are fired by oil fuel, and a speed on service of about 13 knots will be attained. The steamer will be driven by a single screw, actuated by double reduction geared turbine of the Brown-Curtis type. Super-heated steam will be provided by three double-ended cylindrical boilers working under Howden's system of forced draught, at a pressure of 220 lbs. per square inch, and arranged to burn oil fuel. The machinery is designed to give a shaft horsepower on service of 2,300, with a propeller running at 90 revolutions per minute.

Federated Malay States Railways

In a speech introducing the Supply Bill to the Federal Council on November 25, the chief secretary to the Federated Malay States Government outlined the railway programme for the coming year. He stated that economic considerations demanded the expenditure of a considerable sum of money on the extension of the Eastern Branch of the railway through Pahang and Kelantan. An expenditure of 3 million dollars for work from the northern (Kelantan) end and of a million dollars from the southern (Pahang) end was asked for, and was recommended. With the approval of these allocations, the Pahang section should be completed during this year, without further cost, and on an estimated additional expenditure of 4 million dollars in 1926 and 2,800,000 dollars in 1927, the Kelantan section should be completed in the latter year.

Apart from railway construction in Pahang and Kelantan the work of the construction branch is to be confined to the completion of schemes already in hand. Special services on the open-line account amount to $867,000, and that figure has been arrived at after the most careful scrutiny of the department's requirements.

During the first half of the current year, the railway receipts showed a 13 per cent. increase over the corresponding figures for 1922, owing largely to the operation of the revised goods rates introduced on January 10, 1924. A general reduction in passenger fares came into operation on July 1, 1924.

History of Bamboo Steel

By Wong Kok-shan

THE history of Bamboo Steel dates as far back as the first importation of foreign steel into China. The importation of foreign iron and steel first figured in the Customs Returns in 1859, *i.e.* 16 years after the port of Shanghai was opened to international commerce, while Bamboo Steel was only first separately classified in the returns for 1903. But it is traditionally known that Bamboo Steel preceded the coming of Mild Steel and came only a few years after Wrought Iron and Nail Rod Iron, and that it has been in circulation in the market for the past 50 years. So the probability is that it was first introduced into China in the neighborhood 1875 or even earlier.

It is interesting to trace the origin of the shape of the Bamboo Steel, which, from its corrugations, gave rise to the appellation of " Bamboo." In the advance of metallurgy from wrought iron to steel about 60 years ago, the first attempt in manufacturing steel was in the Rhine region in Germany. It was made in small shops by water power and hand forging, which accounted for the corrugations. To make the quality distinctive from Wrought Iron, the steel was made hard and brittle by higher carbon content and heat treatment. Such steel was first exported to China and the Balkan States. In China it found ready favor, and by reason of the corrugations or ribs it was given the name of " Bamboo," which has ever since been adopted even in the Balkan States. While the corrugations and heat treatment have no technical value, the form and brittleness, which have given currency to the brand and by which its commercial value is appraised in the market, have to be retained, thus what could not be got rid of from the start by forced of circumstances have perforce to be perpetuated by means of special rolls and machines involving unnecessarily extra expense. The highest grade of Bamboo Steel is without " water cracks " being more homogeneous in structure, but as this would cost £2 more to manufacture, the grade that is exported is of the second grade with " water cracks." Another kind of steel made in Germany, similar to Bamboo Steel but without corrugations and heat treatment and softer in quality, is Schweiss Stahl (Welding Steel), which is only exported to Turkey.

The first importation of malleable iron into China was Wrought Iron of only a few shapes, such as iron plates and nail rod iron, while such shapes as round square and flat bars were not imported then. At that time native smelters in Hunan made a sort of wrought iron bars of about 2 inches square by 6 inches long and shipped in bundles of 20 bars. Such bars were very malleable and could be forged into very thin bars without cracking, but they could not be made into knives. The edge of the knife was, therefore, supplied by Bamboo Steel, which had a higher carbon content than Wrought Iron and was hard and brittle. The manner of making a knife was to first take a piece of Bamboo Steel and hammer it to about ⅝-in. wide and ¼-in. thick, which would then be inserted into the edge of the piece of wrought iron intended for the blade of the knife. The same would be welded and hammered until the edge of blade with the pieces of Bamboo Steel getting very thin. The sizes of the Bamboo Steel used vary according to the sizes and kind of tools to be made, such as crow-bars, axes, knives, farming implements, etc.

In the earlier days the " Double Horse " brand imported from Germany was not popular in this market, which were sold at about Tls. 5.00 per case. The quantity imported during the first few years was no less than from 40,000 to 50,000 cases a year. After a few years the " Deer " brand and the " Double Deer " brand gradually came into the market, which were then selling at a lower price than the " Double Horse " brand, but the quality was in no way inferior to the " Double Horse " brand. Consequently the two new brands gradually displaced the " Double Horse " brand in this market.

During the Great War the source of supply was cut off as no shipment could be made from Germany. Towards the end of the war an American firm Messrs. Thomas Simmons Company produced on the China market a brand of American Bamboo Steel known as " Ship " brand, selling at that time at about Tls. 10.00 per case. The total quantity sold was over 10,000 cases. This was afterwards followed by Robert Grant, who sold in 1920 and 1921—27,000 cases of Bamboo Steel in Shanghai, Hongkong, Bangkok, Singapore and Manila. However, as the American Bamboo Steel were afterwards being shipped in very thin wooden cases with very poor packing, which was different from those of former shipments, the dealers began to lose faith in the quality of the steel.

The only American manufacturers who are still making Bamboo Steel and importing them into China are the United States Steel Products Co., and from their general catalogue the following statement may be quoted, as showing the standard sizes and standard mode of packing :—

> " This product is extensively used in China, Japan, the Phillippine Islands and the Dutch East Indies for a large variety of purposes, including the making of wood-working tools, razors harvesting knives for hemp, tobacco, sugar cane, etc., and other implements. It is usually furnished in the following sizes :
>
> Round and Square bars ⅜-in. to 2½-in. inclusive.
>
> Flat bars, with either round or square edges: 1-in. by ¼-in. 1¼-in. by ¼-in., 1½-in. by 5/16-in., 1¾-in. by 5/16-in., 1⅜-in: by ⅜-in. 1½-in. by ⅜-in., 1¾-in. by ⅜-in.
>
> Other sizes may, however, be submitted for our consideration.
>
> In ordering Flat Bamboo Steel with round edges, state whether the width mentioned is measured over all or on the flat.
>
> Our Bamboo Steel consists of plain smooth bars, without any lugs or corrugations.
>
> It is usually furnished in strong wooden boxes made of wood 1-in. thick securely strapped to withstand the handling incidental to ocean shipment, containing 133⅓ lbs. (1 picul) 80 lbs., 72 lbs., or 70 lbs., net weight, but boxes of other weight can be furnished if desired."

According to the above the United States Steel Products Co.'s Bamboo Steel is only in plain smooth bars, without any lugs or corrugations, but the proper trade name for such steel is not Bamboo Steel but Milano Steel, which is exclusively used in such places as Bangkok, Singapore and Manila. The chief distinguishing feature of Bamboo Steel from other kinds of hard steel or tool steel is the heat treatment, which gives high brittleness, the test demanded by the buyers. Such heat treatment requires a special plant, which is costly.

After the end of the Great War, the German " Deer " and " Double Deer " brands again returned to the market and soon resumed their former position.

The analyses of the German Bamboo Steel are given below :—

	Double Horse Brand	*Double Deer Brand*
Carbon	0.57%	0.44%
Silicon..	0.15%	0.10%
Manganese	0.78%	0.61%
Sulphur	0.03%	0.05%
Phosphorus	0.075%	0.085%
Chrome	nil	nil
Nickel	nil	nil
Tungsten	nil	nil
Vanadium	nil	nil

while another sample gives the following analysis :—

Carbon	0.60 to 0.65%
Silicon	0.15%
Manganese	0.60 to 65%
Sulphur	0.03%
Phosphorus	0.05%

The Yellow Label Tool Steel as sold in the market here has the following analysis :—

Carbon	0.41%
Manganese	0.63%
Silicon	0.14%
Phosphorus	0.011%
Sulphur	0.011%

From the foregoing, it will be seen that as regards analysis, the Bamboo Steel is very much similar to Yellow Label Tool Steel, the only difference being the corrugations or ribs and the heat treatment as stated above.

It may be here remarked that attempts have been made in various countries to make Bamboo Steel, but none has been able to produce it as cheaply as Germany, where the business is controlled by a syndicate.

The following are the Customs Trade Returns for Importation of Bamboo Steel from 1918 to 1923.

	1918		1919		1920	
		Val. Hk.		Val. Hk.		Val. Hk.
Imported from	Piculs	Tls.	Piculs	Tls.	Piculs	Tls.
Hongkong... ...	12,072	211,046	9,402	106,047	13,027	149,128
Macao	9	211	23	138	25	279
French Indo-China	34	785	129	2,083	45	1,045
British India ...	21	495	—	—	119	3,242
Great Britain ...	152	2,587	22,287	176,365	19,832	158,165
Sweden	—	—	1,164	14,934	1,585	11,742
Denmark	—	—	1,873	24,031	—	—
Germany	—	—	—	—	3,200	37,118
Belgium	—	—	—	—	3,413	16,164
Russia and Siberia by land frontier	13	113	—	—	—	—
Russia Amur Ports	—	—	10	183	—	—
Russia Pacific Ports	—	—	2,940	42,085	2,493	29,247
Korea	108	2,254	92	1,905	4,211	38,317
Japan (including Formosa) ...	56,245	815,987	37,582	330,147	23,515	217,377
Philippine Islands	—	—	—	—	80	640
Canada	4,778	71,727	5,459	80,688	1,276	14,456
U. S. of America (including Hawaii)	121,422	1,513,207	101,787	783,566	63,339	466,556
Direct Gross Import	194,854	2,618,412	182,748	1,562,172	136,160	1,143,476
Re-exported Abroad ...	1,766	24,252	528	4,667	4,445	35,979
Total Net Import	193,088	2,594,160	182,220	1,557,505	131,715	1,107,497

	1921		1922		1923	
		Val. Hk.		Val. Hk.		Val. Hk.
	Piculs	Tls.	Piculs	Tls.	Piculs	Tls.
Hongkong... ...	10,060	86,731	6,074	49,520	6,483	51,009
Macao	49	479	34	289	10	56
French Indo-China	359	5,338	1,009	10,188	1,347	11,031
Singapore, Straits, etc.	21	223	13	67	—	—
British India ...	76	1,979	63	1,364	73	1,351
Great Britain ...	9,799	164,715	10,069	94,631	22,646	146,637
Sweden	130	2,299	523	14,778	1	7
Germany	3,511	29,028	9,768	62,341	14,636	89,511
Belgium	2,349	45,793	4,837	30,423	2,249	9,703
Italy	—	—	—	—	279	3,053
Korea	1,359	5,033	1,366	9,128	32	286
Japan (including Formosa) ...	21,783	168,319	4,162	41,349	17,169	141,682
Philippine Islands	7	128	1,132	4,983	222	677
U. S. of America (including Hawaii)	32,902	400,925	33,514	208,275	43,722	254,100
Direct Gross Import	82,405	910,990	72,564	527,336	108,869	709,103
Re-exported Abroad ...	1,133	11,261	1,284	5,927	380	2,243
Total Net Import	81,272	899,729	71,280	521,409	108,489	706,860

Launching of a New "Holt" Vessel for Far Eastern Trade

ONE of the most interesting launchings that has taken place for a very long time in England occurred at the end of May, when the *Promehteus* was launched from Scott's Shipbuilding and Engineering Company Ltd.'s. Cartsburn Dockyard.

The vessel which is a twin screw oil-engined boat, was built to the order of Messrs. Alfred Holt & Company, of Liverpool, for their Far Eastern passenger and cargo services.

The launching of the *Prometheus* marks a new era in the development of ship construction, the outstanding feature being the adoption of a new kind of steel technically known as elastic limit steel. This, it may be remembered is the outcome of researches made by Mr. F. G. Martin, who is metallurgist to the owners.

Messrs. Holt & Co., have always been one of the foremost ship-owning firms in promoting developments likely to lead to improvements, and having realized the far-reaching effect of this material on ship design they decided to test its effect upon this vessel, and it will be of special interest in technical circles to learn that their efforts have resulted in a saving of fully 10 per cent. of the total steel material used.

The owners followed their usual procedure of deciding the scantlings themselves, and these were afterwards accepted for classification purposes by the British Corporation of Shipping and Lloyd's Register, and also by the Board of Trade in connection with the passenger certificate.

The vessel is of the poop, bridge, and forecastle type, with a length of 425 feet between perpendiculars, a breadth of 54 feet 6 inches, a depth to the bulkhead deck of 32 feet 9 inches, and the gross tonnage is about 6,300 tons.

The equipment is of the highest standard, the cargo gear comprising eighteen electrically operated winches, and one of the derricks is suitable for 50 ton lifts.

All the requirements of the British Board of Trade for passenger carrying have been provided, including emergency dynamo, emergency electric bilge pump, boat turning-out gear, etc., and the weather decks are wood sheathed all fore and aft.

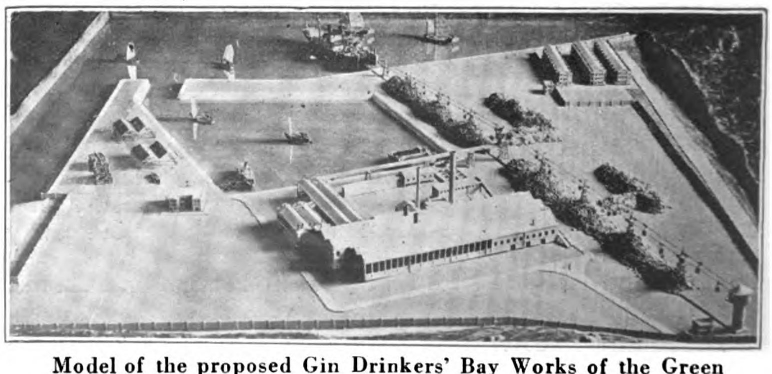
Messrs. Wailes Dove Bitumastic Ltd., have applied their Bitumastic enamel in peak tank, heels at bulkhead, under the sidelights and in the chain locker.

After the launch the vessel was berthed in the builders' wet basin, where two sets of eight-cylinder four stroke single acting Diesel engines of 3,700 b.h.p. will be installed.

Although this is the first of this type of vessel to be launched, the economies effected have encouraged the builders sufficiently to lay down another vessel on identically similar lines.

Green Island Model at Wembley

An interesting exhibit of the Hongkong Section at Wembley this year is an exact reproduction in miniature of the works the Green Island Cement Company propose to erect at Gin Drinkers' Bay. The model, made principally of zinc and sheet brass and enclosed in a handsome handcarved stand, with glass on all four sides, is the work of the Hongkong and Whampoa Dock Company. The buildings,—the fine offices, the factory, the clinker store and the Chinese staff quarters—as well as the 400 feet pier and the limestone conveyor, 1,600 feet in length, are depicted to scale and give a good idea of the magnitude of the undertaking.



Model of the proposed Gin Drinkers' Bay Works of the Green Island Cement Company

New P. & O. Steamers—"Ranpura" and "Rawalpindi"

THE P. and O. Company is rapidly overtaking its war losses and new launchings are frequent. The latest additions to the huge fleet are the *Ranpura* and the *Rawalpindi*.

The *Ranpura* is a large and handsomely modelled passenger and mail steamer with two funnels, built by Messrs. Hawthorn, Leslie and Company, Ltd., Hebburn-on-Tyne, and has successfully run her trials in the North Sea. A speed of 17¾ knots was attained.

A feature of the vessel is her unique style of decorations in the carrying out of which, Lady Inchcape, wife of the chairman of the P. & O. Company, and her daughter, the Hon. Elsie Mackay, have taken the keenest interest.

The vessel is the first completed of four which the company have ordered for their London and Bombay passenger and mail service. Two of the vessels are being constructed on the Clyde, and Messrs. Hawthorn, Leslie & Co., will have ready within a few months the *Ranchi,* which is a sister ship to the *Ranpura.*

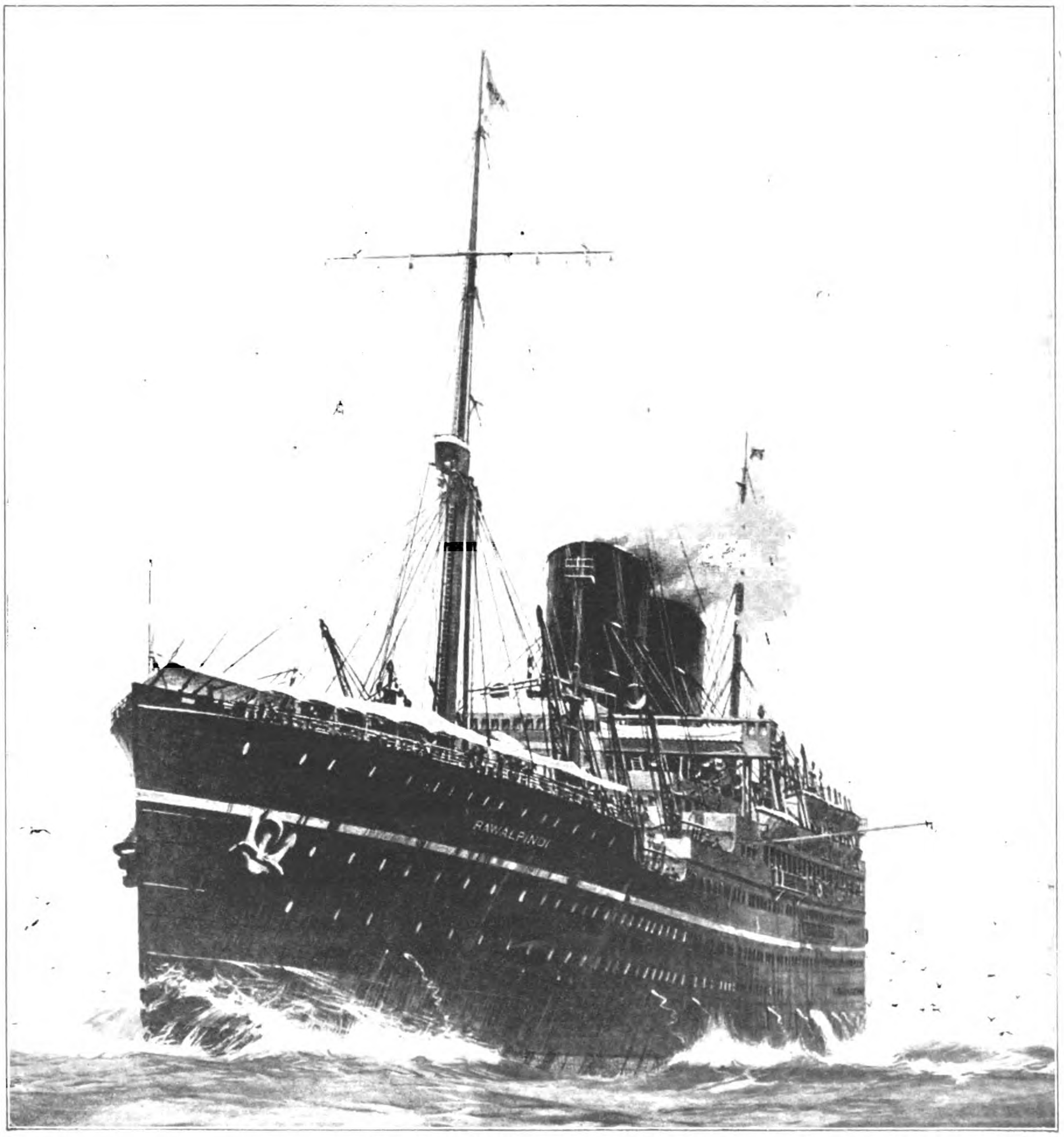
The *Ranpura* has a length overall of 570-ft., extreme beam 71-ft. 3-in., depth 47-ft., and a gross tonnage of 16,585. She will carry 312 first class and 295 second-class passengers, and has been designed on the most modern lines to ensure to the highest degree possible the comfort of persons travelling in tropical climates. There are seven decks, which provide spacious promenade accommodation, while the saloons, dining rooms, cabins, etc., are all designed to give ample space, comfort, and convenience.

Not only have Messrs. Hawthorn, Leslie and Co., constructed the hull and engines, but they have done the whole of the woodwork required, electrical wiring and fittings, etc., and other work which is often deputed to sub-contractors. The decorations and furnishings have been carried out to a point of highest luxury, and special systems of ventilation and heating have been provided throughout the whole vessel.

The first class saloon is decorated in a French style, and finished in grey with silver enrichments. The lounge, writing, card, and smoke rooms are designed with high ceilings, skylights and large bay windows. The lounge is decorated in Georgian style, with green and old gilt enrichments, while the writing and card rooms are finished after the style of the Adam's period. The furniture and tapestries are reproductions of the periods represented. The smoke room of early Tudor design and equipment, which is a feature of the vessel, is finished in grey coloured oak and plaster work, and it opens on to a spacious verandah.

The second saloon accommodation is designed on similar lines to the first saloon, and comprises dining saloon, lounge, and smoke rooms, cabins, etc. The main rooms are tastefully panelled and fitted with large bay windows. Other features of the vessel include an electric passenger lift, a number of cabins de luxe, a special arrangement by which each passenger has a constant supply of fresh air under control, deck games' facilities, printer's shop, two hospitals, dispensing rooms and surgery, barber's shop, and motor life boats fitted with wireless and searchlight. The galleys, pantries, baker's and butcher's shops, etc., occupy a considerable space amid-ships, and are fitted with every appliance for the company's à la carte service. Oil fuel is used in the galleys.

There are seven large cargo holds, divided into mail rooms, bullion rooms, insulated spaces, and bulk cargo holds, and there is an efficient installation of hydraulic cranes for the rapid handling of cargo.



The P. & O. Steamer Rawalpindi

The machinery, constructed at St. Peter's Works, is of the most up-to-date type, and consists of two sets of four-cylinder quadruple expansion engines, balanced on the Yarrow-Schlick and Tweedy system, and developing about 15,000 i.h.p. Direct acting hydraulic engines and turning engines of the two-cylinder, two-crank style, are fitted to the main engines. Auxiliary machinery of the latest type is provided, and the propellers are fitted with adjustable manganese bronze blades. There are six boilers of the multi-tubular type, which burn fuel oil on the Clyde system, in conjunction with Howden's forced draught. The oil fuel burning installation is in duplicate. The refrigerating plant has been installed by Messrs. J. and E. Hall, Ltd., of Dartford.

"Rawalpindi"

The *Rawalpindi* is a magnificent twin-screw mail and passenger liner of over 16,000 gross tons, built by Messrs. Harland and Wolff, Ltd., Greenock. The new vessel, which is classed 100A1 at Lloyd's, is 570-ft. by 71-ft. by 47-ft. 6-in., and has a straight stem and cruiser stern. There are twelve watertight bulkheads, extending to the shelter deck, dividing the vessel below the main deck into seven cargo spaces, cross bunker, two boiler rooms, engine room, fore peak and after peak. The double bottom extends right fore and aft and is divided into compartments for the carriage of oil fuel, fresh water and ballast water. Water ballast can also be carried in the fore and after peaks.

The first class accommodation, which has been arranged on the promenade, bridge, shelter and upper decks, is on a luxurious scale, and provision has been made for 307 persons in this class. In the dining saloon, the walls and ceiling of which are finished in old ivory white, all the passengers can dine at the same time. The walls of the lounge are panelled and finished in ivory white, the ceiling of this apartment being finished in flat ivory white. The music and writing room is in the Adam's design, with Wedgwood treatment. The smoke room walls are panelled in cedar wood, and at the after end is situated the verandah—a very pleasant apartment. The main staircase is in oak with wrought iron balustrading, the smoke room staircase being of cedar wood. An elevator also extends from the dining room to the promenade deck.

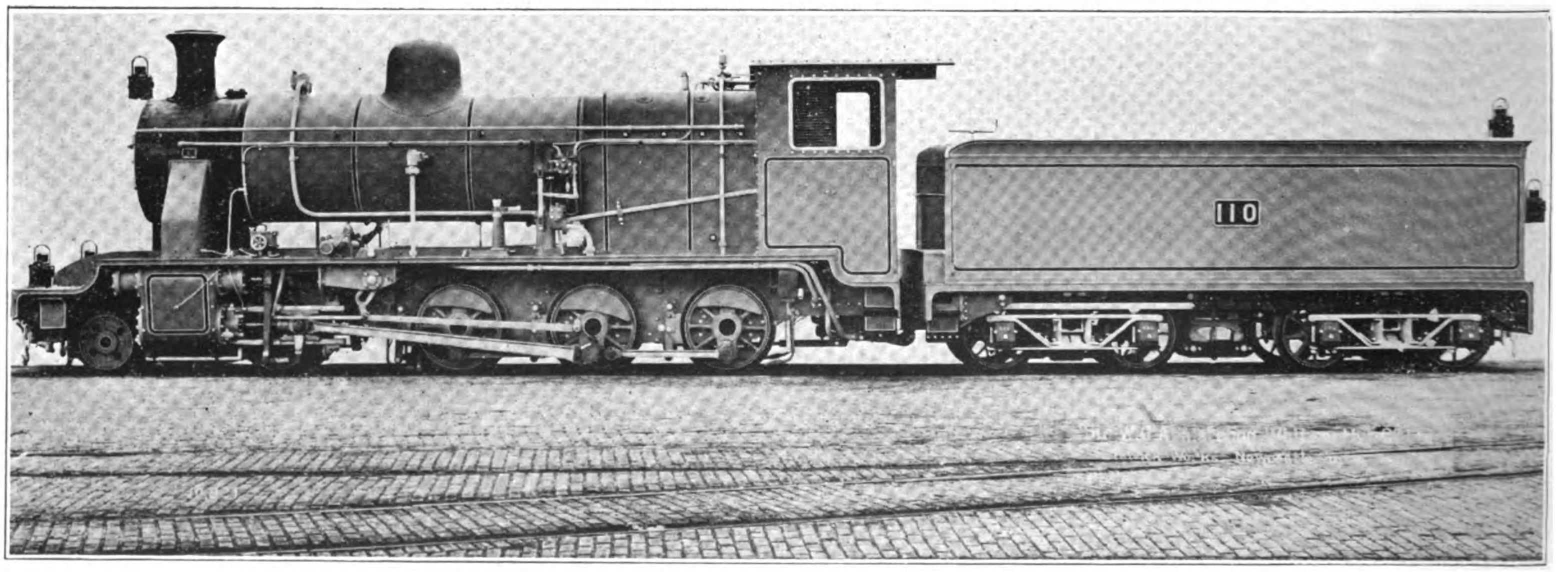
The second class comprises accommodation for 266 persons and is also of a thoroughly up-to-date character, the provision made of the comfort of the passengers leaving nothing to be desired. In addition to the dining saloon, the accommodation in this class includes the smoke room and music room, and the design and arrangement of these apartments embody the latest ideas, while the furnishings are attractive and appropriate throughout. The state rooms, in every case, have natural light and ventilation ; an ample supply of water being laid on to wash basins throughout the accommodation, while the system of mechanical ventilation ensures the comfort and well-being of the passengers in tropical climates. Single berth state rooms with cot berths have been fitted to an unusual extent, and a number of two berth state rooms is also provided.

Special detail has been given to every detail of construction and outfit affecting the safety of the ship. In addition to the watertight sub-division afforded by the twelve bulk heads already referred to, the provision of closely sub-divided oil burners along the ship's side in way of the boiler rooms, forms an additional safeguard of undoubted value. A complete installation of hydraulic cargo gear is installed to ensure expeditious and silent handling of cargo, while the electric installation is of a very complete character for illumination, heating and power purposes.

The propelling machinery of the *Rawalpindi*, which has been constructed at the firm's Belfast Works and will be fitted on board at that port, consists of two sets of quadruple-expansion engines of the balanced type of about 15,000 i.h.p. supplied with steam at 215 lbs. pressure by six double-ended cylindrical boilers fitted with forced draught and arranged for burning oil fuel. The vessel is fitted throughout with Welin quadrant davits.

Messrs. Wailes Dove Bitumastic, Ltd., have applied their Bitumastic solution and Birumastic enamel to the tunnel well, tunnel spaces and engine-room tank, also their Bitumastic solution and Bitumastic covering to the deck in distiller room and tank top in tunnel spaces. They have applied their Bitumastic heat-proof cement to the tank top in engine room thrust recess, drain well in engine room, tank top in forward and after boiler rooms, drain well in boiler room, boiler stools and deck in refrigerating machinery space in engine-room.

The Browning Crane Company is the new name adopted by the Browning Company of Cleveland, makers of locomotive cranes and buckets. The change of name is made to secure a closer tie-up with the company's well-known specialty which it has manufactured for the past twenty-five years and which are in use in all parts of the world. The Browning plant and main offices are located at 16226 Waterloo Road, Cleveland, Ohio. Branch offices are maintained in New York City, Philadelphia, Chicago and St. Louis, with sales agents in Portland, Los Angeles, San Francisco, Montreal, Birmingham and London, England. Browning cranes are built in sizes from 10 to 40-ton capacity.



ARMSTRONG WHITWORTH LOCOMOTIVES

The illustration here shows a new 4—6—0 type Locomotive with double bogie tenders. These Locomotives have been designed and contructed by the Armstrong Whitworth Company for the Portuguese West African Government

They are of a particularly powerful character and designed for a maximum axle load of 10½ tons.

The Siamese Gunboat "Ratanakosindr"

THE Royal Siamese gunboat *Ratanakosindr* was launched late in April, with great *éclat*, from the Armstiong yard of Sir W. G. Armstrong, Whitworth & Co., Ltd., High Walker. The christening ceremony was performed by Madame Bides Bochanavisuddhi, wife of the First Secretary of the Siamese Legation in London.

The builders were represented by Sir Eustace Tennyson d'Eyncourt, K.C.B., F.R.S., etc., managing director of the Armstrong Shipyards, and various others.

The Royal Siamese Government was represented by His Excellency Phya Prabha Karavongse, the Siamese Minister in London, Eng.-Commander Luang Jamni Kolakarn, resident Inspector for the Royal Siamese Government, the First Secretary of the Siamese Legation in London, Sub-Lieutenant Datt Bunnag and Sub-Lieutenant Djamrat, while Sir Archibald Ross, K.B.E., represented the engine builders, Messrs. Hawthorn, Leslie & Co., Ltd.

Among the numerous invited guests present were representatives of the British Admiralty, Board of Trade, Lloyd's Register, British Corporation, Cunard Steamship Company, London Trinity House, etc.

In a speech after the launch Sir Eustace d'Eyncourt said: — "The vessel which has just been successfully launched is the first war vessel launched from the Armstrong Naval Yard for a foreign Power, and her construction is, in fact, the performance of a pre-war contract between the Royal Siamene Government and Armstrong, Whitworth & Co., Ltd. In 1913 we were entrusted with the construction of a river gunboat for the Royal Siamese Government, and the building of the vessel was in progress at the outbreak of war in 1914. Unfortunately, owing to restrictions imposed by the British Government, work on that contract was suspended, and eventually the material for the vessel already on the blocks and the machinery manufactured were scrapped. The contract for the vessel was subsequently cancelled, and a new contract was entered into with the Royal Siamese Government on July 30 last for the present ship.

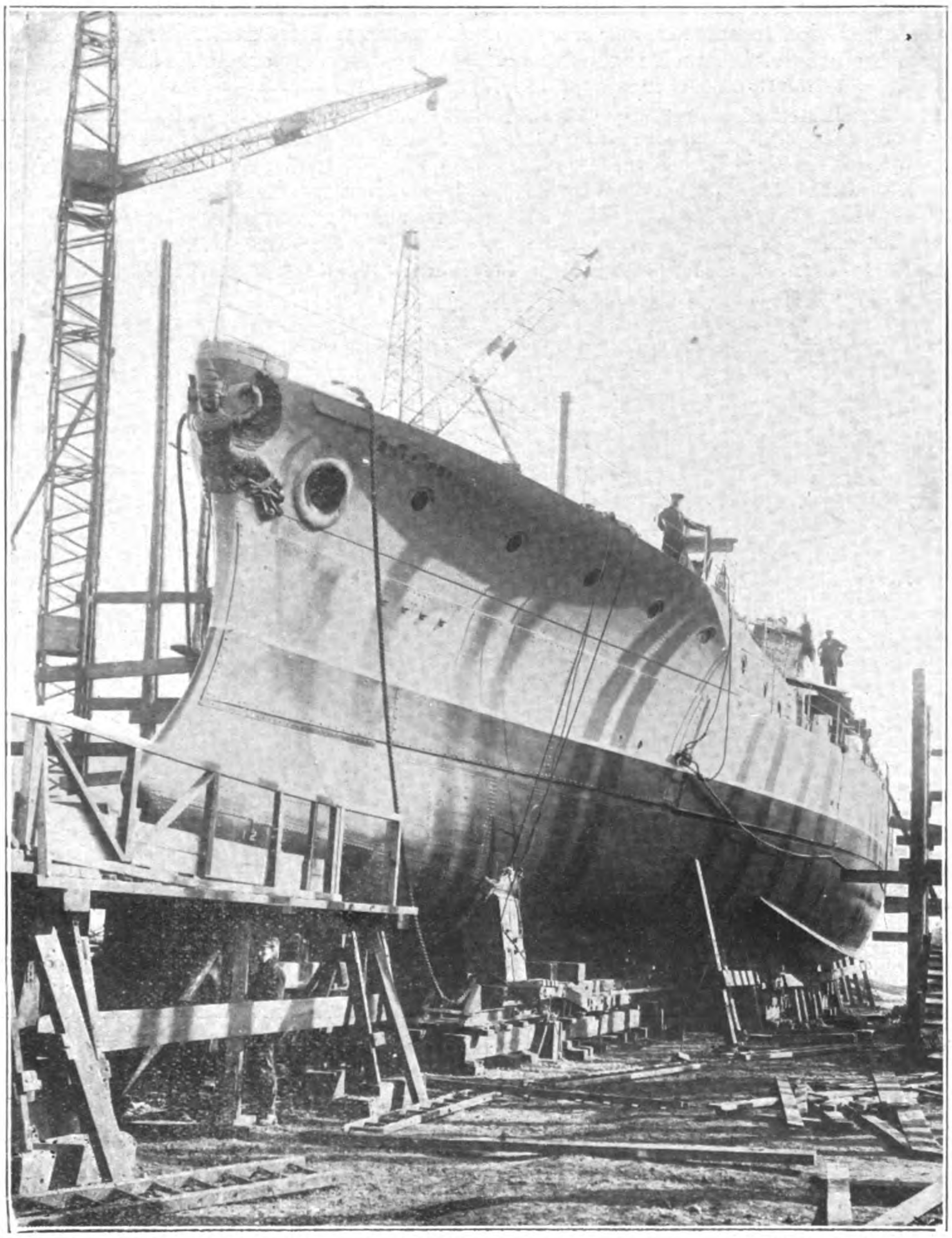
"The interference in the construction of the first vessel and the cancellation of the original contract has not been without its compensations, so far as the Royal Siamese Navy is concerned. The design of the *Ratanakosindr* has been gone into fully, and the experience gained during the war and the improvements resulting from that experience will be embodied in the vessel launched to-day. She is intended for service on the rivers, estuaries, and coast line of Siam, and this particular service has imposed limits on her dimensions and displacement.

"It is a great pleasure to me, on behalf of the directors of my firm, to welcome His Excellency Phya Prabha Karavongse and his suite to our shipyard. We appreciate the visit of His Excellency very much, which I know has been made at some inconvenience to himself in view of the matters of great importance requiring his attention in London at present, and which will necessitate his return this afternoon.

"We are glad to have associated with us in carrying out this contract Messrs. Hawthorn, Leslie & Co., who will supply the propelling machinery of the vessel under the personal direction of Sir Archibald Ross. Messrs. Hawthorn, Leslie & Co. have a world-wide reputation as manufacturers of all types of marine engines, and they have been associated with us on many previous occasions in connection with some of our most important contracts, such as H.M. battleship *Monarch*, H.M. armoured cruiser *Achilles* and the light cruisers *Birmingham* and *Dunedin*, the Chinese trading ship *Chao Ho*, the Turkish light cruiser *Abdul Hamid*, and the Turkish Royal yacht *Ertho Groal*, for which vessels they supplied the main machinery.

"We have been afforded great help and assistance in carrying out this contract by Engineer-Commander Luang Jamni Kolakarn, the resident inspector on behalf of the Royal Siamese Government, and his assistants, and I wish to take this opportunity of expressing the thanks of our officials and staff for their assistance and co-operation.

"You have all had an opportunity of walking through this very large shipyard, and in the course of that walk you have perhaps remarked upon its emptiness. The ship we have launched this afternoon is the only one in that portion of the yard except the British battleship *Nelson*, which is the last of its kind under the Washington Agreement which can be built until 1931. It is true that we have a few moderate-sized tankers and cargo ships at our mercantile yard, but the only way in which this great establishment can be kept going is by keeping the Armstrong yard full also.



The Siamese Gunboat "Ratanakosindr," recently launched from the High Walker Yard of Sir W. G. Armstrong, Whitworth & Co., Newcastle-on-Tyne

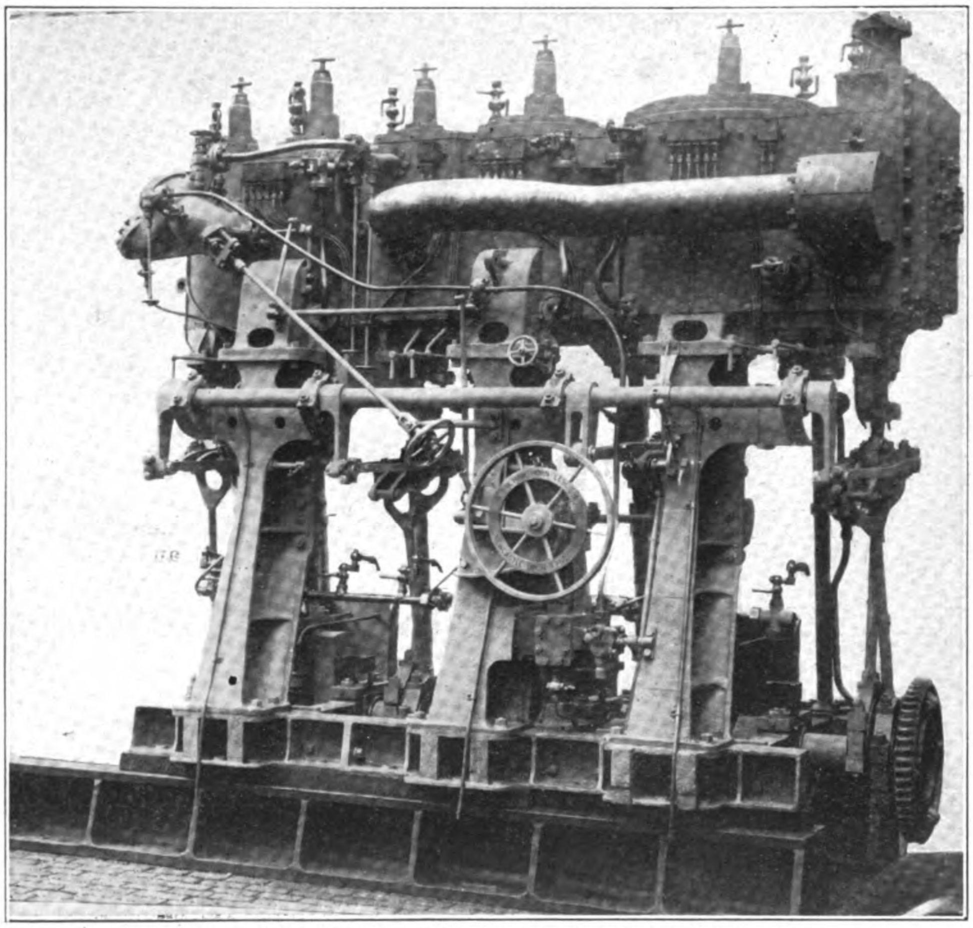
"To do this now is an extremely difficult matter, and it can only be done by our all pulling together and working as hard as possible in every way. We are up against the fiercest competition in mercantile shipbuilding that has ever been experienced in this country, and the Germans especially are trying to wrest from us the supremacy in shipbuilding which this country has hitherto held. Only to-day I see that it is reported that the German Government are giving special rates for the carriage of steel and other shipbuilding material, and in face of this competition, in which they have every help from their Government and from the local authorities, it behoves us to think how we can possibly hope to compete and retain our supremacy in this, which has, perhaps, been the most important and beneficial industry of our country."

Description of the Vessel

The particular services on the rivers, estuaries and coast line of Siam for which this vessel is intended imposes limitations upon the dimensions and displacement; but notwithstanding her small size, it is interesting to note the combination of offensive and defensive qualities that have been incorporated in the design of the vessel, without exceeding a normal displacement of 1,000 tons.

The principal dimensions of the vessel are :—

Length, overall, 175-ft.; length between perpendiculars, 160-ft.; breadth moulded, 36-ft. 6-in.; depth moulded to upper deck, 14-ft. $11\frac{1}{4}$-in.; mean draught in normal condition, 10-ft. 9-in. The protection of the vessel consists of an armour belt composed of nickel steel $2\frac{1}{2}$-in. thick, running for a length of about 100-ft. amidships, and covering machinery and magazine spaces, and extending from the upper deck to 2-ft. above the normal waterline. This midship belt is extended to the ends of the vessel by nickel steel belts of similar depth, having a thickness of $1\frac{1}{4}$-in. At the ends of the $2\frac{1}{2}$-in. belt transverse armour bulkheads are fitted, that at the former end being $2\frac{1}{2}$-in. thick from the upper edge of armour belt to the sunk upper deck and 1-in. from the sunk upper deck to the bottom of the belt. At the forward end of the superstructure a nickel steel armour screen bulkhead $1\frac{1}{2}$-in. extends the whole width of the superstructure. The barbette rings to the 6-in. guns are composed of nickel $2\frac{1}{2}$-in. thick between the upper deck and the underside of the gunhouse.



One of the Twin Set of Engines for the Siamese Gunboat

A conning tower of cast steel armour quality with walls $4\frac{3}{4}$-in. thick and a roof $1\frac{1}{4}$-in. thick is fitted on the forward superstructure, and a forged steel tube $1\frac{1}{2}$-in. thick affords protection to the communication leads passing from the conning tower to the interior of the vessel.

The upper deck over the machinery spaces is composed of high tensile steel 1-in. in thickness in the neighbourhood of the machinery spaces and $1\frac{1}{2}$-in. thick over the magazines. The funnels above the upper deck are also protected by high tensile steel.

Armament and Fire Control

The armament will comprise :—

2 15.2 c.m. (6-in.) 50 cal. B.L. guns mounted in armoured gun-houses, one on the forecastle deck forward, capable of firing from direct ahead to 55 degrees abaft the beam on either side; and the second gun on the upper deck aft, with similar arcs of training. These guns are fitted with axial hoists, thereby enabling the ammunition to be delivered direct from the handling room to the interior of the gun-house.

Four 76 m.m. (3-in.) 50 cal. H.A.Q.F. guns are installed, two on the foreward superstructure and two on the upper deck amidships, one on each broadside. These guns are to have large zones of fire, and are adapted to be used against either naval or aircraft. A rapid supply of ammunition to these guns is ensured by the fitting of two special 3-in. dredger hoists.

The main mast carries a control top, in which is installed a 9-ft. range-finder and other fire control instruments, while a special range-finder for use against aircraft is fitted on the special platform just abaft the funnel. Two 24-in. searchlights are carried, one above the chart room forward, and a second on a special platform upon the mizzenmast. A 6-in. director sight is fitted on the roof of the chart and wheelhouse. The normal ammunition supplied to the vessel consists of 100 rounds for each 15.2 c.m. gun, and 300 rounds for each 76 m.m. gun.

Propelling Machinery

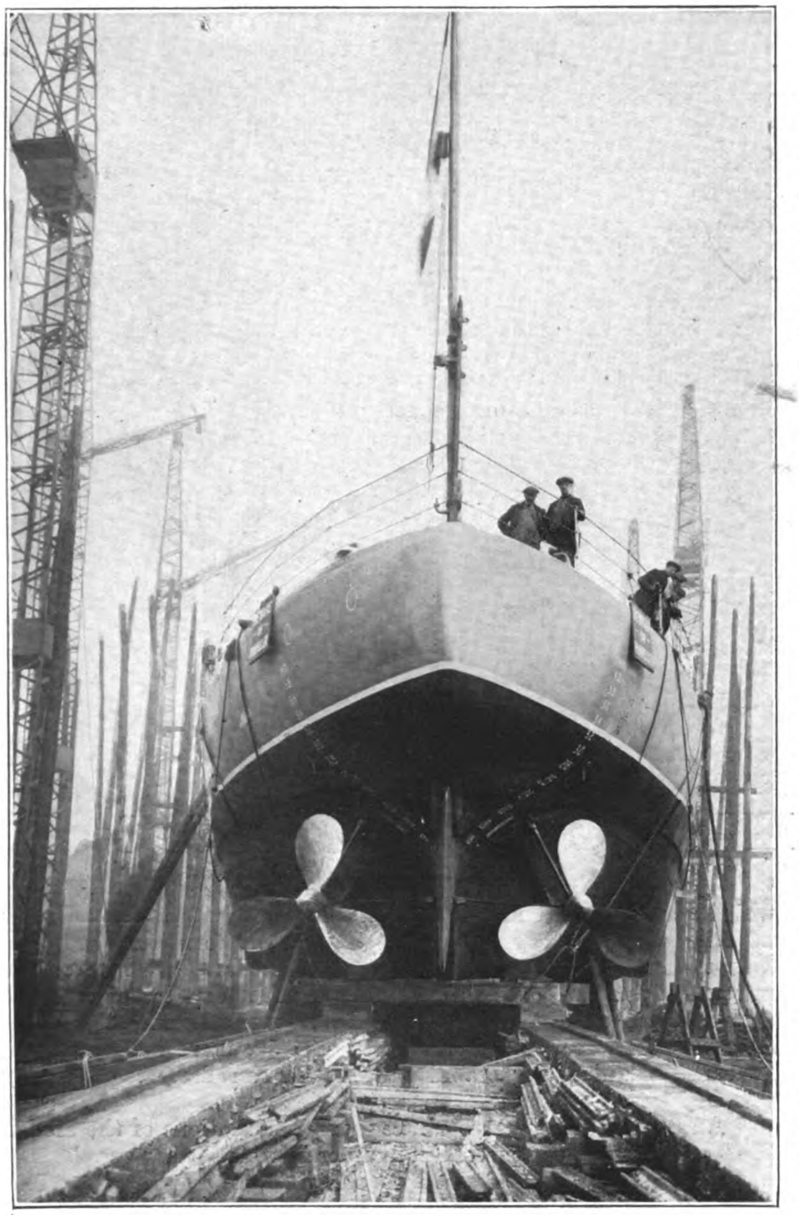
The machinery which is being manufactured at Messrs. Hawthorn, Leslie's St. Peter's Works, consists of an installation of twin screw vertical type expansion engines, each having cylinders $10\frac{1}{2}$-in. 18-in., and 30-in., with a stroke of 22-in. capable of developing, collective power of 850 i.h.p. when running at 150 revolutions per minute. It is estimated that when developing this power the vessel in a normal condition will attain a speed of slightly in excess of twelve knots.

The boiler installation consists of two water-tube boilers of the three-drum type, having a working pressure of 225-lbs. per square inch, and fitted for burning oil.

The auxiliary machinery of the vessel includes one 50-k.w. dynamo, one 26-k.w. dynamo, one petrol paraffin dynamo. An electric capstan is fitted aft, capable of working $\frac{3}{4}$-in. chain cable and $2\frac{1}{4}$-in. steel wire hawser. On the forecastle is fitted a steam capstan capable of working $1\frac{1}{4}$-in. cable and $3\frac{1}{2}$-in. steel wire. A wireless installation by the Marconi Company, and having a minimum range of 500 miles, is installed.

The boats carried consist of 24-ft. motor-boat of 8 knot speed, 24-ft. cutter, 18-ft. lifeboat, 18-ft. gig. These boats will be lifted overboard by a special derrick fitted on the mizzen mast.

The captain's quarters are situated at the aft end of the vessel, and consist of a saloon, separate sleeping cabin, and lavatory. Adjacent to the captain's quarters is the wardroom, wardroom pantry,



Stern View of the Gunboat just before launching

chief officer's cabin, chief engineer's cabin, and two further cabins for officers, having two berths in each.

In the superstructure amidships on the upper deck is housed the sick bay, officers' lavatories, officers' messes and pantry, ship's office, officers' bathrooms, warrant officers' bathroom, officers' galley, and crew's galley. Under the forecastle forward is provided the crew's accommodation.

Contracts for Lifeboat Wireless Sets

Recently the Marconi International Marine Communication Company has received orders from Messrs. John I. Thorneycroft and Co., Ltd., for seventeen lifeboat wireless sets for lifeboats of the Peninsular and Oriental Steam Navigation Company. The same company has also placed an order with Thorneycroft's for two complete sets with searchlights which are to be installed on the *Naldera* and *Narkunda*, on the return of these vessels to London. In addition the same firm are supplying ten more sets to Messrs. William Hill Limited, of Tyne Dock, for the P. & O. Company. Messrs. Harland & Wolff Ltd., have also placed a further order for twenty-two installations, which will be fitted in various life boats at Belfast, Liverpool and Southampton, during the next few weeks. In addition to these orders placed in England for vessels trading with the Far East, The Canadian Pacific Steamships, Limited, have ordered twenty-seven sets, the Atlantic Transport Company two sets, the Anchor-Donaldson Line Ltd., four sets, and Messrs. Hamblin & Company of Blackwall, four sets.

New Indian Cable Steamer

The *Patrick Stewart*, a new cable steamer, constructed by Messrs. William Simons & Co., Ltd., of Renfrew, for the Indian Government Telegraphic Service, has lately been successfully launched.

The vessel has been built under the direction of the naval architects, Messrs. Sir J. H. Biles & Company of London and Glasgow. She is fitted with two sets of triple expansion surface condensing engines, and steam is supplied by two cylindrical multitubular boilers, fitted with forced draught and oil-burning installation, and is specially fitted up for work in a hot climate with regard to ventilation, refrigerating plant, etc. The cable machinery is of the latest and most approved type.

The christening ceremony was performed by Mrs. Simpson, wife of Mr. M. G. Simpson, director of the Indo-European Telegraph Department.

New Mail Steamer for D.E.I. Service

There has recently been launched from the yards of the De Schelde Royal Shipbuilding Company of Flushing, the twin-screw motorship *Indrapoera*, for the Rotterdam Lloyd Mail for passenger and cargo service between Rotterdam and Batavia.

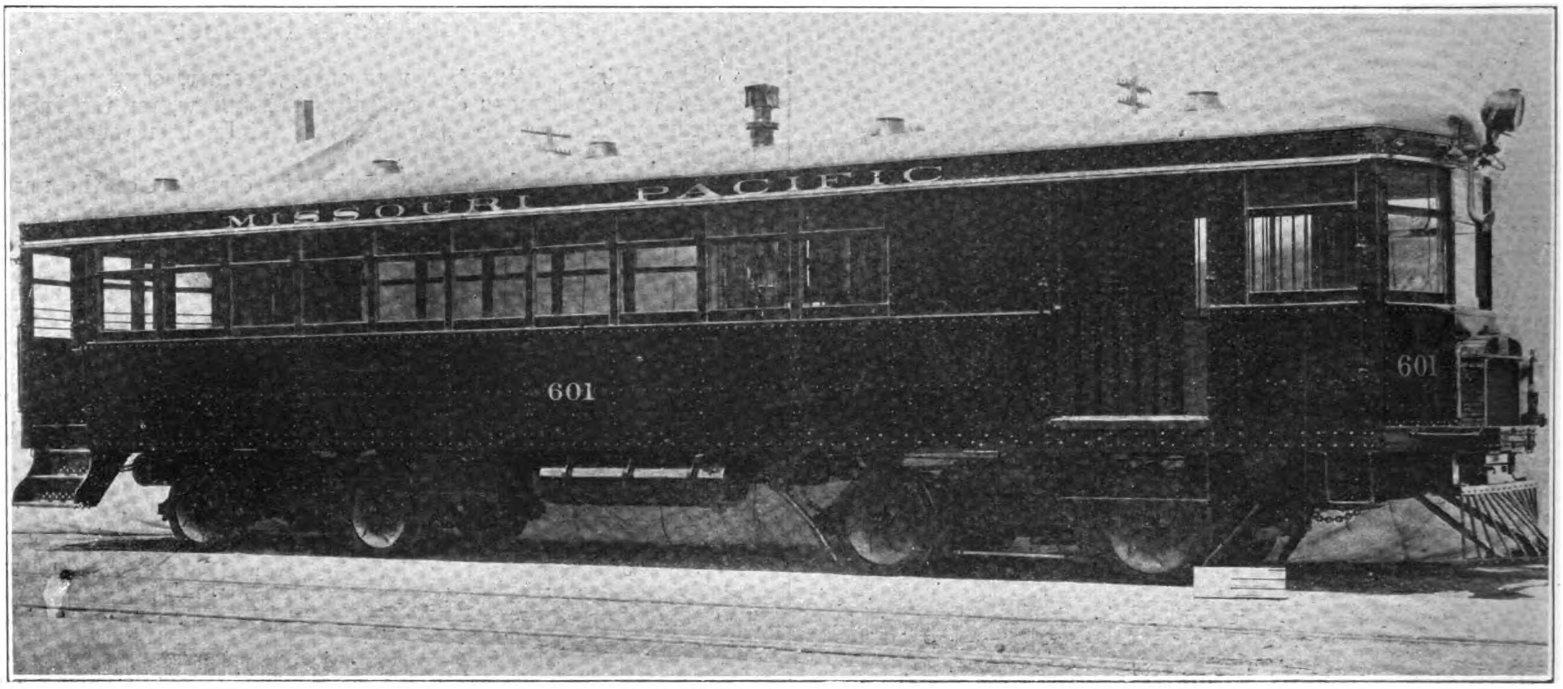
The gross register tonnage of the vessel is about 10,500 and her principal dimensions are: length on load water line, 500 feet, extreme breadth 60 feet, and depth to upper deck 38 feet. The ship will be propelled by two Schelde-Sulzer marine Diesel engines each developing 3,500 shaft h.p. at 85 revolutions per minute, which will give the ship a mean speed of 15 knots at sea fully loaded. The engines are of the two-cycle single-acting type, with cylinders 760 mm. diameter by 1.3404 mm. stroke, and each engine drives two air compressors from separate cranks at the forward end; scavenging air is supplied by two electric ventilators. All auxiliaries not driven by the main engines are electric, current being supplied by 4 dynamos, each coupled to a four-cylinder Schelde-Sulzer two-cycle Diesel engine of 400 effective h.p. The machinery is placed in two watertight compartments, the after compartment containing the main auxiliaries oil engines and electric dynamos, the forward compartment electric transformers, auxiliary air compressors, refrigerating machinery and other auxiliaries, including a dynamo driven by a 100 h.p. Kromhout oil engine to supply current to the deck machinery in port. The main and auxiliary Diesel engines are being built and installed by De Schelde Company.

A Handbook on Superheated Steam

SUPERHEAT ENGINEERING DATA—A Handbook on the Generation and Use of Superheated Steam. Sixth Edition Revised. (Superceding Data Book for Engineers.) The Superheater Company, New York and Chicago, 1925. Bound in Keratol, 4½ by 7-in., 208 pages, 85 illustrations and diagrams, 69 tables. Price $1.00.

This handbook contains condensed data for steam power plant engineers and operators. A feature of the book is the index consisting of 16 pages, assuring ready reference. Superheated steam, its advantages over saturated steam, and the proper design and performance of superheaters, are briefly discussed. It illustrates superheater arrangements in practically all stationary, marine and locomotive type boilers commonly made in America. Waste heat, portable and separately fired superheaters are also shown. Brief comparative data is given as to sizes, tube sizes, arrangement of tubes, etc., for the stationary water tube boilers illustrated. The steam tables cover pressures from below atmospheric to 600 lbs., absolute, and include properties of superheated steam from 50 to 300 deg. F. superheat.

The section on piping includes information for figuring piping for handling water, saturated and superheated steam, and velocity and pressure drop of water and steam flowing through piping. In this section is included also the proposed American standards for high pressures. Superheat Engineering Data also contains engineering data on coal and oil fired boilers, which include tables of heat values for gaseous, liquid and solid fuels. Other miscellaneous data include complete conversion tables and data on bolts and screw threads, with the recent work of the American Engineering Standards Committee, and the National Screw Thread Commission. There are also many miscellaneous tables frequently used by steam engineers.



Brill Model 55 Gasoline Car

J. G. Brill Company's Gasoline Cars

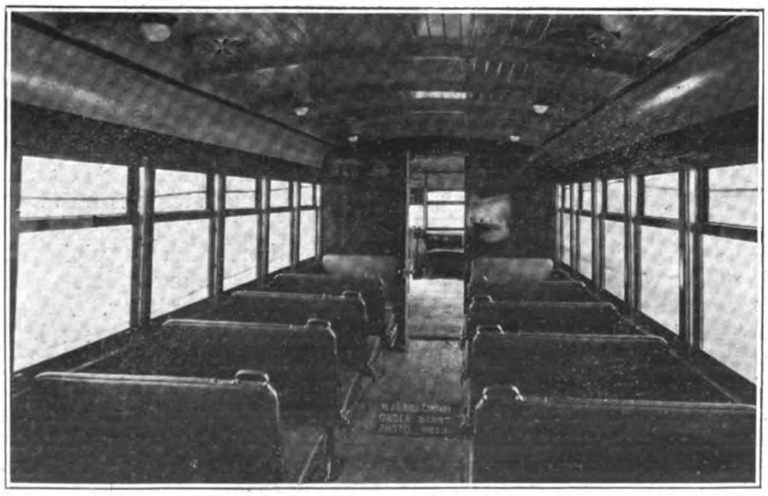
OPERATING costs in excess of existing revenue on short line railroads and branch lines of trunk systems have been confronting the railroads for many years. Various experiments have been made to reduce expenses and to stimulate business with more or less success but never with complete satisfaction. Within recent years through the expansion of the automotive industry gasoline-propelled vehicles have been developed for this service. Their outstanding features, of course, have been the comparatively low cost of equipment, the low cost of operation in replacing the usual locomotive and coach, and the possibilities opened up by these economies for increasing the service, thereby stimulating business and increased revenue. In this publication some operating results are given which give a general idea of what these gasoline cars accomplish, as well as a comprehensive idea of design and construction of modern types of equipment.

The introduction of Model 55 type marked an advance in the development of gasoline equipment on steam railroads, which stimulated interest and, consequently, resulted in a more general use of gasoline-propelled rail vehicles.

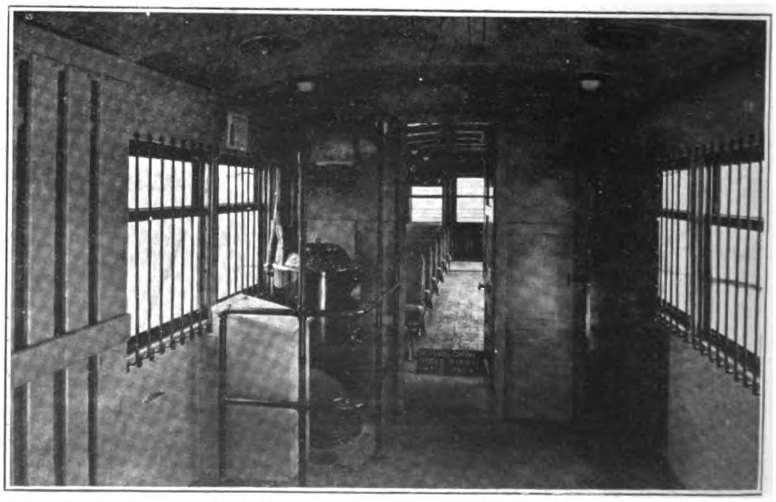
Prior to the development of the Model 55 Gasoline Car, the tendency was toward the use of smaller and lighter traffic lines, and which were designed more along the lines of a motorbus on rails with flanged wheels at rear and small four-wheel pony truck at front. This type is represented by our Models 30 and 43 illustrated on pages 9 and 10. The necessity for equipment capable of meeting the requirements of the heavier traffic on many short and branch lines was soon recognized and the Model 55, more in keeping in appearance and riding stability with modern railroad equipment, was designed.

An outstanding feature of the many installations of the Model 55 Gasoline Car is the successful manner in which it has supplanted the steam locomotive and single coach, generally employed in short and branch line service, and it's comparatively low cost of operation. Of course, the different conditions encountered on various lines will naturally result in a wide range of operating costs, but regardless of this fact the comparison with the cost of the replaced equipment is so favorable to the gasoline car that service is possible at a profit on lines which had been previously operated at a loss. In most cases the operating cost per mile of the Model 55 Gasoline Car is about one-fourth that of the steam locomotive and coach.

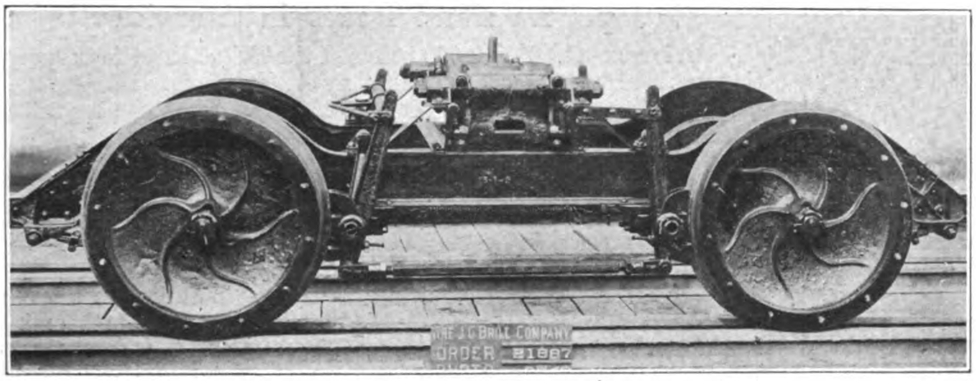
The Gulf, Texas & Western Railroad, which had discontinued its passenger service over a period of two years, placed in service a Model 55 Gasoline Car, of the combination passenger and baggage



Passenger Section of a Brill Gasoline Car



Freight Section of the Same Car

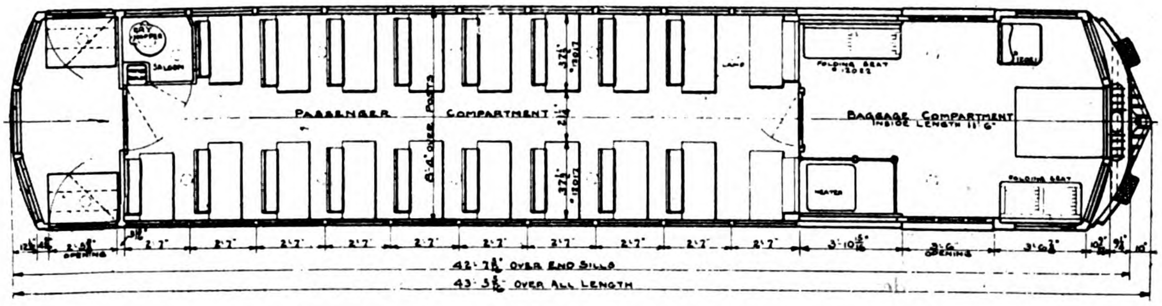


Truck Under Model 55

type, between Mineral Wells and Seymour, making one trip daily or a distance of 216 miles. Reports of its operation show a most consistent performance. During the first seven months in service, it never missed a daily trip, something which could not be said for its predecessor and its record of being on time 97 per cent. of the time is also noteworthy.

Prior to the inauguration of gasoline car service the company had been standing continually a loss of from $3,000 to $5,000 a month, which was not only eliminated but a profit of from $2,000 to $3,000 was soon being made. An analysis of a report of this car for a period over three months shows that in operating 19,872 miles the cost per train mile was but 15.3 cents and that gasoline or fuel consumption averaged 7.19 miles per gallon.

Among some other operating reports submitted are the following, which are representative of the results generally obtained with Model 55 cars. In every case reported thus far, even in the highest, the comparison with the cost of steam train operation is so favorable to the gasoline car that all the railroads having placed this of type car in service have shown worthwhile economies.



Cross Section of Car

RAILROAD	Days Operated	Total Miles Run	Average Miles per Gallon	Operating cost Per Mile
St. Louis, San Francisco Railway	177	35,000	6.05	.259
Cleveland, Cincinnati, Chicago and St. Louis	306	48,650	5.8	.291
Philadelphia and Reading ..	31	2,877	6.27	.26
Chicago Great Western	285	45,894	5.63	.2446
Tennessee, Alabama and Georgia	27	5,041	6.57	.1996

The attitude of the travelling public toward the Model 55 Gasoline Car has been very favorable. In such cases where it is possible to provide two trips daily service in place of one daily trip of the steam train, the operating companies have received much commendation. It is invariably found that with the installation of these cars, the public is much pleased with the service and would be loath to return to the old conditions.

In view of the necessity for furnishing a combined passenger and baggage service on most short and branch line railroads, the most popular type of Model 55 Gasoline Car has been that having accommodations for both.

This car measures 43-ft. $5\frac{5}{16}$-in. over pilot and has a total seating capacity of 43, five of which are on folding slat seats in the baggage compartment. This latter compartment measures 11 ft. 6-in. long inside and, in addition to 70 square feet of baggage storage space, there is also available room for the operator and the engine equipment.

The carbody is constructed of steel. All lower sash, with the exception of that to the operator's left, raise; and each side of the rear platform is enclosed with a single swing type door, glazed in the upper portion, which folds against the rear body bulk-head, a standard steel trap door covering the step opening when this door is closed. A single sliding door of ash, 3-ft. 6-in. wide, glazed in the upper portion, is provided on each side of baggage compartment.

In the passenger compartment there are 19 non-reversible transverse seats, with spring edge cushions, upholstered in brown imitation leather. Interior of the passenger compartment is finished in cherry stained mahogany with carline celinings and agasote lining below the window rail.

Renitent Posts

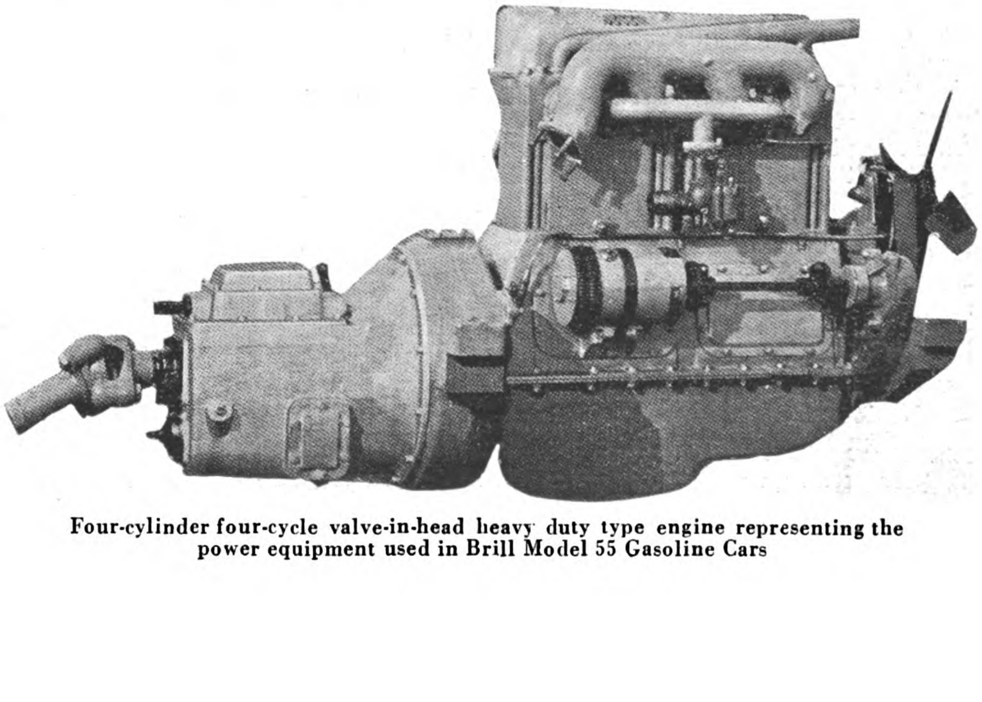
An outstanding feature of all Brill Model 55 Gasoline Cars is their construction with Brill Renitent spring brass post casings. This feature, while adding very little to the car weight, makes possible a sash fit which is both air, dust and water tight. With this construction the stiles of the lower side window sash, which raise, are fitted with brass channels which slide in grooves of the spring brass post casings.

The Power Plant

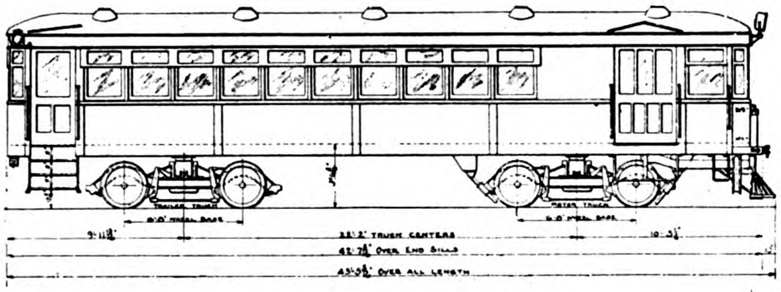
The engine equipment of Brill Model 55 Gasoline Cars is the most powerful heavy duty type available, developing as high as 68 h.p. at 1,500 r.p.m., which propels the car at a normal speed of 38 miles per hour. This engine drives the car through a multiple disc clutch and 3-speed heavy duty transmission to an auxiliary transmission housed in the cast steel bolster of the forward or motor truck. There is provided a total of six speeds forward and three reverse. This engine is located under the hood at the forward end of baggage compartment and is removable as a unit.

The Trucks

The Brill 81-Motor and 81-Trailer Trucks illustrated on page eight are standard for Model 55 cars. Simplicity predominates the design of both trucks and, while the forward truck is equipped with the auxiliary transmission, in many instances like parts, such as



Four-cylinder four-cycle valve-in-head heavy duty type engine representing the power equipment used in Brill Model 55 Gasoline Cars



Length of baggage compartment, 11-ft. 3-in.; total seating capacity, 43; weight, 29,000-lb.

tires, wheels, wheel bearings, axles, truck frames, brake shoes and brake linkage, etc., are interchangeable between both motor and trailer trucks. Wheels, 30-in. in diameter, are of the patented cushion type, with rolled steel removable tires and cast steel centers. Trucks have 22-ft. 2-in. truck centers and are capable of operation on roads having a minimum curve radius of 70 ft.

In addition to semi-automatic air-brake equipment the brake linkage is connected to emergency brake staffs operating with Brill Vertical Handle Brakes, one each of which is located against both front and rear body vestibules.

Trailers

In some instances we have been called upon to furnish either passenger or baggage trailers. These are mounted on No. 81-T trucks and have been developed according to the requirements of the contemplated service. The passenger cars, like the one illustrated above, conforms in general details of construction to the passenger compartment of the combination passenger and baggage cars, measuring 34-ft. 2-in. over platform and accommodating 36 additional passengers. This unit weighs 23,380 pounds complete on the rails.

Brill Gasoline Car Trucks

The three types of Brill Gasoline Car Trucks illustrated were designed to provide a particular type of truck equal to the service requirements of each type gasoline car. They were developed after a most careful study of the requirements of gasoline car service and with the experience of Brill engineers gained in long identification with the field of electric traction cars and trucks.

Ingersoll-Rand's New Arrangements

A CONNECTION of much significance to the engineering world has lately been arranged between Carels Brothers of Ghent, Belgium, and the Ingersoll-Rand Company of New York City, by which the Belgian concern will have the right to manufacture the well-known Ingersoll-Rand solid-injection type of oil engine.

Carels Brothers—organized in 1875—have long enjoyed a prominent place in the industrial life of Belgium, a country of outstanding importance among the engineering and manufacturing nations of the world. To-day, after successive periods of expansion, Carels Brothers are officially known as the Société d'Electricité et de Mecanique.

Carels Brothers were among the first of the European licensees to work under the Diesel patents ; and Carels-Diesel engines have won wide recognition in many fields of service because of their excellence. Even so, Carels Brothers have sought to strengthen their enviable position in this department of engineering by means of the working rights obtained from the Ingersoll-Rand Company.

The interesting feature of this arrangement is that Europe has now gone to America for the latest and the highest developments in heavy-oil engines. Thus American skill turns the tide of technical obligation by giving the fruits of its labor to Europe—the land in which the heavy-oil engine originated.

Japanese Bond Issues in America

An issue of G.$20,000,000 bonds of the Tokyo Electric Corporation was sold to the Guaranty Company of New York. Public offering of the issue is expected within a short time. The issue is part of an extensive program of public utility expansion in Japan, in which American capital has been active. An issue of $13,500,000 bonds of Daido, another large Japanese electric company, was floated in July by Dillon, Read & Co., and a few months ago the Guaranty Company floated a G.$15,000,000 issue for the Toho Electric Power Corporation of Tokyo.

The super-power idea is being introduced in Japan on a broad scale, and large revenues already are in evidence. The forthcoming issue is understood to bear 6 per cent. interest and to carry a three-year maturity.

Ujigawa Floats Domestic Loan

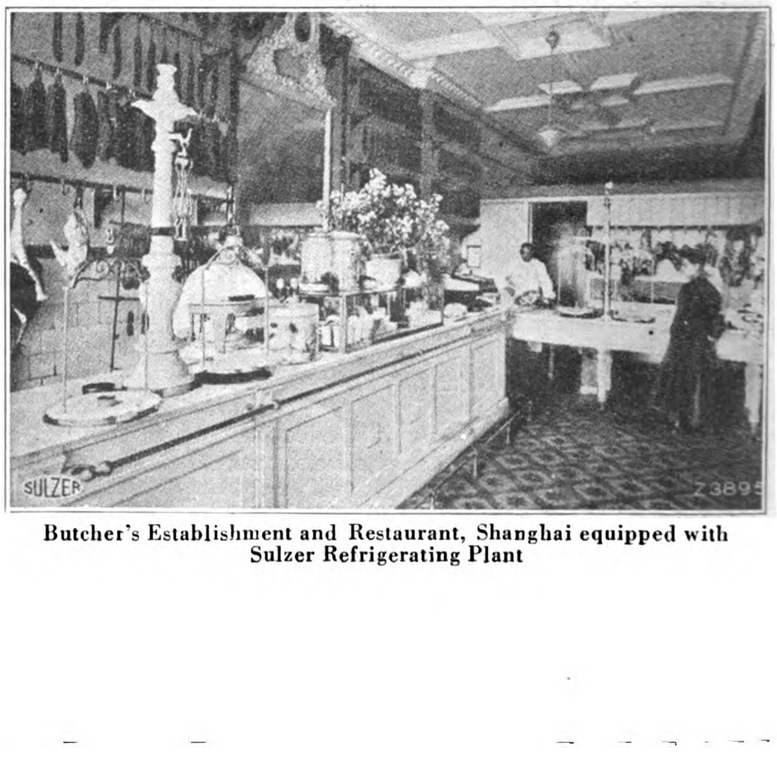
The Ujigawa Hydro-Electric Power Company, at an extraordinary shareholders' meeting held at the Oye Building, Osaka City, on August 5, decided to float a domestic loan of Y.8,000,000. The conditions on which debentures will be issued follow :

Total face value : Y.8,000,000.
Denominations : Four : Y.100, Y.500, Y.1,000, and Y.5,000.
Interest : 7 per cent. per annum.
Redemption : By September 10, 1930, but unredeemable for the first two years.
Selling price : At par.

The Nomura Bank will take over the debentures, but the Sumitomo Bank may handle some. The Ujigawa Hydro-Electric Power Company raised foreign loans some time ago to the amount of Gold $14,000,000. The amount was exchanged for Y.29,000,0000 with a view to redeeming a Y.35,000,000 domestic loan, floated previously, but there remained a deficit of Y.6,000,000; hence the recent decision to issue new debentures, amounting to Y.8,000,000. The remainder—Y.2,000,000—will be used for promoting new business. The 7 per cent. interest on the debentures has attracted attention in financial circles, because the rate is a new record in the Japanese bond market.

Refrigerating Plant in a Butcher's Establishment

Futterer's, a well-known butcher's establishment and restaurant in Shanghai, has had a refrigerating plant installed for cooling the cold storage rooms and a special service counter fitted with cooling coils. This butcher's establishment is one of the largest and best-equipped in China and has an excellent reputation. There is a restaurant on the first floor which is frequented by foreign residents. The refrigerating plant consists of a vertical Sulzer ammonia compressor rated at 29,000 b.th.u. per hour. The Sulzer plate condenser generally used in connection with such a plant was not fitted, as the only water available for cooling purposes is warm and muddy. A double-pipe condenser has therefore been installed, the water pipes of which can easily be cleaned.



Butcher's Establishment and Restaurant, Shanghai equipped with Sulzer Refrigerating Plant

A New Armstrong Whitworth Pneumatic Grinder

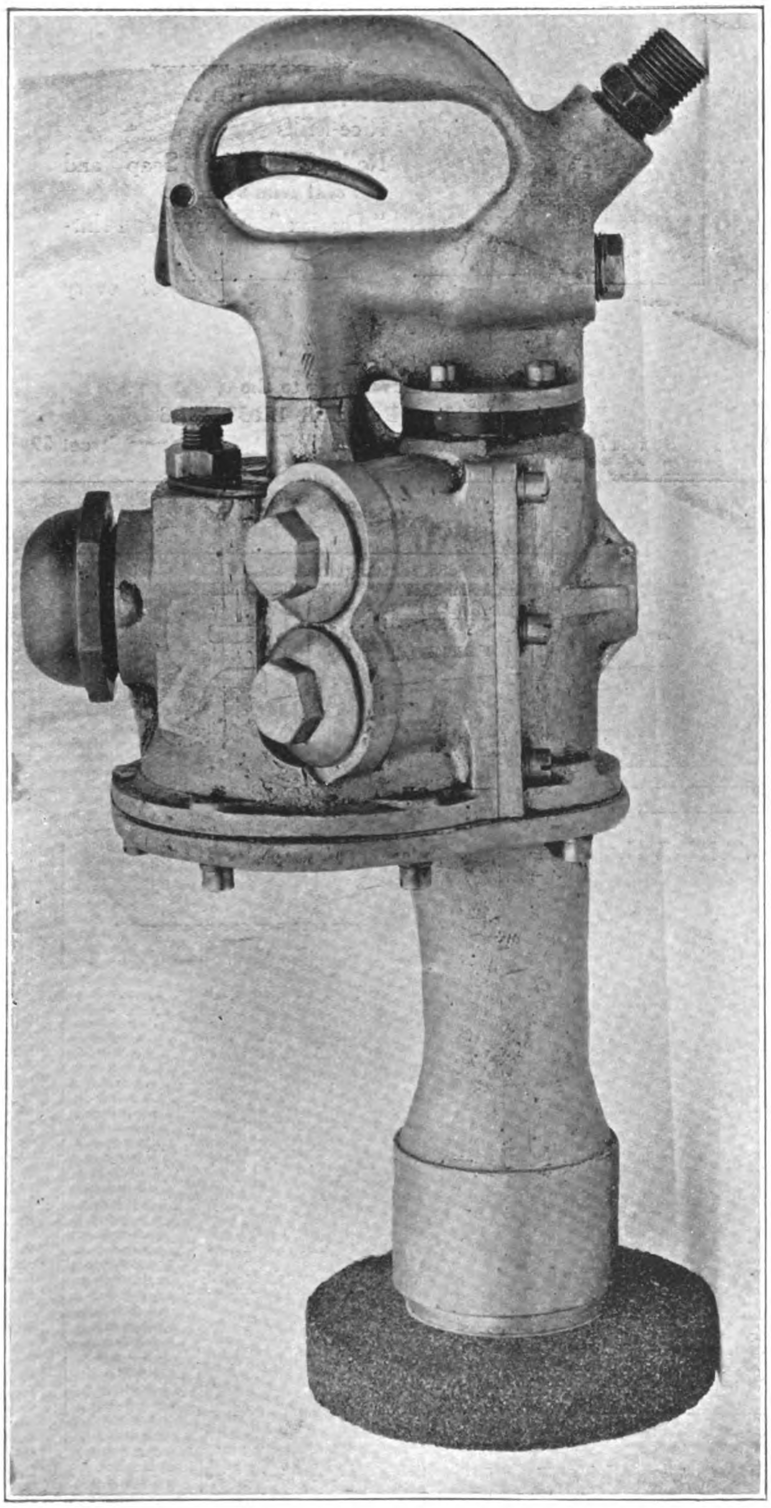
A NEW model of the A. W. Pneumatic Tools is illustrated here. This is a handy grinder for General Work.

The special feature of this tool is its lightness combined with high efficiency.

Being made largely of a special alminium alloy it weights only 14-lbs. as compared to some 37-lbs. for other types of the same size.

The spade handle and method of feed control adopted in this model make it exceptionally easy to handle and operate. The specification of this new machine is as follows.

Weight	Length Overall	Size of Emery Wheel	Approx Speed. at 95-lbs. per sq. in.
14-lbs.	18¼-in.	5-in. by 1-in.	3,300



A New Armstrong Whitworth Pneumatic Grinder

British Competitors' Position in Eastern Railway Contracts

Our London Correspondent.

ATTENTION is being directed in England to some recent cases of the purchase of Far Eastern railway stores in Germany, but inquiry shows that they represent only a small percentage of the total orders placed. Although faced by formidable competition, in which Continental firms secure benefit from depreciated exchanges, Britain continues to secure the bulk of the contracts for India. She does so while the High Commissioner for India in London carries out strictly the orders of the Government of India to buy in the cheapest market, subject to quality, delivery, and other necessary conditions.

In a recent case 34 oil tank wagons were ordered from a German firm at the price of £9,774, while the lowest British tender was £11,540. There was a still lower German tender of £9,092, which was passed over because sufficiently early delivery was not guaranteed. Two other recent German successes have been contracts for 161 meter-gauge wagons, and for 100 oil tank wagons. Against these must be placed contracts secured by British makers for no fewer than 1,688 wagons. The position is similar in respect of locomotives, the bulk of the trade in which continues to be secured by British workshops, though on occasion the High Commissioner has no alternative but to place the orders abroad. For example, seven locomotives are at present being made in Germany at a price 31 per cent. below the cheapest British tender.

The problem for British manufacturers is how to retain their big lead—which has never been below 87 per cent. of the total supply from outside India—in supplying stores to the Government railways. In the fifteen months ended on March 26 the High Commissioner for India placed £923,000 worth of contracts with British firms out of a total of £1,249,000. The corresponding figures for the Indian railway companies working railways belonging to Government were £5,430,000 with British firms out of a total purchase value of £6,362,000.

While the British manufacturer is handicapped in competing for all Far Eastern contracts by the depreciated exchanges of Continental European countries, he has some factors in his favor. For example, many Continental firms have to cover a long distance before reaching the port of shipment, and the sailings therefrom may be relatively infrequent. Again, the additional costs of inspection to insure the quality of isolated orders in other countries may more than offset a small upward difference in the price quoted by British firms.

The essential conditions of British success in a market where no favor is shown on sentimental grounds are that costs of production should be kept down and that the high standards of quality and reliability in respect of delivery should be maintained. In the case of a railway locomotive, for instance, speedy delivery allows railway revenue to be earned quickly, and this is a consideration of importance where the one criterion is that of the interests of the Oriental taxpayer. Apparently no advantage whatever is to be gained by attempting to exercise political pressure. As far as India is concerned, she stands on the same footing in this matter as the self-governing British Dominions.

Two New Motorships for Holt Line

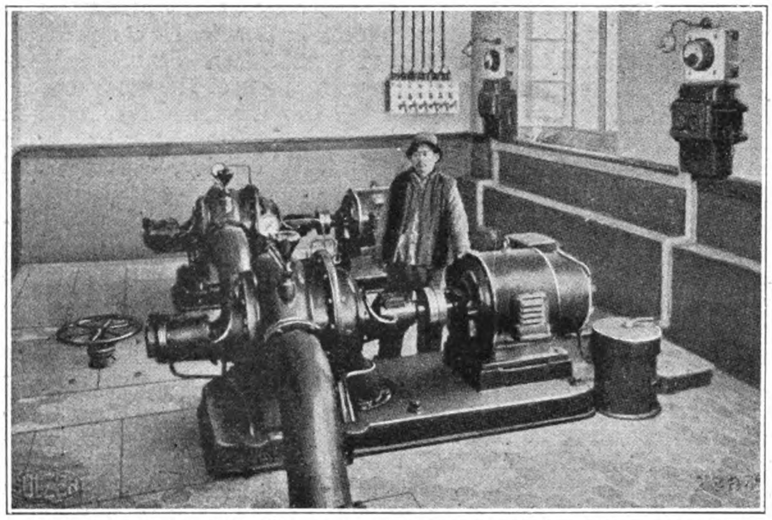
Messrs. Alfred Holt & Company, of Liverpool, have just placed a contract with Messrs. Workman, Clark & Co., Ltd., of Belfast, for the construction of two large motorships for the Eastern trade. The machinery will consist of engines of the Burmeister and Wain type.

The two new vessels will be between 450 and 500-ft. long, with a gross tonnage of about 8,000 tons and a deadweight of about 10,000 tons.

It is interesting to note that the Holt Line has been associated with Belfast for many years. Apart from the small motorship *Marudu*, which was built last year for the Straits Steamship Company of Singapore, a subsidiary concern, the last vessel for the Holt Line launched in Belfast was the *Dardanus* on April 18, 1923, and on that occasion Mr. William Boyd, managing director of Messrs. Workman, Clark & Co., stated that it was the fiftieth ship they had launched for the company.

The Tientsin Native City Waterworks Company

THE Tientsin Native City Waterworks Company has installed two Sulzer high-lift centrifugal pumps delivering the filtered water taken from three clean-water reservoirs at the waterworks into two water towers. Each of these two pumps is calculated for an output of 1,000 gals. per min., and a head of 165-ft. Each, at a



Tientsin Native City Waterworks—Sulzer Centrifugal Pumps, each delivering 1,000 gals. per min against a head of 165-ft.

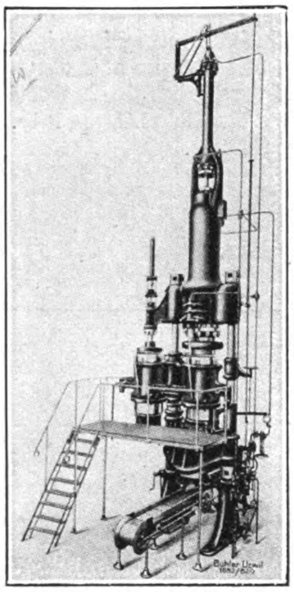
speed of 1,450 r.p.m., absorbs 71½ h.p. The waterworks are established outside the town and up river, taking their water from the Yu-Ho and the Hsi-Ho, and supplying it to the Chinese city (about 816,000 inhabitants), as well as to the French, Russian, Italian, Japanese and the former Austrian concessions. The whole plant is capable of supplying about 4½ million gallons of filtered water per day.

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 **Employees abt. 2,000**



Vertical Paste-goods Presses, Type KF—KF IV for working with accumulator.—Patent Buhler

SPECIALITIES:

- Portland Cement Works
- Bricks and Tile Making Plants
- Chocolate and Cocoa-Factories
- Breweries and Malteries Powder and Celluloid-Presses
- Crushing and Breaking Machinery
- Silico-Calcareous Brick Works
- Paste-Goods Factories
- Briquetting Plants
- Rice-Mills
- Roller-Mills for Soap and Paint Manufacture
- "Duplex" Newspaper Printing Presses
- Conveying Plants of every kind

For particulars apply to the

Far Eastern Office: **BUHLER BROTHERS**

P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE

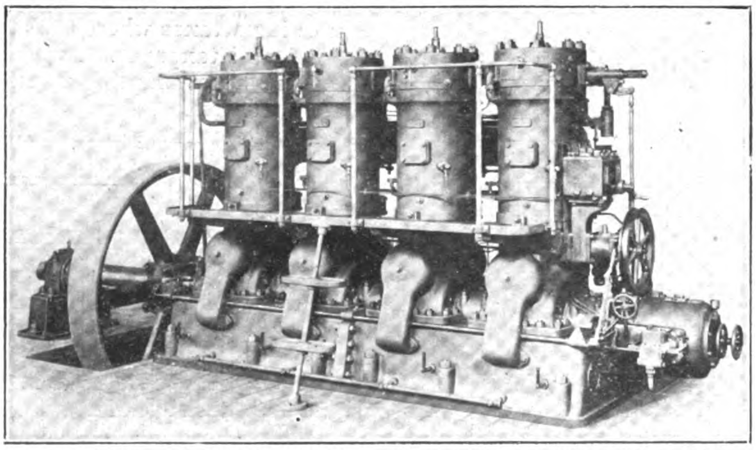
4 AVENUE EDWARD VII.

蘇爾壽工程事務所

上海愛多亞路四號

本公司常備目錄供給各界

垂詢工程事務亦竭誠酬答



Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, Stationary and Marine Diesel Engines, AIRLESS INJECTION DIESEL ENGINES, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

4-CYLINDER AIRLESS INJECTION DIESEL ENGINE

SIMPLE DESIGN; SIMPLE ATTENDANCE; RELIABILITY AND ECONOMY

WINTERTHUR. SWITZERLAND.

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

DEC 2 1925

THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

上海仁記路拾六號

遠東時報

THE RED INVASION OF MONGOLIA

AND YET AGAIN, THE AUTUMN MANOEUVRES

JAPAN'S STAND AT THE TARIFF CONFERENCE

THE LAUNCHING OF THE "TAISHAN"

ELECTRIC POWER DEVELOPMENT IN NAGOYA, JAPAN

THE DIESEL ENGINE IN FAR EASTERN VESSELS

ASBESTOS IN THE PHILIPPINES

THE DAIREN BEAN OIL INDUSTRY

Vol. XXI October, 1925 No. 10

SHANGHAI, PEKING, TOKYO AND MANILA

A. L. TAYLER

JAPAN

Published Every Month by
TOYO KISEN KAISHA
JAMES KING STEELE, Publisher and Editor

551 MARKET STREET, SAN FRANCISCO.

JAPAN

September 29, 1925.

My dear Rea:

I have just spent a very pleasant hour going over the Reconstruction Number of the Far Eastern Review and I want to compliment you on that tremendous production. It is truly a monumental edition that deserves great praise being the most comprehensive thing of its kind that has to my mind ever been attempted. It is too bad, from a financial point of view, that you cannot turn out a number like this every issue.

With kind personal regards and best wishes,

Sincerely,

James King Steele

JAMES KING STEELE.

Mr. George Bronson Rea,
Editor & Publisher,
Far Eastern Review,
16 Jinkee Road,
SHANGHAI.

Address all communications to JAPAN
Editorial and Business Offices: 551 Market Street, San Francisco

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street.

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

TOKYO: The Foreign Agencies Corporation, Mitsubishi Building No. 21, Marunouchi.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum.

VOL. XXI — OCTOBER, 1925 — NO. 10

CONTENTS:

	PAGE
THE RED INVASION OF MONGOLIA	631
AND YET AGAIN, THE AUTUMN MANOEUVRES	633
CREDIT INSURANCE AS A TRADE BUILDER ...	634
A BUILDER'S BIBLE	635
THE DAH TUNG COTTON MILL	*635
JAPAN'S STAND AT THE TARIFF CONFERENCE ...	636
FINANCIAL INDEPENDENCE OF THE ADMINISTRATION OF COMMUNICATIONS OF THE REPUBLIC OF CHINA	638
JAPAN'S SUPER POWER SYSTEM	*642
INTERNATIONAL TRADE IN CEMENT	*647
NOBEL AT WEMBLEY	*654
THORNYCROFT DEPOT AT SINGAPORE	*654
THE ELECTRIFICATION OF THE JAVA STATE RAILWAYS	*655
DESIGN AND APPLICATIONS OF POWER SHOVELS AND DRAGLINES	*658
THE DAIREN BEAN OIL INDUSTRY	*666
NEW VESSEL FOR PACIFIC ISLANDS TRADE ...	667
BELT CONVEYOR SYSTEM USED AT ROCK QUARRY	*667
THE LAUNCHING OF THE "TAISHAN"	*668
THE "SILVERAY" FOR FAR EASTERN SERVICE	*669
ELECTRIC POWER DEVELOPMENT IN NAGOYA, JAPAN	*671
ASBESTOS IN THE PHILIPPINES	*672
THE NEW s.s. "CHANGTE"	*673
NEW ORIENT LINER THE "OTRANTO"	*674
THE NEW B.A.T. BUILDING IN SHANGHAI	*675
LOCOMOTIVE FEED WATER HEATERS	*675
THE DIESEL ENGINE IN FAR EASTERN VESSELS...	*676
CHINESE MARKET FOR LOW-GRADE IRON AND STEEL	677

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allan, Whyte & Co., Ltd. 27
Allen & Co., Ltd., Edgar 11
American La France Fire Engine Co., Inc. 75
American Locomotive Sales Corp. .. 25
American Tool Works Co. 1
Armstrong, Whitworth & Co., Ltd., Sir W. G. 18-19
Associated British Locomotive Manufacturers for China .. 49
Attwater & Sons 48
Avery, Ltd. W. & T... 11

Babcock & Wilcox, Ltd. 36
Baldwin Locomotive Works .. 65
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 17
Bethlehem Steel Export Corp. .. 31
Bliss Co., E. W. 73
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Brown & Sons, Ltd. David 3
Browning Co., The 63
Bucyrus Company 63
Buhler Brothers 678
Butterfield & Swire 44

Canada Carbide Co., Ltd. 70
Chambers Scott & Co., Ltd. .. 14
Chartered Bank of India, Australia & China 48
Chinese Eastern Railway 50

Daido Electric Power Co., Ltd. .. 28
Dai-Ichi Ginko Ltd. 62
Dai Nippon Brewery Co. 34
Diamond State Fibre Co. 74

Dixon Crucible Co., Joseph .. 70
Dodge Brothers 5

Electricity Department, S. M. C. .. 6
Escher Wyss & Cie 16
Evans & Sons (Wolverhampton) Ltd., Joseph 2
Exchange Bank of China .. 61

Fairbanks Co. 21
Fairbanks Morse & Co. 79
Fuji Gassed Spinning Co. 10

Gaspary & Co., Dr. 14
Gleniffer Motors, Ltd. 10
Goodell Pratt Co. 77
Goulds Manufacturing Co. .. 14
Graham Brothers 4
Green Island Cement Co., Ltd., The 20
Greene Tweed & Co. 73

Hasler Telegraph Works 71
Hennef Engineering Works .. 74
Hongkong Rope Mfg. Co. Ltd. .. 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co.,Ltd. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. .. 58
International Banking Corporation 55
International General Electric Co., Inc. 51
International Labour Office .. 77

Japan Sugar Co., Ltd. 6
Jardine Engineering Corp., Ltd., The 12
Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. .. 2
Kawasaki Dockyard Co., Ltd. .. 33
Kokusai Kisen Kaisha 45

League of Nations 77
Link-Belt Co. .. Under Index
London Directory Co., Ltd. .. 50
Louisiana Planter & Sugar Manufacturer, The 72

Mather & Platt, Ltd. 17
McConway & Torley Co. 14
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd... 38
Mitsubishi Marine & Fire Ins. Co., Ltd. 38
Mitsubishi Shoji Kaisha 76
Mitsubishi Warehouse Co., Ltd. .. 38
Mitsubishi Zosen Kaisha, Ltd. .. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. Ltd. 76
Mitsui Bussan Kaisha Ltd. .. 26
Mustard & Co. 14

Nippon Menkwa Kabushiki Kaisha 52
Nippon Yusen Kaisha .. 46, 47
Nipponophone Co., Ltd. 34
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. .. 24
One Hundredth Bank, Ltd., The .. 59
Osaka Shosen Kaisha 42
Oster Manufacturing Co. 75

Petters, Ltd... 15

Redpath Brown & Co., Ltd. .. 15
Reuther & Reisert, C. 74
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 70

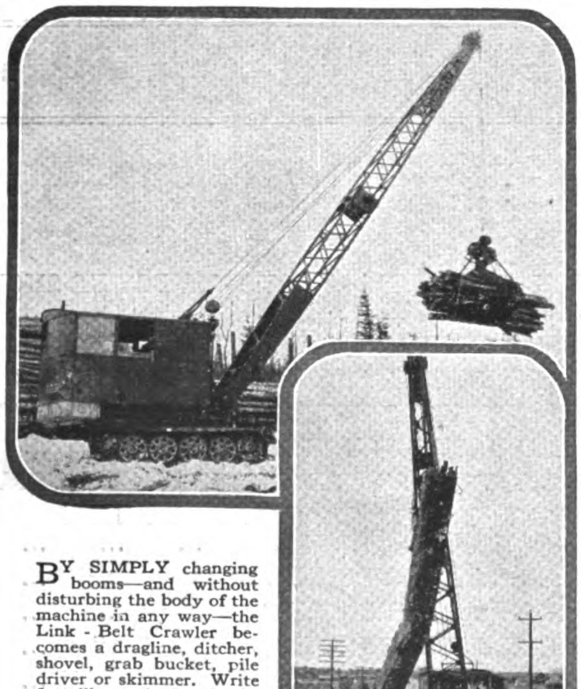
Sale & Frazer, Ltd. 8
Shanghai Dock & Engr. Co., Ltd. .. 32
Shanghai Municipal Council 6
Shibaura Engineering Works, Ltd. .. 7
Siemens China Co. 36
Simons & Co., Ltd., Wm. 13
Smidth & Co., F. L. 41
Smith Major & Stevens, Ltd. .. 16
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. 27
Standard Oil Co., of N. Y. 29
Standard Underground Cable Co. .. 14
Sturtevant Co., B. F. 63
Sulzer Bros. 678
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd... 60
Superheater Co., The 76

Thornycroft & Co., Ltd., John I. .. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 50

Ujigawa Electric Power Co., Ltd. .. 77
United States Steel Products Company .. ..23, 37, Back Cover

Waggon-und Maschinenbau Aktiengesellschaft Gorlitz 71
Wallace & Tiernan Co., Inc. 10
Walworth International Co. 72
Westinghouse Electric International Co. 80
Williams & Co., J. H. 3
Wotan Werke, A. G. 35

Yarrow & Co., Ltd. 21
Yasuda Bank, Ltd. 62
Yokohama Dock Co., Ltd. 34
Yokohama Specie Bank, Ltd. Cover
York Manufacturing Co. 74



BY SIMPLY changing booms—and without disturbing the body of the machine in any way—the Link-Belt Crawler becomes a dragline, ditcher, shovel, grab bucket, pile driver or skimmer. Write for illustrations of the machine at work; also users' operating costs.

An All Service Crane

THE Link-Belt "Built for Service" Crawler Crane is built for continuous operation. Its application is unlimited, operates equally well with shovel attachment, wood grapple, drag line, ditcher, clam shell or hook block for general lifting jobs.

It is a universal machine, supplying its own tracks and propelling itself to any place where an opportunity for cheap and rapid handling exists.

Quiet, powerful and fast, with convenient arrangement of levers make it the choice of the operator.

Let us show you what this Link-Belt Crawler Crane has done for others in your line of work. Send for Book No. 795.

LINK-BELT COMPANY 2373
WOOLWORTH BUILDING, NEW YORK, N. Y., U. S. A.
CABLE AND RADIO ADDRESS "LINKBELT"

LINK-BELT
THIS YEAR LINK-BELT IS FIFTY YEARS OLD

"Built for Service" Crawler Crane

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, OCTOBER, 1925 No. 10

The Red Invasion of Mongolia

Soviet Russia has Created Mongolia into an Autonomous Buffer State Republic—A Huge Territory has been Stolen from China by the Most Hypocritical Imperialistic Power of Modern Times

The Sore Spot of Asiatic Politics

THE imperialistic policy of Soviet Russia has two direct aims: 1. the creation of buffer republics friendly to Soviet Russia on the Russian frontiers, 2. the creation of disturbances beyond the buffer states with a view toward making an attack on Soviet Russia difficult if not impossible. Soviet Russia had adopted the whole of the imperialistic program of Imperial Russia, which means that in Europe the Soviet seeks the humiliation of Poland and in Asia, the humiliation of China and Persia. The two chief objectives of Russian venom are Great Britain and Japan—Great Britain because of her position in India; Japan because of the successful outcome of the Russo-Japanese War and because of Japan's predominant position in Asiatic affairs. Although individual Russians know no race prejudice perhaps because Russia is such a conglomerate of Asiatic races, Russia views with distrust, jealousy and hatred, the rise to power of an Asiatic people, the Japanese. The anti-British policy of Imperial Russia kept Central Asia in a turmoil for almost a century. The anti-Japanese policy of Soviet Russia is to-day helping to keep China in chaos and turmoil. In discussing the Russian invasion of Mongolia, it is necessary to keep in mind the permanent, fixed international policy of Soviet Russia.

The Invasion

Before China signed a treaty of peace with Soviet Russia, the Russians had already invaded Mongolia and had taken Urga. The excuse was that the "White" Russians were using Mongolia as a base for counter-revolutionary movements. The Chinese government had established a Frontier Defence Force, but the funds for this purpose were dissipated and nothing beneficial to China came of it. The Soviet's excuse for the invasion of Mongolia is only remotely justifiable, but not more so than the Imperial Russia's invasion of Aberzaijain province in Persia. It was simply part of an imperialist scheme to sieze territory belonging to another nation.

Russia had for more than a century played upon the Mongol's antagonism to China. Russian agents, even in the days of the Czar sought to develop a Russian orientation among the Mongols. Mongol Princes were sent to schools in St. Petersburg and Moscow, even to the exclusive Page School attached to the court. Russia hoped to build feeders into Mongolia for the Trans-Siberian Railroad. Mongolia was a step to Thibet and therefore to India. Mongolia was a step to China and therefore to Japan.

When China signed a preliminary agreement with Soviet Russia, this Mongolian question loomed large. China wanted the Soviet troops withdrawn. In a statement of China's wishes with regard to the new treaty, the Waichiaopu stated:

> (2) The withdrawal of Soviet troops from Outer Mongolia should be made a more definite undertaking on the part of the U.S.S.R. It should not be made conditional, though necessary details to carry out the withdrawal may be arranged later at the Conference. In other words, the wording of the said provision should be so modified as to make it clear that there is no intention to perjudice the principle of inviolability of territorial sovereignty.

The Treaty

In the treaty signed by Mr. Karakhan and Dr. Wellington Koo, the following agreement was reached;

> "The Government Union of Soviet Socialist Republics recognizes that Outer Mongolia is an integral part of the Republic of China and respects Chinese soveriegnty therein.
>
> "The Government of the Union of Soviet Socialist Republic declares that as soon as the 'questions' for the withdrawal of all the troops of the U.S.S.R. from Mongolia, namely as to the time limit of the withdrawal of such troops and the measure to be adopted in the interests of the safety of the frontiers are agreed upon at the Conference as provided in Article II, of present Agreement, it will effect the complete withdrawal of all the troops of the U.S.S.R. from Outer Mongolia.

The conference alluded to has never taken place, largely through the trickery of Soviet Russia which has steadily refused to meet with the Chinese commission for that purpose. Just before Mr. Karakhan left for Russia, for his health as he put it, Dr. C. T. Wang, practically forced him to open negotiations but they have thus far come to nothing.

The Withdrawal of Troops

Comrade Karakhan sent an unctious note some time previously announcing the withdrawal of the Soviet Army. The note said:

> "With the establishment of order and peace and the organisation of proper power in Mongolia, the Soviet Government gradually reduced the number of Red troops in Mongolian territory. However, the want of relations between the Government of the Union of Soviet Socialist Republics and the Republic of China as well as the latter's participation in the anti-Soviet coalition, prevented the settlement of the question of the presence of the Red Army in Outer Mongolia, and it was only by the agreement signed between the Union and China on May 31, 1924, that the solution of this question was outlined. By virtue of this agreement, it was understood that, as soon as the questions for the withdrawal of the troops of the Union of Soviet Socialist Republics from Outer Mongolia —namely, as to the time limit of the withdrawal of such troops and the measures to be adopted in the interests of the safety of the frontiers were agreed upon at the Conference, that after that the Government of the Union would effect the withdrawal of its trroops from Outer Mongolia.

"However, though the said Conference was to be opened within one month from the signing of the mentioned agreement, internal circumstances prevented the Chinese Government from doing it in due time. Nevertheless, the Government of the Union—although by virtue of the above-mentioned agreement with the Republic of China, it could refrain from effecting the withdrawal of its troops until the time limit for such withdrawal were agreed upon at the Conference and until the Government of the Republic of China give the necessary guarantees for the safety of the frontiers—has decided to effect the withdrawal of its troops immediately, without waiting for the Conference.

"I have now the honor to bring to the cognizance of the Government of the Republic of China that the Government of the Union of Soviet Socialist Republics has proceeded, with the consent of the Mongolian Authorities, to the withdrawal of its troops from Outer Mongolia and that at the present time the withdrawal of the Red Army from the Mongolian territory has been completed.

"Bringing this to your Excellency's knowledge, I may express the hope that the Government of the Republic of China will duly appreciate this friendly measure of the Government of the Union. My Government also hopes that those circumstances which made it necessary at the time to bring the Red Army into the territory of Outer Mongolia, now—when conditions have changed—will no longer occur in the future.

"At the same time, I may be permitted to express my earnest conviction that the Chinese Government will not let such a happy opportunity pass by of solutioning—by a peaceful understanding with the Mongolian people—the question of mutual relations between two brotherly peoples.

"While the Government of the Union of Soviet Socialist Republics considers that the said mutual relations are a matter entirely of the Chinese and the Mongolian peoples, it will, however, be happy to see that the brotherly ties of common life of the Chinese and the Mongolian peoples are established on the basis of justice and their national aspirations—which will ensure the further economic prosperity both of Outer Mongolia and the North-Western region and will likewise promote the development of relations economic and otherwise with the Union of Soviet Socialist Republics.

"I wish to take this opportunity, etc.

(Signed) L. Karakhan."

A Sovietized Mongolia

The Russians then had already withdrawn their troops from Mongolia. That was easy, *because they had drilled and trained a Red Mongol army ; they had officered that army, they had armed that army with Russian arms and munitions. They had established an autonomous Mongolian Government which no longer recognized the authority of Peking. They had financed that Government and had established a Government bank under the management of Russians. They had developed an economic and political suzerainty over Mongolia which amounts almost to the organization of a protectorate.* In the recent internal trouble in China, Soviet Russia has sought to assist the Chinese generals in Mongolia and Turkestan against the Central Government as part of this effort to weaken China's hold on her north-western territories. Soviet Russia has done everything possible to wean Mongolia away from China and the Chinese people have been silent and asleep. Mongolia is so far away and there are so many problems facing China, that this was unnoticed, overlooked while Comrade Karakhan sat in Peking denouncing others as imperialists.

A Bolshevik Constitution

The Mongolian constitution perhaps more clearly than any argument, indicates the effect of Soviet influence on Mongolia. Imagine, the Mongols, who have not a modern industry in their whole country, so solicitous of the working classes and so hateful of capitalism! In a country still in pastoral condition, without roads or railroads, with barely a large city, where there is neither capital nor labor, but a nomadic population on the steppes of 2 per square mile and Sino-Russian-Mongol-Buriat *intelligentzia* in the few cities, what can this constitution mean but a blatant piece of Soviet propaganda, a noisome outcry against China ?

The constitution as published by Soviet Russia reads as follows :

1. Mongolia is proclaimed to be a republic of independent people, the entire administrative power of the country belonging to *the working people of Mongolia.*

2. The fundamental object of the Mongolian Republic is to uproot the feudal divine right system and solidify the foundation of the Republican Government.

3. The land, underground wealth, forests, lakes, rivers and all resources thereanent belong to the Republic, and *their private ownerships is forbidden.*

4. All the international covenants, obligatory agreements, and foreign loans concluded prior to the revolution of 1921 are considered to be null and void, as they were forced upon Mongolia by foreign countries concerned.

5. For the purpose of securely maintaining the absolute governing power in the hands of the working people, *a national Mongolian revolutionary army is organised, and whilst the working people of the Republic are armed, general military training shall be given to young working men.*

6. Religion and temples are seperated from the State, the former being declared to the entire people of the Republic to be a private affair of each citizen concerned.

7. For the purpose of assuring the freedom of speech of the *working people*, the Republic of Mongolian People shall organize a publishing establishment to be offered to the working people.

8. For the purpose of assuring true freedom of the *working people*, they are allowed to hold public meetings and gatherings, the Republic offering them suitable buildings for their meeting places.

9. For the purpose of assuring the working people the freedom of forming associations, the Republic shall give every assistance to *poor working people and manual laborers.*

10. For the benefit of poor people and for facilitating the people in general to acquire knowledge, the Mongolian Republic shall carry out education of the children of the working people free of charge.

11. The Mongolian Republic recognizes that the people of the Republic, irrespective of races, religion or sex, have equal rights.

12. The ranks and titles of former rulers or princes or nobles are abolished, and the proprietorship possessed by the Hutukhtu is abrogated.

13. In view of the efforts being made by the *working people of various countries in the world for the destruction of capitalism and realization of communism, the Republic of the working people shall exert its utmost to co-operate for the promotion of interest and fundamental object common to small nations diplomatically tyrannized, and to revolutionary working people throughout the world.*

In consideration of the existing conditions in the Republic, however, the possibility of establishing friendly relations with capitalistic countries is reserved, it being understood that any country trying to encroach upon the independence of the Republic of the Mongolian People shall be resolutely opposed.

In a letter which appeared in the Chinese press of Peking, the Mongols further show the effects of Soviet inspiration. Mongolia, which never feels the effects of the Powers' diplomacy in China protests against it. Mongolia which knows only the Power of Russia, asks for freedom from the clutches of the Powers. The Mongols refer to matters which they do not understand and which do not concern them. The letter in part reads :

"It should be realized that between the Chinese Government and this Government, there is not the least blocking. The only thing this Government hopes for is an early stopping of civil wars, and the early shaking-off by the Chinese Government of the clutches of the aggressive policies of the Powers. A real Republic should be made to appear and such reformation should be carried out so as to give each of the five races a chance of being blessed with peace and liberty and equality. Otherwise each will be given the authority of settling their affairs by themselves.

"This Government is hoping for the early issue of that sort of mandate by the Chinese Government. Immediately

after the appearance of that mandate, that is, to let the different races settle their own affairs, this Government will name plenipotentiary representatives to the Central Government in order to discuss the plans for perpetual peace and safety between the Chinese and Mongolians.

Mr. A. V. Marakueff, a Russian financial agent, who has somehow become the Manager of the Mongolian Bank and who came to China as a representative of the Mongolian Government gave an interview to the *North China Star* which contains some interesting, if startling information, all of which points to the fact that Mongolia no longer considers itself part of China and no longer is willing to abide by the treaty obligations between China and the Powers. He first calls attention to a Soviet conducted census of Mongolia. He said :

"Mongolia will no longer be a land of mystery." began Mr. Marakueff. "The first census of population of the Republic of Mongolia will be taken in the beginning of next year and the report will be accompanied by a statistical survey of the cattle and sheep raising industries in Mongolia. A prominent Moscow lawyer and statistician, Mr. Vsiehsviatsky, has been invited by the Mongolian Government to organize and to carry out this undertaking.

The Rape of the Customs

He then calls attention to a fact which has hitherto been ignored:

There are now 41 Custom Houses scattering in different places along the frontier and in such inland places as Urga, Ulliassutay, Kobdo, and Tzainshaby.

Both exports and imports are subject to a duty of 6 per cent ad valorem with the exception of tobacco, the duty on which being 12 per cent. and spirits and playing-cards, duty 30 per cent. The valuation of goods is fixed by the Urga Custom House and is subject to periodical revisions. There are constant complaints against this procedure which is very slow on account of the necessity to file Customs declarations and the lack of experienced Customs officials. However, a school for the Customs employees, recently opened at Urga, will undoubtedly cure this defect.

This particular statement is startling in the extreme because under all the treaties Mongolia is a part of China and is therefore bound by China's treaty arrangements. Under existing treaties China collects a 5 per cent. *ad valorem* duty on all imports. The 6 per cent. duty is a direct blow at the treaties. The additional one per cent. is added not to increase revenue but to indicate independence of China and contempt of the Powers. It is a challenge which ought not to be disregarded by the Tariff Conference, if it even meets. The fact that valuations are fixed by the Urga Customs House rather than by the Inspectorate of Customs in Peking is a further challenge to the Chinese government. The whole enterprise smacks of Soviet propaganda rather than statesmanship. As the trade between Mongolia and the world, except through Tientsin, is almost of no importance, business is in no way affected. But the sovereignty of China is impeached, treaties are *ipso facto* scrapped and the Powers are flouted. It is the Soviet doctrine to have such things accomplished by weak and helpless nations, while they stand behind laughing up their sleeves.

The Railway Struggle

Until the Chinese Government authorized the building of the Taonan-Tsitsihar Railway, Soviet activities in Mongolia were almost entirely of the secret, propagandistic type. The Taonan-Tsitsihar Railway, however, indicated that China was preparing to meet Russian activities in Mongolia. In spite of civil wars and other disturbances, the Chinese Government was becoming conscious of the dangers of Bolshevik efforts to take Mongolia from China not by conquest but by propaganda, not by the will of the Mongolian people but by the machinatious of a small group of Soviet trained and Soviet paid officials of the self-created Mongolian Republic. The railway was China's first move in self defence. Russia protested against this move, because the South Manchuria Railway obtained the contract to construct the line, but the Chinese Government ignored the protest and the line is almost completed. The Russians are now planning to construct railways in Mongolia, altogether ignoring the sovereignty of China in the matter. The Russian railways will feed into the Trans-Siberian line, thus continuing the imperialistic Czarist tradition. It will not be long before the Chinese people awaken to the dangers of the situation, before they see the skins, furs, wool, hides and other products of Mongolia, passing through Russia to Europe, instead of through Tientsin and other Chinese ports, as at present.

Japan's Vital Inerest

In the Mongolian question, Japan has a most vital interest. As long as the "white" nations hold that the Japanese people are to be excluded as Asiatics, that they cannot emigrate to the great open spaces of the "white" countries, that they may not cultivate the ground or provide themselves with raw materials for their industries, Japan has only Manchuria and Mongolia to look to for peaceful penetration. Mongolia has a population of 2 per square mile. The Chinese do not object to Japanese economic activity in Mongolia so long as such activity does not imperil the sovereignty of China. Japan has no aims on the sovereignty or integrity of China. Japan is reaching a point in her relations with China where the Chinese people look to Japan as a best friend, as a defender of China's rights. What Japan has done for Manchuria, Japan can do for Mongolia. Soviet Russia, on the other hand, has the great steppes of Siberia still to colonize and to cultivate. Russia does not require land for her surplus population or raw materials. Russia is underpopulated and her industries are neglible. Russia has more raw materials than her people can utilize. She hoards and seizes and holds like a miser among nations. Soviet Russia's activities in Mongolia imperil Japan's last chance for an underpopulated place in Asia which may be developed by her surplus population by peaceful means without interfering with the peace of the world. **Soviet Russia's interference in this situation creates a danger spot over which nations are bound to fight, as men fight for their chance to live. And when that struggle comes, China and the "white" nations of the world, in fairness, will support Japan against the arch-imperialist, the seducer of small peoples and the disturber of world peace—Soviet Russia.**

And Yet Again, the Autumn Manoeuvres

CHINA'S annual civil wars may be a pleasant pastime for the militarists who infest the country, but it is horribly destructive of business. Every time, it looks as though the country were to settle down to quiet so that enterprises of industry and engineering might be undertaken, another militarist throws over the traces and hits on a mad trail, which invariably ends nowhere. The stampeds of the military hordes not only destroys the crops of the country, the trade and commerce of the people, but it interferes and impedes the development of the natural resources, the opening of mines, the building of railroads, the draining and widening of rivers and the thousand and one reconstructive tasks which face a modern nation. In this issue we publish a summary of the situation as regards the railways and other means of communication by H. E. Yeh Kung-cho, Minister of Communications. In this article Mr. Yeh clearly points to the fact that it is even difficult to maintain the *status quo* on the railways, that is, that it is even difficult to keep them up to their present standing. How beyond all expectation is it to make improvements or to build new lines !

To the friends of China in other countries, these constant wars can only be described as the tragedy of a nation not understanding its own position in the world. The Chinese continue

to speak of what they will accomplish by diplomacy, of their wonderful opportunities, of the horrors of inequality, of the barbarism of the foreigners, but they fail to understand that their own inability to establish a sound government, to develop their own country, to give an exhibition of their ability to manage their own affairs in an orderly manner, leads others to believe that they are altogether lacking in governmental ability and that they are failing to win their rights by their own unwillingness to achieve equality. Among the nations of the world, only those are equal which are economically equal, only those can control their own destiny which maintain their position, not by propaganda nor by patriotic speeches and demonstration but by works, by developments, by economic stability. If one studies the course of history in Europe, Asia and America, the story is always the same : the economically independent nation is politically independent. The economically powerful nation, is politically powerful. Where there are works of engineering, where there are modern communications, modern mills and factories, modern commerce and industry, there is political strength and political independence. Ten years of peace in China will make China one of the greatest nations of the world. But the Chinese themselves keep their country in everlasting turmoil. The Chinese themselves, by the lack of foresight and genuine patriotism, keep their country in chaos and bondage.

The Destruction of the Railways

When the railroads of China were built, as few and as scattered as they were, it was hoped that they would be the media for the uniting of the country and the spreading of democracy. The railway program was never completed because the country could never be unified and pacified. Now, the railroads are being abused by the militarists who seize the cars and locomotives, who tear up the rails in their petty wars, who destroy goods in transit. Worse still, each militarist levies on the cars which pass through his territory, so that business is more heavily taxed and commerce is made still further to suffer. The cars and locomotives in the possession of the military men are never sent to the repair shops. The wear and tear on the rolling stock is beyond the purview of railroad men. The result is that the lines have deteriorated and no replacement is taking place. If nothing is done to check this process, it will not be long before the railroads of China will become so much scrap.

In this article, we are not discussing the foreign interests in these roads, the fact that most of them have been built with foreign money and that the interests of the shareholders are not being protected. We are simply discussing the effects on business and development projects in China. For fourteen years, with the exception of the Peking-Suiyuan Railway, practically nothing has been done for the development of China's lines. River conservancy has cost a huge sum of money but the rivers still overflow their dykes. This year, the erratic Yellow River has become so mad in its course that millions are homeless ; it is even feared that the river will return to its old bed of some fifty years ago. There was a spurt in cotton mills and flour mills during the end of the war boom, but the Chinese companies were poorly capitalized and worse managed and now there is little to show for the huge investments which were then made. Other industries are simply crawling ; they are not yet beyond the most infantile stage.

Only the wars and bad politics of the country are responsible for this condition. There is plenty of money in China and the people are industrious and thrifty. Given a peaceful administration, a few years of constructive endeavor and the money which is not being hoarded in holes in the ground would come to the surface to be circulated among the people and to go into industry and commerce. China can stand such an engineering development as no country in the world has previously known and there would be huge profits in such a developments not only for the Chinese but for engineering and merchandising firms in the principal markets of the world. China could utilize the profits from these enterprises to develop into a debt-free modern nation. But instead of following such a course, the Chinese politicians play their eternal game of infantile politics and the Chinese militarists chase each other about the country like a lot of silly fools. For there is no glory in their wars, no sense in their programs and no reason in their proposals. They fight because when the Spring comes they feel an urge to do something and when the Autumn comes they must hold manœuvres.

Japan—An Example

Japan's history might have proved an incentive to the Chinese, were it not that they suffer from an overweening sense of their inevitable greatness. Japan, in the short period of fifty years, achieved a position of equality with Great Britain and the United States in the family of nations. This was not accomplished, as some think, by the defeat of Russia, although that was a factor in the making of Japan. It was accomplished by the organization of Japan's economic life on a modern basis. The development of the iron and steel industry, the textile industries, railways and waterways, communications of every sort, the utilization of water power, the electrification of the country did more for Japan than the victories in Manchuria. They made Japan a great Power, because Japan become economically a sound Power. The proof of this lies in the fact that Japan can go into the markets of the world and can borrow hundreds of millions while China cannot get a single dollar anywhere. Yet, look at the resources of China and Japan. Look at the population of China and Japan. The smaller country, Japan, commands respect because her people work and her officials function. The large country, China, is in a ridiculous position, because her people are oppressed and her officials play. Japan is in a position to dictate terms with regard to the Pacific while China is begging for a 2½ per cent. tariff increase.

We have no desire to make China appear to be ridiculous. We simply call attention to glaring facts and wonder in all friendship at the unwillingness or inability of the Chinese to see themselves as others see them, to save themselves from eternal backwardness by a little constructive genius and a little civic interest. The Meiji statesmen in Japan might have taken advantage of the great changes made at that time to labor in their own interests. But they sacrificed themselves for the sake of the country. They worked for Japan. They changed the character of the country and rejuvenated the interest of the people. Their one idea was that Japan should be the equal of any nation on the face of the earth and that that equality was to be won not begged for. In the end, Japan accomplished her purpose. To-day, China is still nowhere. Instead of the front pages of newspapers carrying reports of great developments in China, as they do of developments in Japan, they again carry the tale of one militarist going after another, of another railway line cut, of more men shot in warfare, of continued suffering of the people. What is the use of it all and where will it end ?

Again we say to the Chinese : study the history of Japan and gain strength and wisdom therefrom.

* * *

Credit Insurance as a Trade Builder

From Our London Correspondent

SOME few years ago certain clever and far seeing underwriters in England conceived the idea of credit insurance, not only from an insurance point of view but with the idea of encouraging export trade from which they would be able to build up a large and it was hoped, profitable revenue. Wise men in the financial world —in their hide-bound conservatism—predicted disaster, merchants however, on the other hand, saw that they could increase their turn-over without having to find additional capital, since they had the assistance of a company prepared to indemnify them for any losses incurred over a certain amount they were themselves prepared to undertake.

The result was that the Trade Indemnity Company, with Mr. Stanley H. Spain as underwriter, and Mr. Cuthbert R. Heath as chairman, with a comparatively small capital, made good. Then the bankers and others who originally scoffed at the idea, began to see that there was something in the idea, and finally the Government approved of the suggestion until business increased so rapidly that the original capital was quintupled and the company to-day stands with £250,000 paid up.

Although in the first instance, from treading on unknown ground the company, naturally went somewhat gingerly, the results proved so undeniably good that the Government's attention became so focussed on the new idea, that they requested the Federation of British Industries to go thoroughly into the matter and issue a report thereon. Meanwhile the original company commenced a policy of expansion and established branches and agencies in many parts of the world, a circumstance which proved their wisdom

since the report issued is of such a favorable nature as to encourage a number of the composite insurance companies to forthwith commence operations in credit insurance. The original company, however, from its more intimate knowledge of the conditions pertaining to the business, based upon experience, is established on practically unassailable lines, and is by no means afraid of competition. In fact they maintain that there is business for all, and that the wider the knowledge of the scheme the greater the amount of business that will result and the greater the benefit to trade in general.

The report of the Federation bears this out to a very large extent, and as the scheme is likely to play a very prominent part in increasing the volume of trade with the Orient, the salient features are well worth perssal. Briefly, this is the gist of the Federation's finding.

The outline a system which, they submit, would facilitate the granting of longer term credits. The problem involved, it is pointed out, is that of placing companies insuring credits, in such a position that they should be able greatly to extend their operations, and, secondly, of providing policies of such a nature as to facilitate the discounting of bills or advances to the manufacturers or exporters against the insurance policy. It is generally accepted, the report points out, that, a greatly increased volume of export trade could be done provided that credits could be granted more freely to the foreign buyer, and, from an industrial point of view, the advantage in the extension of a system of credit insurance would lie in the possibility of enabling a manufacturer or other exporter to botain the financial facilities necessary.

Discussing the question of catastrophe risks—those occasioned by war, revolution, or other disaster—the committee remark that it would seem that these can only be insured as excess risks, and it is suggested that this special re-insurance should be undertaken by the Government itself on the following principles :

That the Government should agree to reinsure for a small premium an agreed proportion of all the losses above an agreed amount in any one year on credits insured in respect of goods of United Kingdom origin, by any approved company or companies, e.g., assuming that the agreed amount of loss was 100 per cent. of the premium income of the approved company any loss in excess of this amount might be borne, say, as to 90 per cent. by the Government and as to 10 per cent. by the company.

To facilitate the discounting of bills or advances to the exporter on the security of the policy, it is emphasized that two points must be met :

(1). The policy should not be invalidated owing to the giving of false information by the assured or the suppression by him of information which should have been given. The Federation would note that in actual practice they doubt whether policies would frequently be invalidated on those grounds. It seems highly improbable than any trader of substance would incur the risk to his reputation and general standing and to his chances of getting further insurance of this character by deliberately giving false or insufficient information.

(2). The policy should provide for payment of loss immediately on failure of the customer to meet the obligation on the due date.

Referring to longer term credits for one, two, or even three years, so frequently required by purchasers of capital goods, such as power plant, machinery, rolling stock, road transport plant, agricultural machinery, milling plant, etc., the opinion is expressed that the export of these goods is particularly important since not only do they bring direct immediate orders to this country, and particularly to those trades that are at the moment suffering most severely from under-employment, but they frequently lead to a valuable trade in repairs, replacements and extensions. Moreover, they would tend directly to develop production in the countries to which they are sent, thus improving the buying capacity of those countries and developing them as future markets for British trade.

It is confidently believed that the issuance of this report will be shortly followed by largely increased applications for credit insurance, upon which many of the first class companies are now preparing to embark. The fact of being able to extend credit up to three years must in itself have a wonderful pulling power and materially facilitate in the booking of orders the terms of which at the present time are unacceptable to buyer and seller alike.

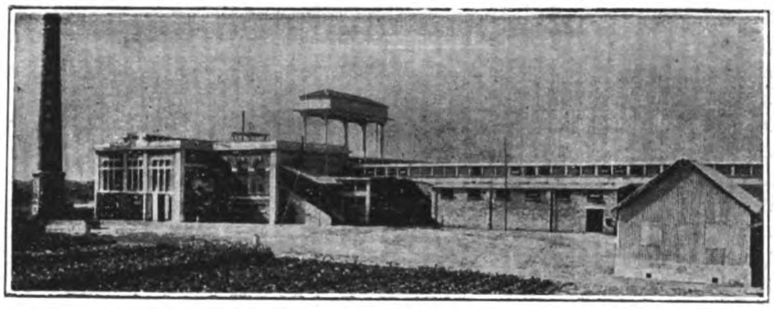
A Builders' Bible

"THE CHINA ARCHITECTS' AND BUILDERS' COMPENDIUM 1925." $10. North-China Building, Shanghai.

The China Architects' and Builders' Compendium for 1925, the second edition of this useful work, has just been published. It deals with everything relating to building and constructing in Shanghai and Hankow, though most of the information can be applied to any of the Yangtsze ports. Part 1 gives information regarding taxes, land fees, land values, building rules, and charges for gas, water, electricity and telephone service. Two good maps are also included—one of Shanghai and one of Hankow.

Part 2 contains technical information relating to weights of various local building materials, local data on costs, properties of materials, quantity surveying, foundations, etc. A very useful addition to this year's edition is the inclusion of the conversion tables of weights and measures most used by architects and builders in the Far East. Advertisements are so arranged that descriptive matter relating to similar products is kept together, making reference a simple matter.

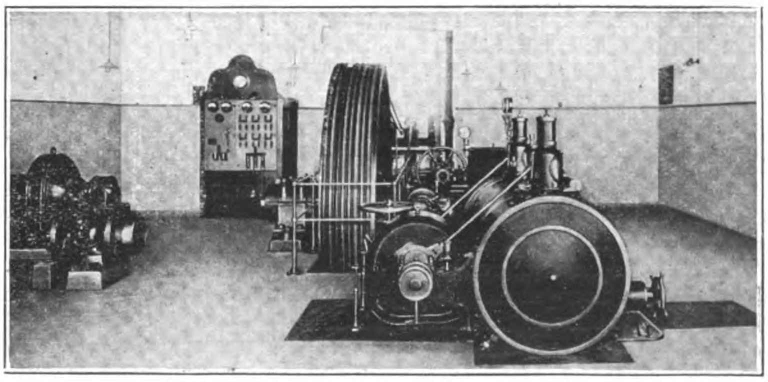
The work should be welcomed by all who are interested in civil engineering or constructional work in China. It is well indexed and illustrated.



Dah Tung Cotton Spinning Mill. Tsungming Island (near Shanghai)

The Dah Tung Cotton Mill on Tsungming Island

On the island of Tsungming, not far distant from Shanghai, the Dah Tung Cotton Mill recently started work, and the up-to-date plant installed has aroused great interest in industrial circles in China. The inception and financing of this concern was wholly carried out by the natives of the island and the commercial and technical management was entrusted to Chinese textile specialists. The mill is in immediate proximity to rich cotton fields and is equipped with a 440 b.h.p. Sulzer Uniflow Steam Engine for driving the spinning machines. Power is transmitted to the shafting by ropes. The mill has at present 10,000 spindles.



Sulzer Uniflow Steam Engine G.H. 6½, 400 H.P. installed at Dah Tung Spinning Mill, Tsungming Island (near Shanghai)

Japan's Stand at the Tariff Conference

A Large Body of Chinese are Opposed to the Begging Attitude Adopted by the Chinese Government

Internal Reforms Must Precede International Equality

THE opening of the Tariff Conference was exactly what might have been expected. The Chinese Government demanded Tariff Autonomy. The Foreign Governments were prepared to meet China more than half way in the accomplishment of her national aspirations. They suggested that, after the conference had concluded those questions which the Washington Conference delegated to them, they would consider those proposals which China desired to make with regard to Tariff Autonomy. One of the proposals at Washington was the abolition of likin, a tax which destroys internal trade and industry of China, impedes foreign commerce and intercourse and proves absolutely ruinous to the political fabric of the country, because it gives corrupt politicians an opportunity to impose illegal taxation and to pocket huge sums which imperils the people of the country and leaves the government without revenue. Likin is a curse to China, more a curse to the Chinese than to the foreigners of the country. If China were in a position to abolish likin, the country would become infinitely more prosperous. A middle class of merchants and industrialists would rise. The Government would be in a better position to collect taxes and to impose national revenues because the people would not be taxed almost beyond endurance by these illegal and harmful taxes. The politicians and militarists naturally do not want likin abolished because they pocket the money therefrom themselves. In their efforts to deal with Tariff Questions without reference to the Washington treaties, they hope to evade the whole question of the abolition of this mischievous impost. To that the Powers cannot agree.

There are many Chinese who feel that the Tariff Conference should not have been held at this period of disturbance, because in view of China's internal conditions, it is impossible to do the thing properly. Mr. Tong Shao-yi issued a statement previous to the holding of the Conference which has received a wide endorsement throughout China. In it the veteran statesman makes it clear that China must not beg, but should wait until she can dictate. His statement follows :

"The problem of China's tariff was brought before the Washington Conference by the Chinese delegation. This question has not yet been settled and the Peking Government has now invited the nine Nations signatory to the Washington Treaties to attend a Tariff Conference in China and has set a date for this meeting.

" According to the third clause of the Washington Tariff Agreement there is to be an increase of 2½ per cent. on the import duty and from 2½ to 5 per cent. on luxuries. The Tariff Conference is called to arrive at an agreement with regard to this question. If an agreement is reached, our national revenue will be increased by approximately, Tls. 19,000,000, which is not a very considerable amount. Moreover, we are bound to accept these terms for a period of years and we have no increased control over the administration. Under these conditions it appears to us, that we are begging favours of the foreign nations, a condition to which no sovereign state should be required to submit.

" Although, under the revised arrangements, we might be permitted to make still another increase after a certain length of time, and that even autonomy might be granted to us after still a further lapse of time, we are nevertheless uncertain as to whether we shall obtain all the benefits which are provided for in the treaties, because in accordance with the diplomatic practice prevalent in China, new provisos always arise to prevent the fulfilment of treaty obligations. The foreign Powers take advantage of such incidents to postpone the fulfilment of the treaty promises, with the result that nothing is accomplished. The diplomatic history of China will verify the truth of this statement.

" But, even if the new treaties are signed, it is doubtful whether the signatory Powers will be bound to live up to the new obligations. For there are the nations with whom we are in treaty but who are not to attend this Conference to provide the 2½ per cent. additional duty, and in accordance with the operations of the Most Favoured Nation Clause, the signatories will have all the benefits which the non-signatory nations may enjoy. What steps can we take to prevent these contingencies from arising ?

" Our representatives at the Washington Conference made a serious mistake by not protesting against the present administration of the Customs and by agreeing to the Tariff Conference. Now, the Peking Government continues this stupid policy by consummating this agreement. The purpose of the Peking Government is simply to indicate to the Powers that China is unified and to lead the people to believe that their influence with the foreign Powers is considerable. They hope to utilize this impression to check their opponents in the country so that they may continue to remain in office, so that they may negotiate huge loans to satisfy their extravagances and to enrich themselves. It is difficult to calculate how much the country will suffer from the new obligations and what an additional burden will be placed on the people. The results of this Conference can bring us only a great loss; surely the country and the people have nothing to gain from it.

" Our policy should be to demand the right to fix our own tariff rate, adjusted to our own needs. There is no need for a Conference, for the very meeting of such a conference is proof of the lack of recognition of our right to tariff autonomy. We ought not to beg the Foreign Powers to grant us tariff autonomy; this should be inherent in our sovereignty. When the time comes that we have created conditions suitable to the achevement of this end, the Powers will not be able to deny us our rights. Before this can be accomplished, we must have a legal government which commands the respect of the people. Before we can achieve tariff autonomy, the Government will have to budgetize its expenditures, will have to reconstruct the army, improve communications, reorganize the judical system, develop popular education and industry, adjust foreign and domestic loans, abolish likin and reform the currency. These problems directly affect the welfare of the people and no government should neglect them. The people should reflect upon the past and reach some decision as to the future.

" Now, the whole nation is demanding the abolition of unequal treaties, but if the Conference is held, it can only mean that we shall suffer from additional inequality. The Government is attempting to mislead us, but are we as citizens to remain silent ? On the eve of this Conference, we should go carefully into the advantages and disadvantages of this meeting. At this time when we are living under an iniquitous government, we must be vigilant of its actions ; we must prevent it from bringing further disasters upon the country internally ; we must prevent it from making further sacrifices of the sovereignty of the nation externally. Whether the country continues to exist or vanishes, rests with you. Fellow-countrymen ! Take notice."

Mr. Hioki, the Japanese delegate to the Tariff Conference realized that China must go through the processes which made Japan great. He realized that internal anarchy do not go hand in hand with international equality. On behalf of China's great neighbor, Japan, he suggested the course of events in China which would make that country one of the greatest of the world. It was in a spirit of friendship, with the utmost good-will and candor, with a hope for accomplishment that Mr. Hioki made the suggestion. The question is : can China fulfill the hopes and wishes of her friends ? Does China contain the men, the forces to accomplish

a great program of reconstruction? It is impossible to believe that a nation of 400,000,000 cannot produce the leadership and intellect to accomplish the equality which comes only from hard work, reconstruction and unity.

Mr Hioki's opening address at the Tariff Conference follows:

"The Japanese Delegation have come here with the serious conviction that some definite results in the direction of a common purpose and a common understanding between China and other Powers may well be attained at the present Conference. In now pledging our whole hearted co-operation to this end, we are confident that its deliberations will be marked on all sides by fairness and moderation in spirit and simplicity and directness in method, which alone can ensure the success of any international conferences.

"Japan has always watched with keen and abiding interest every effort made by the Chinese people for the realization of their legitimate national aspirations. She has herself been subject at one time to unilateral restrictions upon her freedom of action in matters of fiscal and judicial administration. The present struggle of the Chinese people to be relieved of those restrictions has had its counterpart in her own history. It may, therefore, be of some interest to review as briefly as possible the path which Japan feels she has opened up for the solution of the same problems that are now engaging our attention.

"In 1858 Japan for the first time opened her ports to foreign trade. Under the commercial treaties that were then concluded she had to concede extraterritorial rights, she had to undertake unilateral engagements in the matter of the Customs tariff. In 1866 these treaties were revised, but our import tariff remained fixed for the following 33 years on the general basis of 5 per cent. *ad valorem*. Similar restrictions were imposed on our exports. The Japanese people, dissatisfied as they were with such arrangements, were sensible of their own shortcomings. They perceived that the weakness of their international position was but a result of their internal weakness. They saw the futility of all attempts to remove the effect without removing its cause. In this conviction they set to work silently, steadily, resolutely, with their eyes fixed upon the completion of all reforms needed in their domestic administration.

"The treaties as revised in 1894, provided for a graduated customs tariff at rates ranging generally from 5 to 15 per cent. The new tariff was to come into force upon the expiration of five years from the dates of the signatures of those treaties and thenceforth was to remain operative, for the period of 12 years. It marked a step forward to a solution more in keeping with modern requirements, but it continued to be unilateral without any *quid sro quo* being undertaken by the Powers. In 1899, Japan succeeded with the willing consent of the Powers in terminating all extraterritorial jurisdiction within her borders.

"But it was only in the year 1911," continued Mr. Hioki, "that through another revision of treaties the unilateral conventional tariff was replaced by bilateral engagements on a more rational basis of mutual concessions. It meant for Japan 58 long years of patient and energetic work expended in effecting many necessary reforms in various branches of her government.

"China," he said, "is still following the same path that we once pursued. The difficulties, the embarrassments and the perplexities that confront China to-day have once been ours. The Japanese Delegation will approach the problems before this Conference with sympathy and understanding and with intimate apprehension of the Chinese position. I am happy to state at the outset that the Japanese Delegation are fully prepared to consider in the friendliest way the question of tariff autonomy which appears in the agenda presented by the Chinese Delegation. However, an immediate duty is incumbent upon us who are here assembled.

"The present Conference has been called together pursuant to the provisions of the Washington Treaty of 1922 concerning the Chinese Customs tariff. The treaty has in view the provision of an increase. Customs revenue for China in order to assist in the financial rehabilitation of the country. It requires of this conference the consideration of two distinct matters. In the first place, Article 2 provides that the Conference shall take immediate steps to prepare the way for the speedy abolition of likin, and for the fulfilment of the other conditions laid down with a view to levying a surtax provided for in the previous treaties between China and other Powers. In the second place, Article 3 provides that the Conference shall consider certain interim provisions prior to the abolition of likin and authorize the levy of a surtax at a uniform rate of 2½ per cent. *ad valorem* and, in the case of certain articles of luxury, at a higher rate not exceeding 5 per cent. As to the levy of a surtax under Article 3, the rate is fixed at 2½ per cent. *ad valorem*. Obviously it cannot be altered without giving modification to the terms of that Treaty.

"At the time of the Washington Conference it was estimated that this surtax would secure an additional revenue amounting to approximately 29 million dollars in silver. The amount of such revenue is sure to increase with the constantly growing volume of trade as the Chinese Customs returns clearly testify. Again there will also be an annual Customs surplus available after the existing charges on that revenue have been meet. Our financial experts are of the opinion that, with these new sources of revenue it will not be difficult to work out a feasible plan that would meet the needed administrative expenditure of the Chinese Government and would at the same time further the general financial adjustment of China. The Japanese Delegation will, on another occasion, have the honour of tendering before this Conference their concrete suggestions on this subject. We are not, however, disinclined to take up any proposal which might be put forward with a view to the levying of a reasonable surtax higher than 2½ per cent.

"Such a proposal may be considered as falling within the terms of Article 2 of the Treaty. But since this would constitute an intermediate step prior to the total abolition of likin, it should be requisite for China to effectuate at least a partial abolition of likin, as well as to fulfil certain conditions provided for in the Treaties between China and other Powers.

"Returning to the question of tariff autonomy, the Japanese delegation are willing, as I have already stated, to consider sympathetically and helpfully any reasonable plan of the Chinese Government looking to the realization of their national aspirations in this regard. Evidently the goal could be reached only by successive stages and we rest assured in the belief that an immediate and unconditional surrender by the Powers of their existing treaty rights is not within the contemplation of China herself.

"At this juncture," continued Mr. Hioki, the Japanese Delegation venture to suggest the following alternative plans that might, as an intermediate step, be adopted for a definite period to be agreed upon. First, that a statutory tariff on a fair, and reasonable basis be established for general application, subject to the provisions of special conventional tariff on certain specified articles to be agreed upon separately between China and each of the Powers directly interested; or secondly, that a graduated tariff, so devised as to be acceptable to the Powers concerned, be established at an average rate of not more than 12½ per cent. *ad valorem* and generally in a manner consistent with the provisions of Article 2 of the Washington Treaty. The inauguration of a *regime* of tariff autonomy in China implies the existence of an adequately strong and unified government and pre-supposes a complete removal of all restrictions which might impede the freedom of intercourse and trade between China and other Powers.

"We confidently hope," said Mr. Hioki, "that, endowed with remarkable qualities of self-government and supported by the growth of nationalism now so manifestly asserting itself in the country, the Chinese people will succeed in accomplishing reforms towards these ends, as much desirable for their own welfare as for the common good of all nations. Moreover, the Japanese Delegation believe that by going through a practicable step such as I have taken the liberty to outline, China would be able, without fail and without injury to herself or her friends, to accomplish the hnge task of bringing her fiscal administration upon a sound and scientific basis and ushering in a new era of prosperity in the Republic.

"In conclusion," said the speaker, "I desire to reaffirm on behalf of the Japanese Delegation our faith in the spirit of friendliness which animates this important gathering. We ardently hope and believe, that by frank discussion and neighborly co-operation, by mutual assistance and concession, and by the exercise of due respect for one another's rights and interests, the present Conference will find equitable solution for every problem before it to the satisfaction of all, and thus demonstrate its will to live and let live."

Financial Independence of the Administration of Communications of the Republic of China

By H. E. Yeh Kung-Cho, Minister of Communications

NEARLY half a century has elapsed since China began to possess modern means of communications. A special department of the Government was established 20 years ago to attend to their administration and development. Still only a few people possess a clearly defined idea of the nature and functions of communications as related to society and the government. For a modern society communications are as indispensable as water and air to human life. Without them civilization steps back immediately to the mediaeval ages.

This idea is clearly understood in foreign countries; so they zealously work for the improvement of communications. Progress serves only to stimulate further efforts, and every day brings forth new glories in achievements, either in the way of invention or expansion. China, on the other hand, lags in the march of progress, failing even to maintain what means of communications she has already constructed.

It is a fair question to ask, what is the cause of China's backwardness? An attempt was made indeed to lay the foundation of the systems of communications on a solid basis, when in the third year of Hsuan Tung (1911), a system was adopted providing for the independence of the administration of communications. In this system were incorporated the best points of all countries, after a careful and thorough study of the subject. Financial integrity of the systems of communications is necessary, because as commercial enterprises, they must have their funds at their own disposal and further safeguarded by accurate accounting. Hence the Special System of Accounts.

It is to be observed that financial integrity of the Communication Systems is provided for in the laws of all foreign countries. The best known system is to be found in the new constitution of Germany, Article 92 of which states:

> "The national railroads, irrespective of the incorporation of their budget and accounts in the general budget and accounts of the Commonwealth, shall be administered as an independent economic enterprise, which shall defray its own expense, including interest and the amortization of the railroad debts, and accumulate a railroad reserve fund. The amount of the amortization and of the reserve fund, as well as the purpose to which reserve may be applied, shall be regulated by special law."

Article 30 of the Japanese Accounting Law provides that in case of necessity, when the law is not applicable, a special law of accounts may be established. The first article of the Japanese Railway Accounting Law also expressly states that for the purpose of railway administration and with the object of safeguarding railway funds and regulating the disposal and use of the funds, all the earnings and miscellaneous revenues may be applied to the use of railway enterprises, and an independent system of accounts may be established.

The idea of financial integrity is to give recognition to the fact that the accounts of government-owned enterprises are different from those of ordinary government offices. So a separate system, adequate and suitable for the purpose, must be established. The fundamental principles underlying such a system should, however, be the same as those of the general system of accounts, and the authority for its establishment should be derived from the accounting law of the country. (The existing railway accounting regulations of this Ministry, for instance, are based upon Article 34 of our Accounting Law, which states that in case of necessity when this law is not applicable, a special law of accounts may be established). Such a system is, therefore, a part of the general system of finance of the government and is subject to the supervision of the law of the country.

From the foregoing, it will be seen that legally the system of independent accounts for government-owned enterprises is well established. It remains to be shown in the following that unless such a system is established, no public utility or other enterprises of the government can be prosperous.

To illustrate, the example of commercial concerns may be taken, for in the final analysis the principle determining the success or failure of a government-owned enterprise is the same as that of a commercial concern. The first essential to the success of a commercial concern is to have proper accounting; business accounts must be kept strictly separate from household expenditures, otherwise there will be no way to ascertain whether the business is making money or not. When the business is of the nature of partnership or company, such a separation of accounts is imperative. The same principle governs the operation of government-owned enterprises. In the same way their accounts must be kept strictly apart from those of governmental expenditures. When the enterprise is financed by the joint capital of the people and the government, the necessity for a separation of accounts is obvious.

The fact that government-owned enterprises are run primarily for the benefit of the public and secondarily for profits does not alter the fact that they must be run successfully. No one can bring success to an enterprise when it has no capital to begin operations with or when its funds are being taken away as soon as it makes money. So when the government plans to develop an enterprise, it must appropriate for it a sum of money to be used as capital, and this capital must be applied exclusively to its development. If the enterprise makes money, the funds at its disposal must be used primarily for its development and expansion, and should not be appropriated for other purposes until its needs are taken care of adequately. On the other hand, failure is as certain as that the sun will rise, if the funds of an enterprise are treated in the same way as an ordinary source of government revenue to be appropriated at random. The system of independent accounts has for its purpose the preservation of the funds of government-owned enterprises for their own use first, hence the necessity of its establishment.

Chinese Government-owned enterprises are still in a stage of infancy. Protection is needed to nourish their growth. On account of the poverty of the national treasury, no financial assistance has been given or can be expected from this quarter. They must look to themselves for mutual aid. A judicial adjustment of the funds at their disposal is necessary to render help to those enterprises which are still undeveloped from the profits of the established ones. This will be impossible if the funds are taken away, and the result will be to kill off, or arrest the progress of all the enterprises. For their welfare, protection in the form of an independent system of accounts is absolutely necessary. There is another reason why the funds of Government-owned enterprises must be protected, as it affects not only the enterprises, themselves, but also the credit of China. Most of the Government-owned enterprises were financed originally by foreign loans. Foreigners are interested in their having a sound financial system. So unless their funds are safeguarded from misappropriations, their credit is bound to suffer, which will naturally give rise to complaints and criticisms. The demand for protection of Government-owned enterprises and the credit of China is another reason why an independent system of accounts should be established.

The establishment of an independent system of accounts is dictated, therefore, by reasons of legality and necessity. It must be pointed out as a conclusion drawn from the facts mentioned in the foregoing that independence of accounts should be established not only in the narrow limits of Communications but it should have

a wider scope to apply to all Government-owned enterprises. This seems to be lost sight of in China, and it has been thought that it applies to communications alone, since the latter were the first to adopt the system. Misunderstanding has given rise to criticisms, which are not well-founded, in view of the fact that the system in its methods and operations, is even more elaborate than the ordinary system of accounts, providing a great many more safeguards against corruption and dishonest practices. The usual procedure of examination of the budget and accounts by the authorized Government Bureau of Audit is provided for. Furthermore, the accounts and statistics are published annually and made available both in China and abroad, thus wide publicity is given to them.

China's trouble lies not in the want of a good system but in the fact that the good system is not effectively enforced. During the last 13 years, the so-called financial integrity of the administration of communications exists only in name. It has been trammelled and put under fetters. There is no public opinion to come to its rescue and restore it to its proper function. As a result the revenues from Communications during the last 13 years have been diverted to other purposes, and loans have been contracted ostensibly for the purpose of their development but actually to meet the requirements of governmental and military expenses. In more recent years, the revenues of the railways have become a source of income to militarists, who appropriate them directly. The Kin Han Railway alone supplies more than $10,000,000 annually to military requirements. The funds that have been seized from other railways and telegraph offices are enormous. Not satisfied with merely commandeering the earnings, railways and telegraph offices have been obliged to borrow money at a high rate of interest to meet these military demands. There have even been cases of high military officers borrowing directly from the merchants pledging the revenues of communications as security, and pressure has been brought upon the railways and telegraph offices to pay back the loans accordingly. It is estimated that up to the end of the 13th year of the Republic no less than $180,000,000 have been appropriated, seized and taken away in one way or other by different forces. If interest on this amount is calculated, the total amount comes up to $250,000,000. The funds at the disposal of the means of communications are drained dry and the revenues yet to be earned are mortgaged. The means of communications are left with no funds to carry on their operation. If the independence of accounts had been enforced, such an enormous amount of money could be used, in the first place, for the amortization of debts, which would greatly lessen the burden of indebtedness ; and in the second place, it might have been used to start new enterprises. The benefit that would accrue from this would be even greater. But what do we find now ? The funds of the railways are exhausted, and debts are piling up. Work on incompleted lines is interrupted, and deterioration overtakes the existing lines, which are gradually becoming useless. There is no money to buy even the material required for daily use, and wages are overdue. Bridges are decaying and falling. Rolling Stocks are broken down and sadly in need of repairs. Traffic is in daily danger of interruption, in consequence of deterioration and lack of repair. The telegraph service has the same sad story to tell. Loans contracted for its improvement and expansion have been appropriated by the Government for other purposes, and its revenues have been seized by the provinces. Payment of interest on loans has been long delayed, and telegraphic lines have been allowed to deteriorate without the means for repairs or extension.

The railways and telegraph, for which the energy and labor of several tens of years have been spent, are now on the brink of bankruptcy. Navigation and the post fare better, but this is because navigation is still in the stage of infancy. The post is only able to maintain itself. If no radical departure is made from the present way of doing things, it is reasonable to expect that the railways, and telegraphs will become so deteriorated in a few years as to become useless. In that event, the difficulties and sufferings that will overtake the nation and the people will be impossible to describe.

Recent events may serve as a warning of what the future has in store. During the last few months traffic was interrupted on account of war. A loud cry of suffering rose from the people. But this was only a temporary state of affairs. Compared with this how much greater would be the suffering should all the railways and telegraphic lines be broken down at the same time on account of deterioration. Repairs can not be completed in a day, and it is questionable whether the Government, poor as it is now, is financially able to undertake repairs on a large scale.

Facing the possibility of total destruction in the not distant future, the immediate problem confronting the country is to maintain the *status quo* of the means of communications, that is to prevent them from becoming worse. Other problems of improvements and expansion are of secondary importance. To merely maintain the *status quo* the first question to which we must direct our attention is how to enforce the financial independence of the administration of communications, which will preserve their revenues for their own maintenance and improvement and for the completion of unfinished lines.

The importance of financial independence of the administration of communications must be clearly understood by the people and popular support must be given to it. If this is obtained, it may then be said that the true foundation of communications is laid. Gradual and steady improvements may then be planned. As the means of communications improve, all other business will progress in their train. In the future when the income from communications is increased, any surplus after deducting what is needed for the amortization of debts, expansion and improvement and for the reserve fund, will naturally be handed over to the Government to supplement its treasury. But if the foolish policy of killing the goose to get the golden eggs be continued, it will be not only the communications business that will suffer but all other new projects also. We tremble when this point is considered. Moreover, we are reminded all the time of the heavy foreign investments in our means of communications by the presistent cry for international control of our railways. If we do not ourselves plan a remedy now, others will presently plan one for us. We can not forbear to mention the direful consequences this will bring to China.

This Ministry being entrusted with the administration of communications, we are more thoroughly acquainted with the real state of affairs. We are in duty bound to lay before the Conference what we consider as the real danger that is threatening the existence of the means of communications and beg to submit herewith our proposal of remedy, which is summed up in the recommendation to preserve and enforce the financial independence of the administration of communications.

Letter to the Ministry of Finance from the Ministry of Communications

With the opening of the Rehabilitation Conference* it is necessary that the respective departments of the Government each submit its plans of reorganization and reconstruction so that they can be carried out with the approval of the Conference.

Aside from the administrative problems which concern this Ministry alone and which the Ministry of Communications has already submitted to the Rehabilitation Conference for consideration, the problem of finance in its bearing upon the systems of communications must be given due attention. As the Ministry of Finance is in charge of all government financial matters of the country, it is deemed proper that the problem of making good the financial losses in the recent years and of devising ways of adjustment must be submitted to the Rehabilitation Conference for its consideration through the Ministry of Finance. If the Ministry of Finance has already submitted its own plans, it is hoped that it will send in the enclosed memorandum with annexes as a supplementary document.

Memorandum of Financial Readjustment

The fact is well admitted by those who have made a study of the policies of communication and transportation in any country that these enterprises are highly necessary to the development of its civilization and industry and to its military affairs and national defence. China cannot at present boast of an adequate system of communication and transportation. In the case of navigation, she has not a single government enterprise to speak of, and those started by the merchants have seldom been encouraged or assisted by the Government. In the case of post and telegraph, there is still ample room for improvement and extension, although the important cities and towns throughout the country can all be reached now either by mail or by telegraph. As to railways, it must be admitted that, except in a very few cases in which China had made plans of her own to attain the above mentioned objects, most of the railways

*A Conference called during 1925 to reconstruct the Government of China. It failed to accomplish anything.

were built with foreign loans, with plans all initiated and laid down by the creditors.

Since the very beginning, China has succeeded in constructing only a few of the trunk railways of the country, with little or nothing else to boast of. While the lack of funds at the outset has been largely responsible for this inactivity, the fact that the incomes of the railways have frequently been diverted has made extension impossible and brought about the present condition. In the recent years, instead of making an effort to maintain these means of communications and transportation in their infancy, there has been repeated encroachment upon them. The retention of the telegraph and railway revenues to meet military and administrative expenses, the mortgage of railway and telegraph property for loans, and the non-payment of transportation and telegraphic charges are direct encroachments which are frequent and which affect very seriously the financial conditions of the railway and telegraph administrations. The indirect encroachments are more frequent and numerous, which consist in the detention of cars and locomotives, interference with the appointments of officials and the carrying on of ordinary business, forcible seizure of telegraph and telephone wires, issuance of unlimited number of free passes, despatch of official telegrams without paying for them, appropriation of railway and telephone and telegraph materials, and finally, destruction of the different kinds of expensive engineering work. The result is that, according to an estimate made at the end of September of the 12th Year of the Chinese Republic (1923), the total indebtedness of the Ministry of Communications runs over $707,-300,000. This figure has not changed much during the last two years.

It is indeed sad to say that the present enterprises of communications are in a very bad state. The fact that all engineering structures are breaking down and equipments deteriorating presents a serious danger to the continuance of the enterprises. That the incomes can not meet the expenses and that the debts are piling up is the financial phase of the peril. What is still worse is a steady undermining of the economic foundation, which is necessary to the maintenance of a sound financial policy. In the past, the Ministry of Communications had always been able to meet its obligations at home or abroad. Although there had been delays sometimes in meeting the internal obligations, for which satisfactory arrangements were always possible, the Ministry had never failed, in spite of all financial difficulties, to maintain its credit abroad. It was for this reason that the Ministry had then still a sound financial policy. But the case is quite different in recent years. The Ministry has not only failed to make good its internal loans, but also failed to meet its obligations abroad. It was only with great difficulty that the Ministry managed at the end of last year to make good its Hukuang loans. The Japanese Legation has repeatedly pressed for repayment of principal and interest on the Yokohama Specie Bank Loan. The Great Eastern and the Great Northern Cable companies are about to discontinue the practice of sending cables on credit, for the Chinese Government has failed to pay either the interest or the principal of their loans. The next payment for the coupons of the German portion of the Hukuang Bonds—having been postponed last year pending a diplomatic settlement—will require a sum of no less than $3,000,000, and there is no definite plan yet to meet this obligation although it may soon fall due. There are many other minor loans for purchase of materials from abroad, which have not yet been made good. The internal indebtedness includes many short-term loans from the Chinese banks, bonds and promissory notes issued by the different railways (not counting the funds which should be reserved for redemption of railways but which have not been paid over). All these short-term loans have been extended again and again, and the different kinds of bonds and notes which are held by the Chinese and foreigners alike have not yet been redeemed. Failure on the part of the railways to make good these bonds sacrifices the confidence of the people, the absence of which would leave no room for financial activity in the future. This deplorable condition, coupled with a total obligation of $707,300,000 with a heavy yearly burden of interest and principal, would make it immensely difficult to maintain the present enterprises of communications as they are. It would be next to impossible to extend or to improve them so as to be helpful in the spread of culture, development of industry, and promotion of military affairs and national defense.

There is, however, a ray of hope, for there is a way to work out a plan of financial re-organization for the Ministry of Communications. The plan is twofold: that which is internal, concerning the Ministry itself, and that which is external, lying beyond the control of the Ministry. The internal part consists in a revision of the transportation tariff, postal, telegraph and telephone rates, reduction of the members of the staff, and economy of materials, so that the income can at least meet the expenditure. In case of any surplus, it can be spent on improvement and extension of these enterprises. All these matters, including considerations for the care of property and maintenance of credit and confidence, are within the proper purview of the Ministry, which has already instructed the different offices to carry them out in the most careful way possible. The external part of the plan depends first upon the removal of all the unnecessary obstacles which have obstructed the administrative unity of the Ministry, and secondly, upon the maintenance of an independent system of accounts, which does not permit any borrowing or appropriation of the revenues by any other party. In other words, the independent financial policy of the Ministry of Communications must not be dynamic, but static, and must not be subjected to the handling by any other department. We need not here go into the reasons for this static policy, which are given in a separate memorandum.

For a sound financial re-organization of the Ministry, a general re-adjustment of its internal and foreign loans is most important. The Ministry of Communications has, as stated, a total indebtedness of over $707,300,000. Of this amount, about $87,200,000 (representing loans on Kao-Hsu, Chen-Tsi, Mongolian, Ki-Hui, Cheng-yu, Tung-Chen, Shanghai-Hangchow Railways, and Telegraph loans) were originally used by the Ministry of Finance, which should, therefore, be responsible for their repayment. The remainder should be met according to the following ways:

A. Those which can be dully paid with available resources, such as the Peking-Mukden Railway Loan, the Tientsin-Pukow Railway Loan, and the Shanghai-Nanking Railway Laon, amount to a total of about $319,200,000. They can be, as they have been, regularly paid out of the revenues of these railways (See Table A for details).

B. Those short term loans amounting to a little over $80,-900,000, can be repaid from the surplus of railway and telegraph revenues. (See Table B.)

C. A total of over $219,900,000 should be turned over to the Commission on Financial Readjustment. A portion of this total relating to loans for railways and telegraph construction the Ministry of Communications will endeavour to meet, while the remainder is entirely beyond its resources (See Table C.)

The Ministry of Communications will undertake to repay the loans of the classes A and B, as it has done in the past, either out of the revenues from the post, telegraph, and railways, or from the surplus after a revision of the rates. It is beyond the resources of the Ministry to do anything for the loans of class C. For the last few years, the advances made to the Ministry of Finanace amount to no less than $180,000,000 in principal alone, without counting interest. It is perhaps unnecessary for this Ministry to recover these advances from the Ministry of Finance directly, but at the same time, it is planned that the loans of class C should be included among those for general readjustment. The Ministry of Finance must have plans of its own to adjust all the unsecured obligations either with the 2½ per cent. tariff increase or any other financial resource as security. How the small loans are to be consolidated and how the short term loans are to be converted into long terms are questions for the Ministry of Finance to decide. As far as the Ministry of Communications is concerned, it craves the sympathy and understanding of the whole country, for much that is to be re-adjusted lies beyond its own power. As a sound financial policy for the Ministry of Communications is a vital problem to China, we hope that the day will soon arrive when an independent system of accounts that the day will soon arrive when an independent system of accounts will become a fact, when responsibilities for the loans are all divided, and when administrative authority will be centralized. When that day comes, there can be a financial re-organization of the Ministry, which will in the end mean a great boon to the future of the enterprises of communication and transportation in China.

We take the pleasure of submitting herewith the reasons and ways for a financial re-organization, which should, with your concurrence, be brought before the Re-organization Conference for consideration and approval.

With enclosures.

(A) Schedule of Obligations with Proper Financial Resources to Redeem the Principal and Interest.

Name of Loan	Amount of Principal Outstanding at September 30, 1923	Amount of Interest Unpaid of Matured Liability at September 30, 1923	Various Currencies converted into Dollars
Peking Mukden Railway Double Track Loan	£ 440,000.00	£ 14,000.00	$ 6,240,000.00
	$ 1,700,000.00		
Japanese Loan for Hsinmintun Mukden Railway	Y. 71,111.12		$ 71,111.12
North China Railway Loan	£ 1,221,875.00		$ 12,218,750.00
Cost of 400 Wagons and Interest up to 31/12/22	£ 509,237.10	£ 56,659.13	$ 5,658,971.50
Peking Hankow Railway Short Term Loan	$ 387,850.00		$ 387,850.00
Tientsin Pukow Railway Original Loan	£ 1,831,200.00		$ 18,412,500.00
Tientsin Pukow Supplementary Loan	£ 1,299,050.00		$ 12,990,000.00
Shanghai Nanking Railway 5 per cent. Gold Loan	£ 2,900,000.00		$ 29,000,000.00
Shanghai Hangchow Ningpo 5 per cent. Gold Loan	£ 1,125,000.00		$ 11,250,000.00
Cheng Tai Railway 5 per cent. Gold Loan	Fr. 22,815,000.00		$ 3,259,285.71
The Purchase of Rolling Stocks Honan Railway	£ 88,787,52		$ 887,872.54
Honan Railway 5 per cent. Loan	£ 569,100.00		$ 5,691,000.00
Kirin Changchun Railway Loan	Y. 6,500,000.00		$ 6,500,000.00
Advance from South Manchurian Railway Co.	Y. 500,000.00	Y. 47,500.00	$ 547,500.00
Lung Hai Railway Belgian Dutch Loan	Flor. 8,807,000.00		$ 4,403,500.00
Lung Hai Railway Loan	Flor. 16,667,000.00		$ 8,333,500.00
" " " "	B.Fr. 37,743,000.00		$ 5,391,857.15
" " " "	B.Fr. 50,000,000.00		$ 7,142,857.15
The Hongkong & Shanghai Banking Corp. and Banque de l'Indo-Chine	£ 3,750,000.00		$ 37,500,000.00
Lung Hai Railway Loan	£ 4,000,000.00		$ 40,000,000.00
" " " "	B.Fr. 50,000,000.00		$ 7,142,857.15
Lung Hai Railway 7 per cent. Treasury Bonds	B.Fr. 20,000,000.00		$ 2,857,142.86
Pien Lo Railway Loan	Fr. 31,000,000.00		$ 4,428,571.43
Ssu Cheng Railway Debentures	Y. 5,000,000.00		$ 5,000,000.00
Advance for Cheng Tao Section	Y. 57,200.00		$ 57,200.00
Temporary Advance for Cheng Tao Section	Y. 8,100,000.00		$ 8,100,000.00
Ssu Tao Short Term Loan	Y. 18,200,000.00		$ 18,200,000.00
Canton Kowloon Railway Loan	£ 1,282,500.00		$ 12,825,000.00
Kiao Tsi Railway Treasury Bonds	Y. 40,000,000.00		$ 40,000,000.00
Hupeh Hunan Section, Commission of the British Chinese China Japan Industrial Development Company	£ 5,702,20		$ 57,021,00
Total amount of Railway Obligations	£ 19,032,451.171	£ 70,659,130	
	$ 2,087,850.00		
	Y. 78,428,311.12	Y. 47,500.000	$ 314,554,347.61
	Flor. 25,474,000.00		
	Fr. 211,558,000.00		
Shanghai Taku New Cable Loan	£ 93,164.00	£ 6,649.00	$ 998,130.00
East Extension Telegraph Co. and Great Northern Telegraph Co. Loan	£ 314,845.10	£ 29,474.2.0	$ 3,443,196.00
Duplicate Taku Chefoo Cable Loan	£ 21,616.00	£ 1,542.00	$ 231,580.00
Total amount of Telegraph Obligations	£ 429,625.10	£ 37,665.2.0	$ 4,672.906.00
Grand Total			$ 319,227,253.61

(B) Schedule of Obligations to be Liquidated by Railways and Telegraphs.

Items	Total	Items	Total	Grand Total
Railway Obligations on Foreign Loans	$12,290,766.46	Railway Obligations on Materials	$34,116,451.10	
Railway Obligations on Domestic Loans	$7,318,388.84	Telegraph Obligations on Materials	$ 5,965,817.85	
Railway Obligations on Bonds	$21,252,843.59			$80,944,267.84

(C) Schedule of Obligations to be Liquidated by Financial Readjustment Program.

Name of Loan	Amount of Principal Outstanding at September 30, 1923	Amount of Interest Unpaid of Matured Liability September 30, 1923	Various Currencies converted into Dollars
Advance for Chu-Ching Railway (American International Corporation)	G.$ 250,000.00	$ 309,673.33	$ 2,919,346.66
Advance for Ching-Men Branch Line	£ 52,972.11.3		$ 529,725.63
Advance for Harbin-Heilungchiang Railway	Q. Nin 500,000.00	Tls. 127,500.00	$ 896,428.57
Tientsin-Pukow Railway Original Loan Part of Deutsche Asiatische Bank	£ 2,650,000.00	£ 795,000.00	$ 34,450,000.00
Tientsin Pukow Railway Supplementary Loan, Part of Deutsche-Asiatische Bank	£ 1,590,000.00	£ 508,800.00	$ 20,988,000.00
Hukuang Railway Loan, Part of Deutsche-Asiatische Bank	£ 1,070,000.00	£ 346,986.00	$ 14,169,890.00
Tientsin Pukow Railway Loan, Advance from Deutsche-Asiatische Bank	£ 900,424.6.4	£ 409,593.2.4	$ 13,100,174.33
Obligations on Materials of Peking Suiyuan Railway, Han-yeh Ping Iron & Steel Works	Silver 676,985.65		$ 967,122.36
Canton Hankow Szechuan Railway Loan	£ 4,750,000.00		$ 47,500,000.00
The Yokohama Specie Bank Loan	Y. 9,670,000.00	Y. 567,250.00	$ 10,237,250.00
Advance for Improving and Developing Telegraph Corporation Ltd. Lines from East-Asia Industrial Co.	Y. 15,000,000.00	Y. 364,000.00	$ 15,364,000.00
Telephone Loan	Y. 10,000,000.00	Y. 1,930,000.00	$ 11,930,000.00
Marconi Wireless Telegraph Advance	£ 200,000.00	£ 26,235.14.6	$ 2,262,357.00
Domestic Short Term Loan	$ 9,055,149.32	$ 1,083,013.67	$ 10,138,162.99
Direct Expenditure of Szechuan Railway	$ 8,007,560.57	$ 3,161,025.09	$ 11,168,585.66
Indirect Expenditure of Szechuan Railway	$ 9,145,669.23	$ 4,938,661.38	$ 14,084,330.61
Hunan Railway Share (Class A) Fixed Bonds	$ 27,815.00	$ 6,303.40	$ 34,118.40
Hunan Railway Share (Class B) Fixed Bonds	$ 4,194,550.00	$ 534,959.35	$ 4,729,509.35
Hunan Railway Loan to Hunan Bank	Hunan Tls. 672,400.80		$ 517,231.36
Kiangsu Railway Share Fixed Bonds	$ 312,250.72	$ 102,001.90	$ 414,252.62
Chekiang Railway Share Fixed Bonds	$ 880,542.38	$ 61,637.93	$ 942,180.31
Chekiang Railway Bonds	$ 206,600.00	$ 23,243.20	$ 229,843.20
Hupeh Railway Share (Issued by Hupeh Provincial Authorities) Fixed Bonds	$ 161,779.71	$ 36,400.44	$ 198,180.15
Hupeh Ry. Share Subscribed by the Hupeh Authorities out of the Revenue of Rice Tax	$ 589,021.40	$ 26,505.96	$ 615,527.36
Lo-Tung Railway Share	P. Tls. 230,000.00		$ 328,571.43
Tung-Pu Railway Loan (From Different shops)	Tls. 540,050.53		$ 771,500.75
Tung-Pu Railway Due to Shanghai Executive Office	Tls. 97,667.55		$ 139,525.07
Guarantee Interest of Tung-Pu Railway due to Shanghai Provincial Office	Tls. 58,224.45		$ 83,177.79
Advance for Anhuei Railway from Provincial Executive Office	Qua Nin 107,390.45		$ 153,414.92
Advance for Anhuei Railway from Provincial Executive Office	$ 45,219.01		$ 45,219.01
Amount of Anhuei Railway Due to Contractor Yao Sin-Chi	Qua Nin 20,000.00		$ 28,571.43
	G. $ 1,150,000.00	G. $ 309,673.33	
	£ 11,213,396.17.7	£ 2,116,614.16.1	
	Y. 34,670,000.00	Y. 2,861,250.00	
	Qua Nin 627,390.45	Qua Nin 127,500,00	
	Silver 676,985.65		$ 219,936,166.98
	Hu. Tls. 672,400.80		
	P. Tls. 230,000.00		
	Tls. 695,942.53		
	$ 32,626,157.34		

Japan's Super Power System

Toho Electric Power Company, Limited

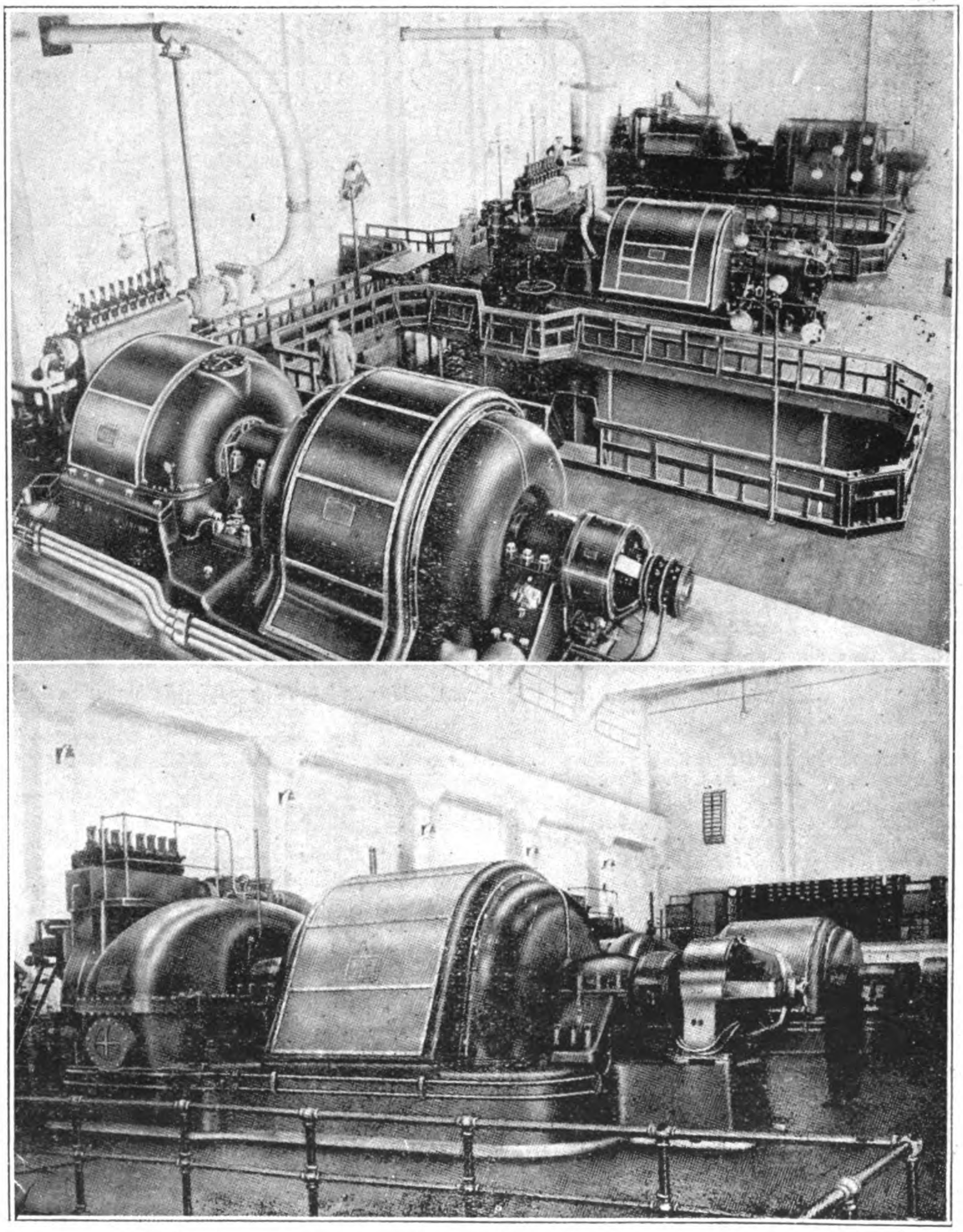
THE history of the Toho Electric Power Company, Limited, is in many ways typical of the general course of electrical development in Japan. It is the result of the gradual amalgamation, during the last several years, of 33 comparatively small power undertakings.

The business originated from the Nagoya Electric Light Company, Limited, one of the first commercial electric companies in Japan. Organized with a paid-in capital of $37,500, that company began distributing electricity in Nagoya on December 15, 1889. As the Company grew and prospered it absorbed, from time to time, various other electric companies operating in the so-called "Kansai District" of Central Japan.

While the Nagoya Company was extending its operations in the "Kansai District" the Kyushu Electric Power and Traction Company, organized in 1896 as the Hakata Electric Light Company, was expanding and consolidating numerous small utility companies in the so-called "Kyushu District" which covers a large part of the island of Kyushu in southern Japan.

Early in 1922 these two concerns were merged. Shortly after this important amalgamation the consolidated company changed its name (June, 1922) to the Toho Electric Power Company, Limited. The Company is, next to the Tokyo Electric Light Company, Limited, the largest retail distributor of electric energy in Japan.

Directly, or through subsidiaries, it supplies practically without competition electric light and power to more than 4,000,000 people in a territory of approximately 4,000 square miles.



Toho Steam Generating Stations. Above, Atsuta; below, Nashima

The Company also does some artificial gas and electric railway business, deriving about 7 per cent. of its gross earnings from these and other miscellaneous operating activities.

Operations are mainly conducted in two distinctly separate business areas, the Kansai manufacturing district in and around Nagoya, Gifu, Nara and Toyohashi in central Japan and the industrially important Kyushu district in and around Fukuoka and Nagasaki in southern Japan. In these densely populated districts, the Company serves 1,489 factories. More than sixty cities with a population in excess of 10,000 each are supplied exclusively by the properties of the Toho system.

More than 20,000 stockholders own the $51,102,112 outstanding capital stock, which is now quoted in Tokyo at a substantial premium.

Total bonds and stocks presently to be outstanding amount to more than $89,000,000.

Territory Served

Nagoya, one of the most important cities of the Kansai district, has an estimated population of 600,000 and ranks as the fifth largest city in Japan.

It is an important manufacturing center. Its diversified industries include cotton spinning mills, porcelain and China factories, clock and watch factories, cement mills, steel mills and machine shops. Other important cities served in this densely populated section are Gifu, Yokkaichi, Toyohashi and Nara. Gifu is well known for its manufactured products, which include lanterns, fans, parasols, silk crepe and the remarkably tough Mino paper that is much used in building construction. Yokkaichi is an important port on Ise Bay.

Nara is one of the oldest cities in Japan. Its history dates back to the year 710. For a time it was the capital of the Empire. It has long been known as the center of Japanese art and culture.

The Kyushu district served by the Toho system embraces that part of the Island of the Kyushu extending from Nagasaki, the principal commercial port of southern Japan, along the western coast through the heart of the Fukuoka mining district up to Shimonoseki, the important gateway to Chosen.

Fukuoka, the center of the Company's activities in this district, is the largest prefecture of Kyushu. It is the mining center of the Island.

The great industrial plants and rapidly increasing population of the territory served by the Toho system afford an ever increasing diversified market for electric light and power.

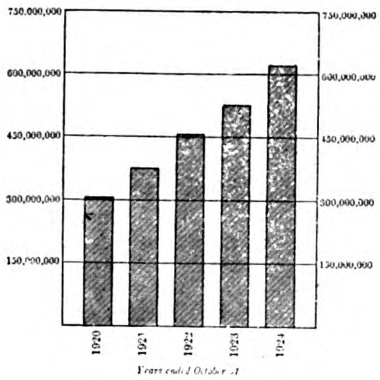
Growth

During the last four years, the quantity of electric energy sold by the properties of the Toho system has more than doubled.

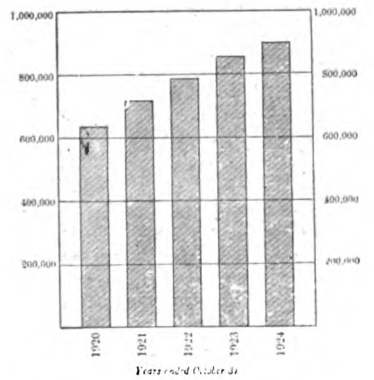
Kilowatt-hour sales to lighting customers have increased approximately 95 per cent. since 1920. This remarkable increase has even been exceeded by sales to poor consumers, which have increased more than 110 per cent. during the same period.

The consistent increase in total sales by properties now constituting the system and the number of customers served is graphically illustrated in the following charts:

Electric Sales in Kilowatt Hours



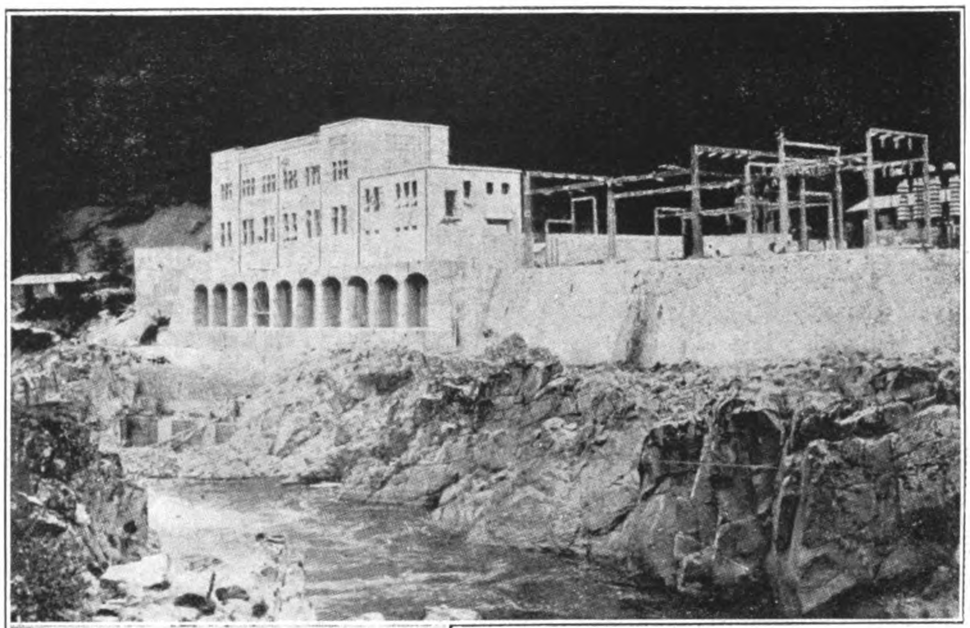
Number of Electric Customers



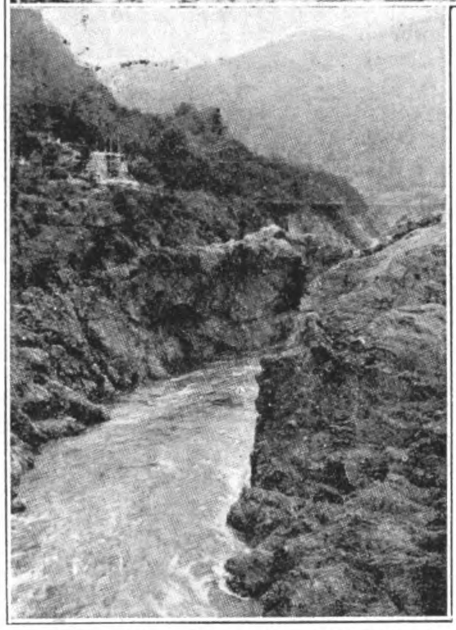
More than 90 per cent. of the total number of households in the districts served are now customers of the Company.

The diversity of market provided by nearly 900,000 customers minimizes load fluctuations and tends to insure a continuity of steady demand.

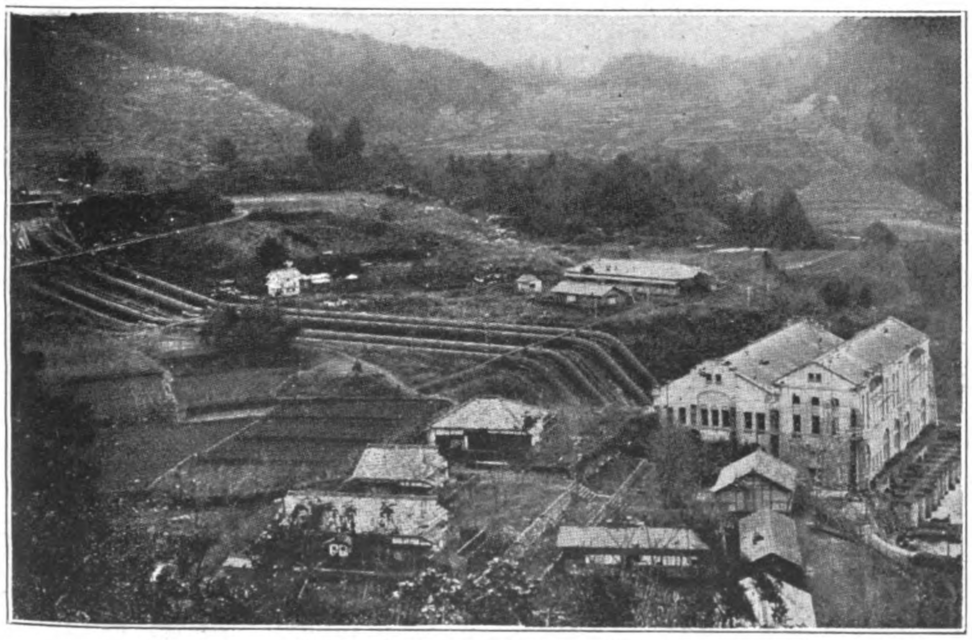
Per capita consumption is still low and a considerable amount of new business awaits the installation of additional generating and distributing facilities.



Hichiso Hydro-Electric Station on the Hida River



Shimoaso Power Plant Site, Hida River



Yaodzu Hydro-Electric Power Station

New Generating Stations

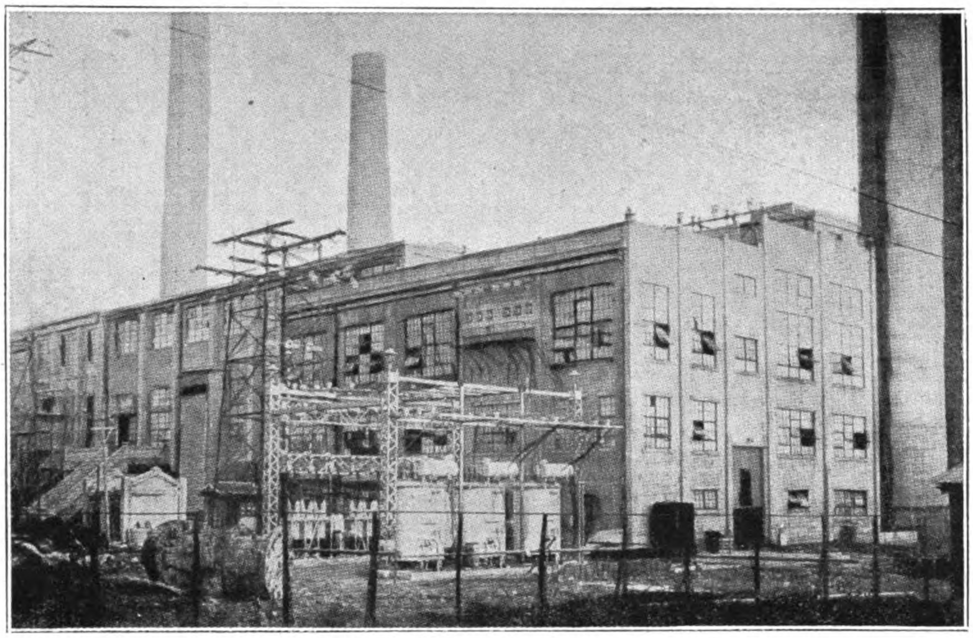
In the Kansai district of central Japan, suitable sites for hydro-electric development abound. As might therefore be expected, the greater portion of the energy distributed by the Toho company in this territory is generated in water-plants. Owing to the fact, however, that there is in most cases a considerable variation in the amount of water available for power production, maintenance of adequate service in the Kansai district is better assured by supplementing hydro-electric plants with steam stations.

The 35,000 kw. initial installation in the new Nagoya steam station should be in regular operating service before November 1, 1925. It will assist in caring for possible power shortages during the low water season and provide reserve capacity for peak-load demands.

On the island of Kyushu where Japan's main steel and iron district are located, hydro-electric sites are relatively scarce. The chief coal deposits, however, are found in this island and in consequence steam stations play a more important part there than in the rest of Japan.

Including the additional 20,000 kw. now being installed in the Nashima steam plant, approximately 83 per cent. of Toho's generating capacity in the Kyushu districts is installed in steam stations, located in the center of the coal mining district. The Company's properties now owned or under construction include electric generating stations with a total installed capacity of 147,563 k.w., of which approximately 30 per cent. are hydro-electric. The Company also controls an additional 79,250 kw. under favorable contracts, principally with closely affiliated companies. Other property owned or under construction includes sub-stations with a total capacity of 294,352 kva. and more than 8,200 miles of transmission and distribution lines. All of the properties have been maintained in first class operating condition.

As is usual with Japanese electric distributing companies, the Company also often owns fixtures and appliances used by its customers in somewhat the same way as telephones are owned by the telephone companies in the United States.



Nashima Steam Power Station

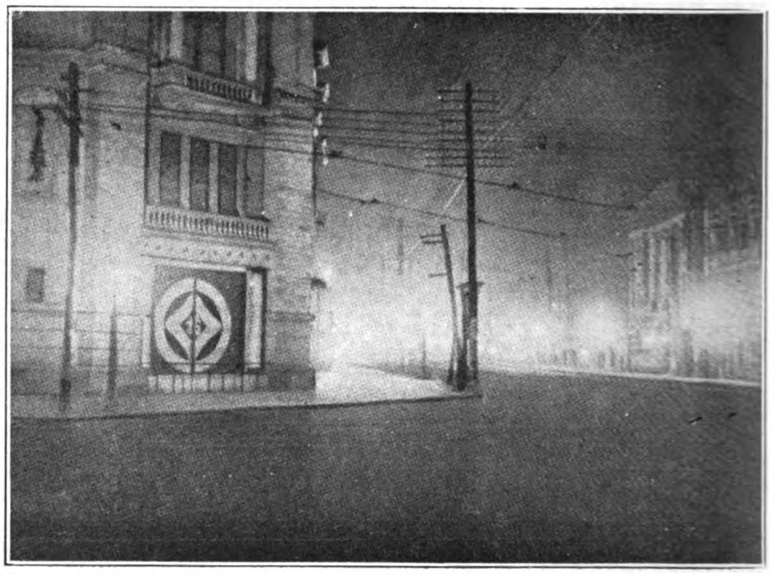
electric companies. The contract with the Great Consolidated (Daido) Electric Power Company, Limited, the largest of such companies, provides that Toho Electric Power Company, Limited, is entitled to receive power in preference to all other companies operating in its territory until 1948 and is subject to renewal thereafter.

Japan is a long and narrow country with a backbone of high mountains, a plentiful rainfall, numerous lakes, and many rivers falling rapidly to an extensive coast line. Its abundant water-powers are therefore capable of economical exploitation.

Hydro-electric stations of the Toho company have a present installed capacity of approximately 50,000 kw. In addition to its already developed water-power concessions, the Toho system controls valuable undeveloped water powers capable of developing an additional capacity of more than 138,000 kw.

Financial

The rapid and consistent increase in the

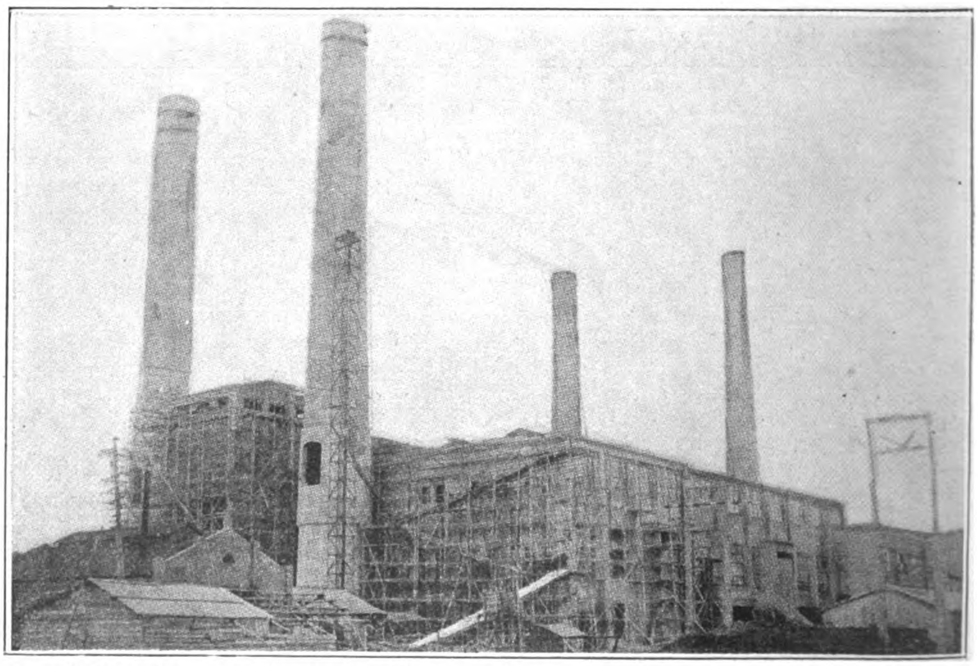


Nagoya's Well Lighted Thoroughfares

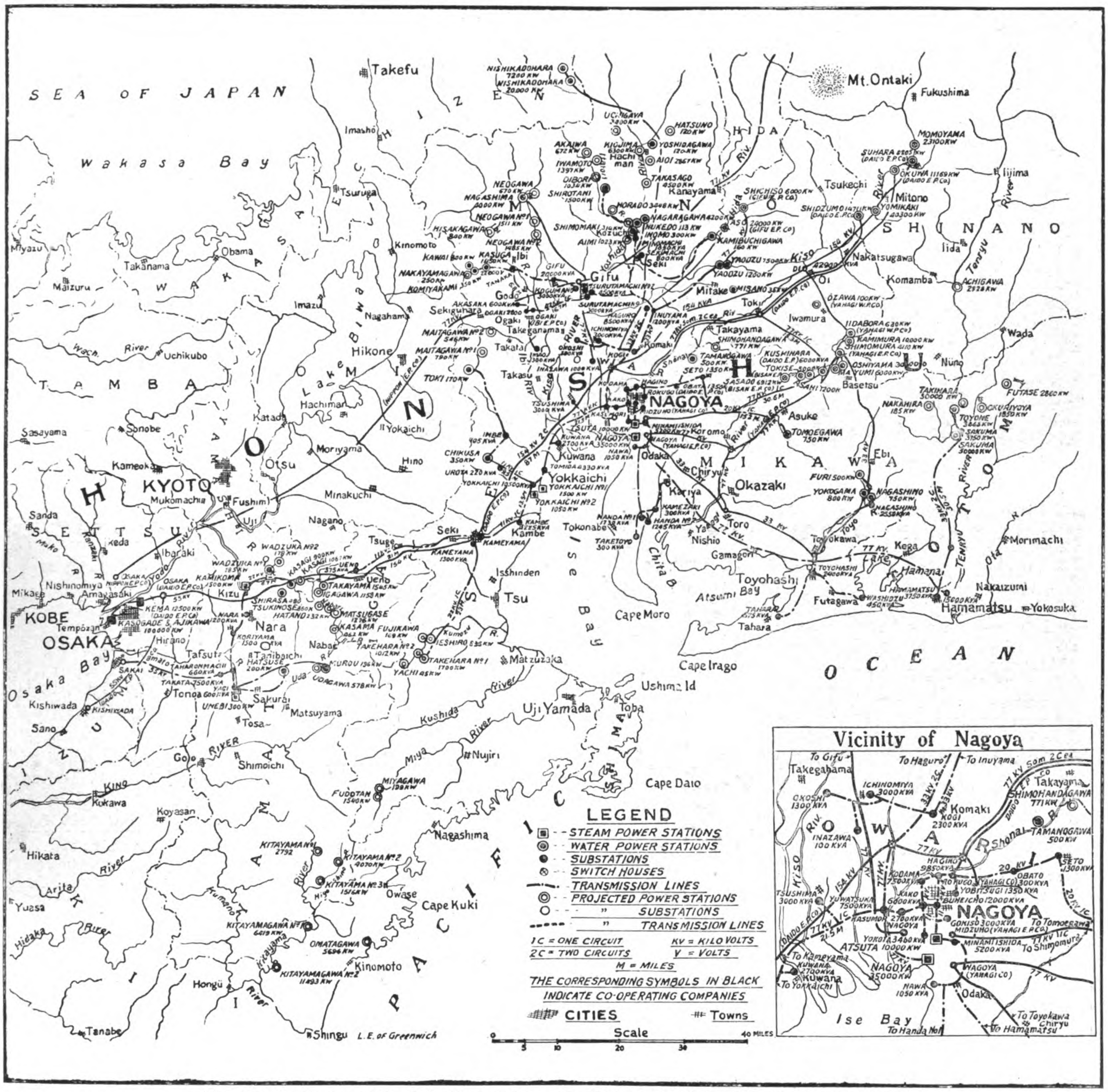
The present depreciated value of the physical properties of the Company, including the new Nagoya steam electric generating station now being built, has been estimated by independent engineers to exceed $47,000,000.

The Company also has investments, with a present indicated market value of approximately $17,900,000, in seventeen other utility companies, many of which are operated under the supervision of the Toho company. These affiliated companies comprise eight electric generating and distributing companies, three street railway companies, four electric apparatus manufacturing companies one gas and electric company and one artificial gas company—The Toho Gas Company—which represents the largest single investment in this group of companies. Through this modern and successful coal-gas property the Toho company controls the entire gas business in Nagoya.

Another substantial investment consists of stock of the Great Consolidated (Daido) Electric Power Company, Ltd. About half of the energy distributed by the Toho company is purchased under renewable contracts with, and upon favorable terms from, nine neighboring hydro-



Nashima Steam Station showing Extension for new 20,000 k.w. unit. Photographed November, 1924



Map Showing System of the Toho Electric Power Co., Ltd., in the Kansai District, February, 1925

gross operating earning of the properties now constituting the Toho system is indicated by the following figures :

12 Months ended October 31	Gross Operating Earnings	Operating Expenses, Maintenance, Taxes and Depreciation	Gross Income (including Other Income) Available for Interest
1921*	$9,223,695	$6,745,059	$4,958,725
1922**	10,375,384	6,970,067	5,455,439
1923	13,267,779	8,577,003	6,376,850
1924	14,654,383	9,645,512	7,174,839

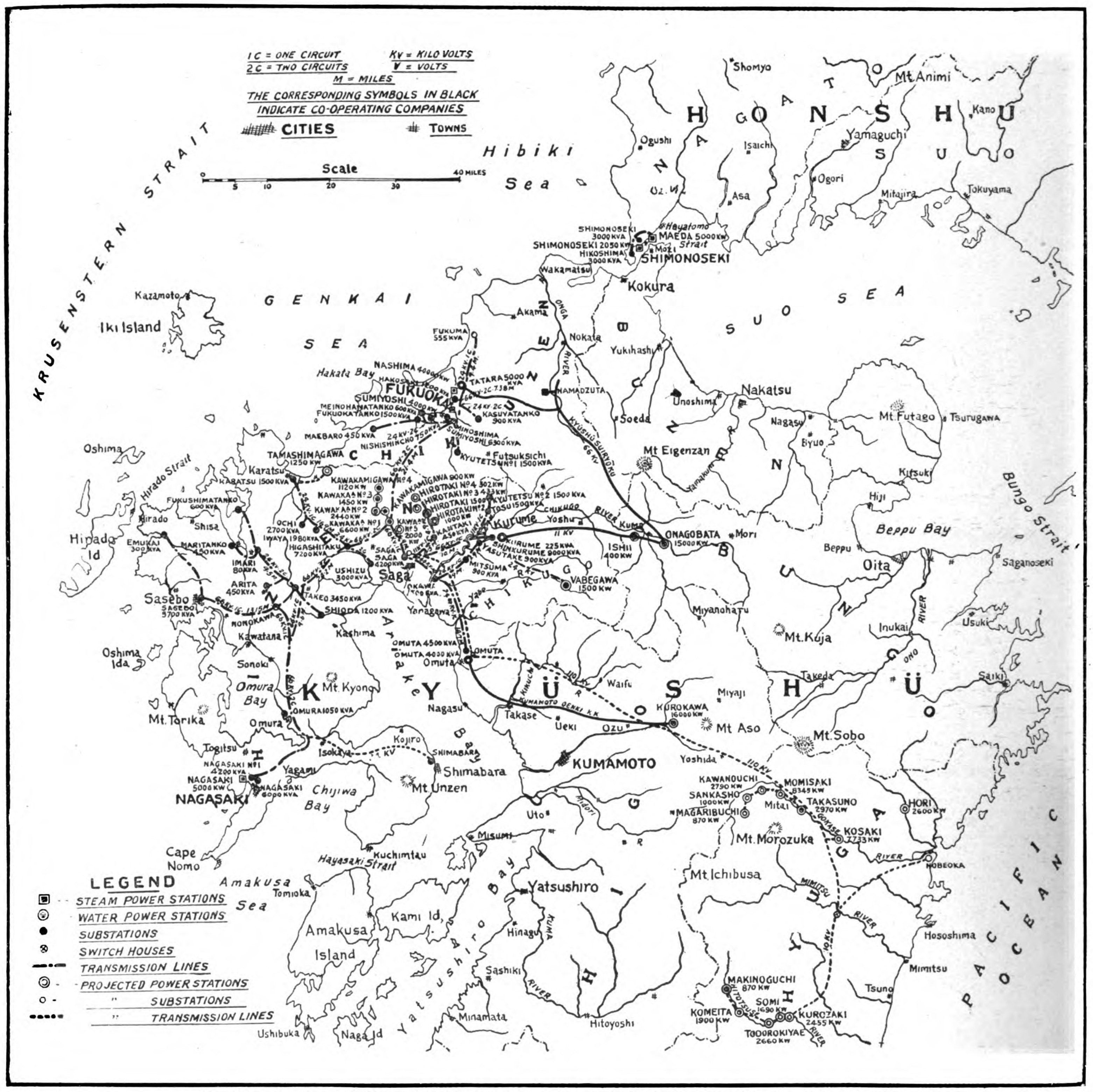
*12 months ended November 30.
**11 months ended October 31.

The above figures for 1921 and 1922 have been taken from the Company's books and have been approved by the shareholders. The 1923 and 1924 figures shown above have been audited by Messrs. Harold Bell, Taylor & Company, Chartered Accountants of London and Japan.

During the period embraced in the foregoing table operating expenses have decreased from approximately 73 per cent. to less than 66 per cent. of gross operating earnings.

The above financial results have been obtained under the Company's present management. With the experienced counsel of Mr. Momosuke Fukuzawa, Honorary President and Advisor to the Board of Directors, and under the direction, of Mr. Yataro Itami, a member for the House of Peers and President of the Toho company, the active management of the Company's affairs is supervised by Mr. Yasuzaemon Matsunaga, Vice-President and General Manager. Before assuming his present duties in 1922 Mr. Matsunaga served as a managing director of the Kyushu Electric Power & Traction Company. His outstanding success in the management of those properties, which now form a substantial portion of the Toho system placed him among the foremost Japanese utility operators.

Prior to 1925, development of the Toho properties had been entirely financed in Japan, principally through sale of capital stock. Paid-up capital stock increased from $17,362,700 on November 30, 1918, to $51,102,112 by October 31, 1924.



Map Showing System of the Toho Electric Power Co., Ltd., in the Kyushu District, February, 1925

New Financing

In March, 1925, there was announced an American offering of $15,000,000 First Mortgage (Kansai Division) Sinking Fund 7 per cent. Gold Bonds, Series A, maturing on or before March 15, 1955.

Proceeds of these bonds are to be used for the retirement of all outstanding bills payable, for the completion of the Nagoya steam station now under construction and for the purchase and installation of other new plant and equipment.

The Toho company also has recently arranged a twenty-year 5 per cent. sterling loan to the amount of £300,000, to be issued in London and guaranteed by the British Government under the provisions of its Trade Facilities Act.

Remodelling Motor Liner for H.A.L.

Built to the order of the Holland-America Line, for their Dutch East India service, the motor liner *Dinteldijk*, has just sailed from Belfast at which port for some weeks she has been having additional insulation space fitted as well as a number of other improvements, by Messrs. Harland & Wolff, Ltd.

The vessel, which is classed 100 A.I at Lloyd's is 502 feet long 62-ft. wide, and 39-ft. 6-in. deep, with a gross tonnage of about 9,400. She is equipped with two of the well-known Harland B. W. 8-cylinder motors, which are now in their fourth year of service in this vessel, and running with the greatest regularity and economy. There are four main electrical gearing sets, each of 100 k.w. at 200 volts, driven by three-cylinder Diesel engines, and some 700 lights are installed throughout the vessel in addition to six 2,000 candle power lanterns for illuminating the decks when working cargo. The steering gear, windlass, and 15 winches are all electrically driven. The refrigerating plant has been supplied and installed by Messrs. J. E. Hall, Ltd., of Dartford.

A sister vessel—the M. V. *Drechtdijk*—is also expected at Belfast shortly to have additional insulation space and refrigerating machinery provided and to receive a general overhaul.

International Trade in Cement

By Reigart M. Santmyers

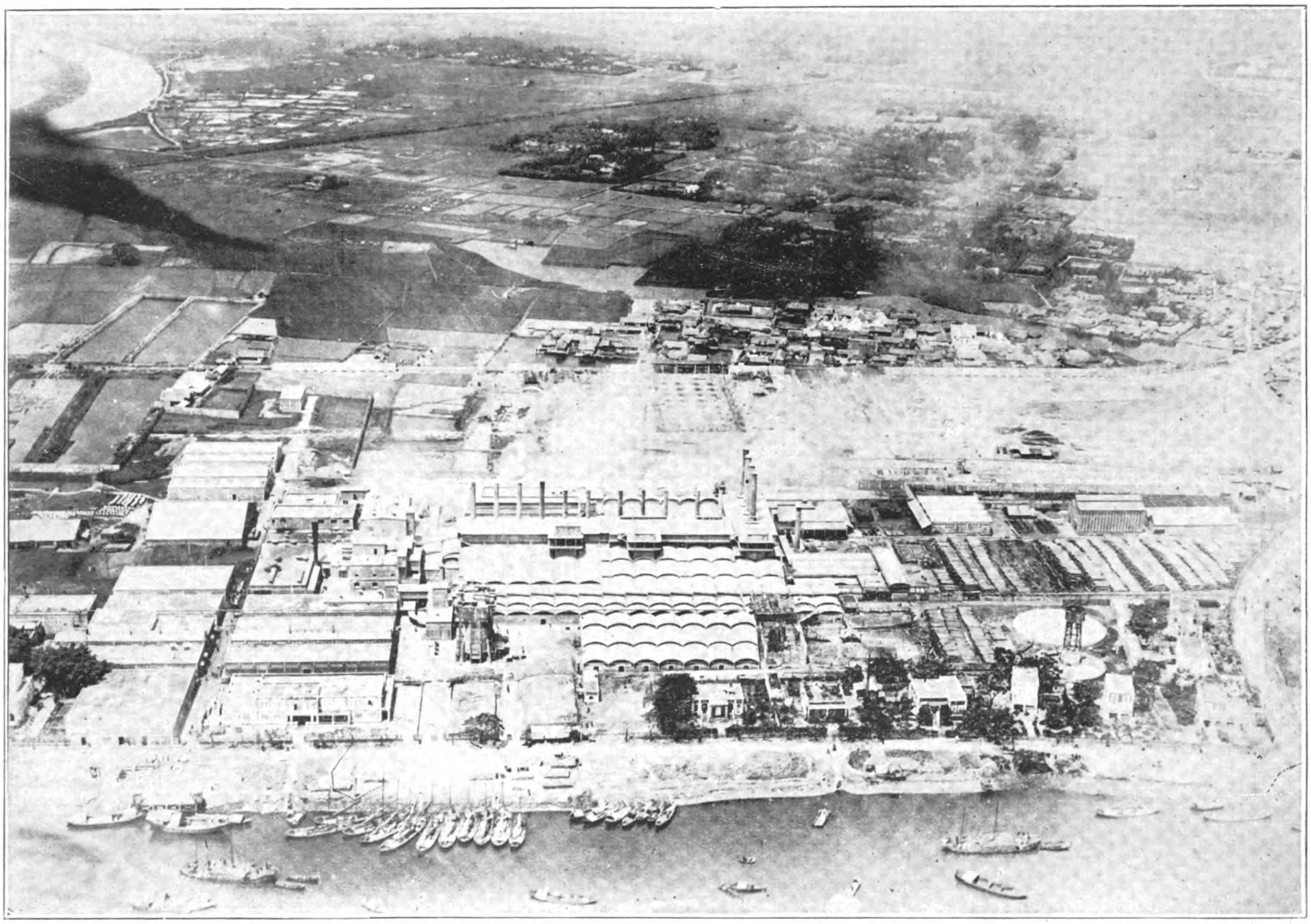
FOR centuries the major part of the structures in China (private homes as well as public buildings, bridges, etc.) have been constructed of brick and stone, as timber is scarce and, as a general rule, more expensive and less durable than any other material. Ordinary lime mortar (lime and sand with water) has been in use for binding these materials.

Within recent years modern Portland cement has become available in large quantities and is being quite generally used in the treaty port cities of China (those opened to foreigners for residence and trade) in the building projects of Chinese as well as foreigners. It is also being used by railroads in their bridge work and is being distributed more and more for use by the natives in the interior cities.

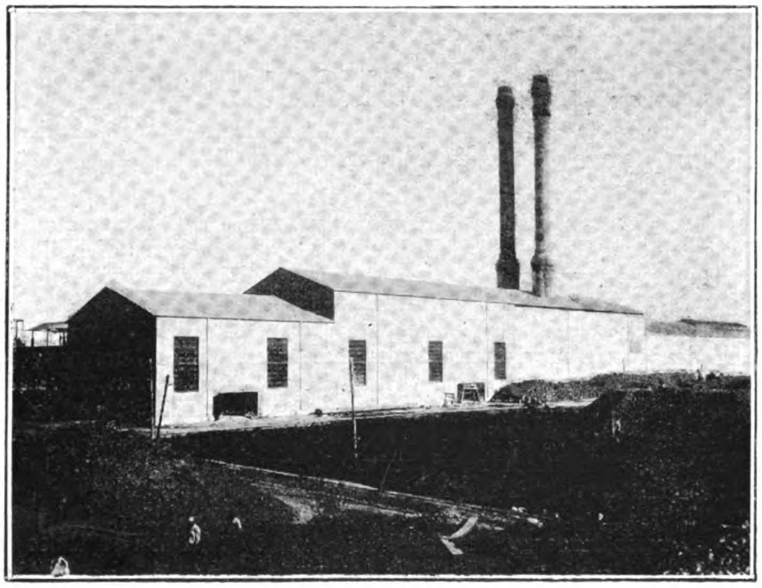
At the present time the amount of cement produced is not sufficient to supply the demand, and importations are being made from Japan and from French Indo-China. Consideration has even been given to the question of bringing in cement from the recently constructed plant at Singapore, whereas formerly considerable cement was exported to the Dutch East Indies and the Straits Settlements.

With the development of China along occidental lines, there is increased construction of the Western type of residences, large office buildings, and hotels in the cities where foreigners reside. Many new industrial plants have also been constructed and others of modern type are being projected. There has been a very remarkable increase within the last few years in the desire to modernize the larger Chinese cities by tearing down the walls of buildings and constructing wide modern streets on the sites, built so that they will bear automobile traffic. Cement is used to a considerable extent in this work. Port development projects are already under way and new ones are planned. New railroad construction is now going on, and with the impetus already given industrial development in China other new railway lines and industrial plants of various kinds will be under construction within a few years. This means an increasing demand for cement, and even to-day the Chinese supply is much below the normal demand.

It would seem that there is a remunerative field in China for one or more large modern cement plants in addition to those already in operation. The first requirement for such a plant—that is, a cheap supply of suitable coal—is, however, not available at present. There is an abundance of coal in China, but the deposits have not been extensively developed. The yearly output of coal in China at present is about 20,000,000 tons, of which 5,000,000 to 10,000,000 tons are produced by primitive native methods. This does not supply the present demand for household and industrial use, and consequently the price is high, ranging from $7 to $24 Mexican per ton, and the demand is steadily increasing. Under normal conditions such prices are prohibitive for cement making and the existing plants can operate profitably only on account of the prevailing high price of cement—$6.30 to $7.40 Mexican per barrel in Shanghai.



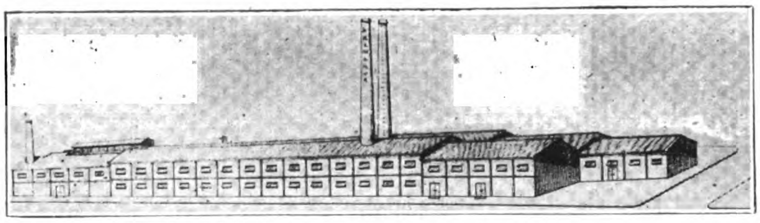
Aeroplane View of the Haiphong Cement Works in Indo-China



Exterior View of Plant at Lunghua

In considerating the erection of a cement plant in China the first step should be an investigation of the supply of raw materials. Available areas of suitable coal can be found, but a modern mine would have to be developed. This coal mine would have a market for its output in the demand from the cement plant associated with the mine and the normal open-market demand. Limestone and clay, strategically situated with reference to the fuel supply, could be located, and a cement plant could be erected in a situation where it should prove successful.

At the present time there are six Portland cement plants operating in China. These are located at Tonshan, Province of Chihli; Tayeh, Province of Hupeh; Tsankan, near Tsingtao, Province of Shantung; Canton, Province of Kwangtung; Kowloon, Hongkong leased territory; and at Macao. The estimated daily capacity, in barrels of 375 pounds, of the cement plants which, have been described, is as follows:



Main Mill Building for the Ta Hu Cement Works

	Barrels.
Tongshan	3,000
Tayeh	1,200
Shantung	300
Kwangtung	500
Macao (Green Island)	350
Hongkong	2,000
Total	7,350

This gives a total annual productive capacity, for all plants of 2,682,750 barrels.

Cement in China is packed in barrels with a net weight of 375 pounds or in sacks of 185 pounds. In some cases a rebate of $0.60 Mexican is allowed for the return of the barrel and $0.15 for the return of the sack. Prices are made at Shanghai, for this city is the central point to which Far Eastern cements are brought by water and meet in competition on equal terms. None of the above plants carries large stocks, and delivery of a 5,000-barrel order would have to be spread over a period of five to six months.

A cement plant, to cost $5,000,000 United State currency, is said to be projected for the Philippine Islands and some of the product may eventually find its way into the Chinese market. There is a modern plant owned by Chinese in operation at Singapore. Cement from this plant has not entered the Chinese market in quantity, but the possibility of putting it on this market in competition with other cements is under consideration.

The imports of cement into China from the United States have always been negligible in quantity as a result both of the greater cost of production and the expense of transportation. Owing to the high cost of shipment from abroad and also the lower cost of production in China, the tendency has been more and more to supply the demand by local manufacture rather than by import from foreign countries.

China Cement Manufacturing Co.—The following was taken from a Japanese newspaper and relates to the erection of a new plant for the manufacture of cement in the Yangtse Valley in China:

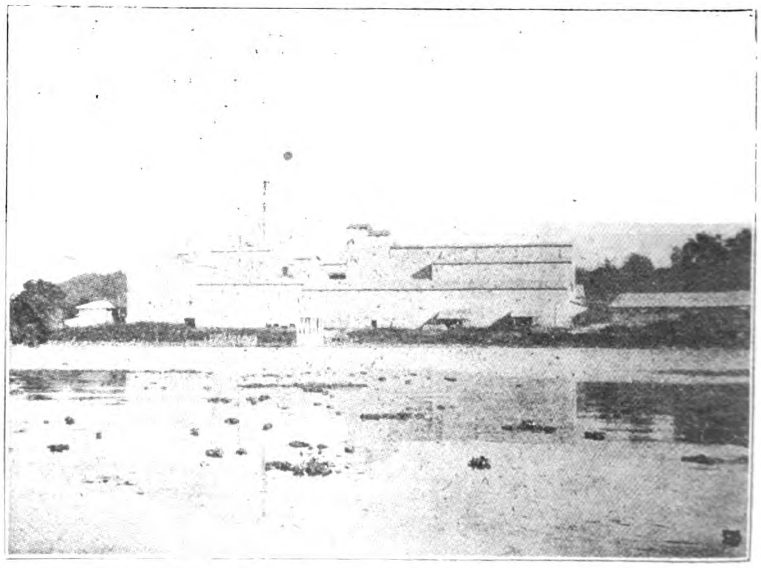
"The greatest demand for cement in China occurs in Shanghai, with Nanking in second place. These two cities are connected by both river and railroad. The transport of commodities produced in one to the markets of the other is quick and cheap, and as the greatest market possibilities exist in the Yangtse Valley it is the logical field of cement production. There are no plants now working in this district, but the China Cement Manufacturing Co. has almost completed its plant at Chuyung, a small village 34 kilometers from the city of Nanking, and expects to begin operations this year. The capital of the company, which will have its head offices at Shanghai, is 500,000 taels, equivalent approximately to $380,000 American currency. The works are being built at Tiger Hill, which is about a mile from the Shanghai Nanking Railway at Lungtan. A spur slightly over one mile in length has been constructed between Tiger Hill and Lungtan. The daily output of the works is estimated at 400 barrels of 375 pounds each.

"Unless the demand for cement increases more rapidly than it has during the past several years, the erection of the plant of the China Cement Manufacturing Co., the contemplated enlargement of the existing plants in other districts, and the completion of a new Shanghai plant, which has been started, will tend to greatly reduce the amount of imports from foreign countries and will probably lower the price of cement in all Chinese markets, where, owing to the increased demand, the tendency has been toward a steady advance during the past several years."

Shanghai Portland Cement Co.—The following statement was taken from THE FAR EASTERN REVIEW OF April, 1923:

"The Shanghai Portland Cement Co., was organized by the well-known Shanghai merchant, Mr. Liu Hong-son, a number of years ago. Mr. Pao Li-liu, the general manager of the company, traveled extensively throughout America and Europe and finally placed the order for the machinery with the Perruseus Engineering Works in Germany at a cost of over one-half million dollars. The total capacity of the plant is 1,200 barrels per day. The works are situated one mile from Lunghua and cover an area of about 100 mow (six mow equal to one acre) facing the Soochow Creek on one side and the Whangpoo River on the other.

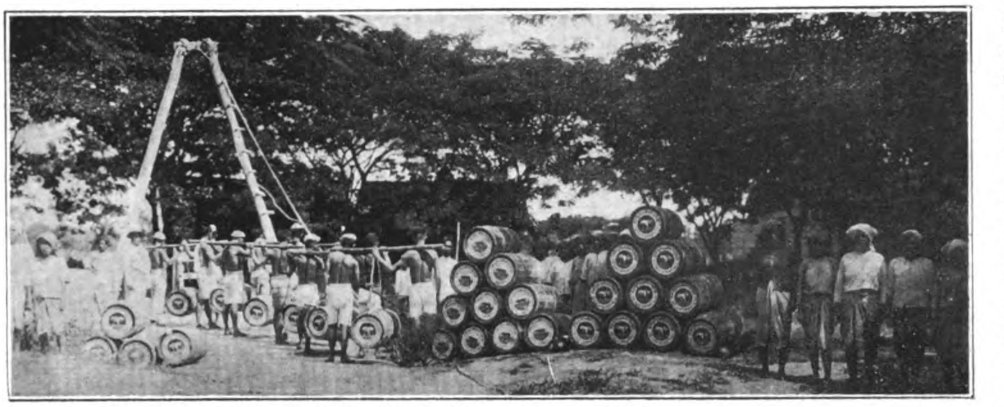
"The plan for main mill and power plant was designed by E. J. Muller, consulting engineer of Shanghai. The payment for the machinery was handled through the China Siemens Co. Con-



Rizal Cement Plant in the Philippines, Closed Down

struction work was started last spring and is expected to be in operation by the late autumn of this year."

China Portland Cement Co. (Ltd.).—This company was founded in the spring of 1921. The promotor is Mr. Yao Sing-kee, now managing director. Several sities were considered, but the present location at Lung Tan, with an abundance of raw material in the immediate neighborhood, was selected as the ideal one. The limestone in this locality is of very pure quality. The rocks are covered with thick layers of clay. Chemical tests showed that the combination of these two materials in a certain proportion produce a Portland cement of the very best quality. Some hundred yards away are coal mines which supply very cheap coal for the power station, but as it contains too much sulphur and ashes it can not be used in the kilns for manufacturing cement. The transportation of the raw materials is very economical, the deposits being higher than the factory and conveyed to it by gravity.



Native Staff of Siam Cement Works

Imports

The importation of cement into China for the years 1911 to 1914 averaged 93,219,000 pounds, valued at $485,660. Of this amount Hongkong and Japan shipped in about equal proportions—34,931,000 pounds, or 37 per cent., from Hongkong and 34,926,000 pounds, or 37 per cent., from Japan. Hongkong's exports of cement to China were valued at $172,612, or 36 per cent of the total imports, while Japan's was valued at $170,564, or 35 per cent. The United States played only a very minor part in supplying the cement needs of China, shipping in during this same period an average of about 4,000 pounds, or 4 per cent., valued at $79.

In the post-war years 1919 and 1920 Japan increased its exports to China by 403 and 261 per cent., respectively. Its shipments for the first year amounted to 140,799,000 pounds or 69 per cent. of the total cement imports of China (203,047,000 pounds), while in 1920 its exports dropped to 91,225,000 pounds, or 39 per cent. of the total. Hongkong in these two years sold China cement to the amount of 20,113,000 pounds and 33,667,000 pounds, or 10 and 14 per cent. of the respective total imports of cement.

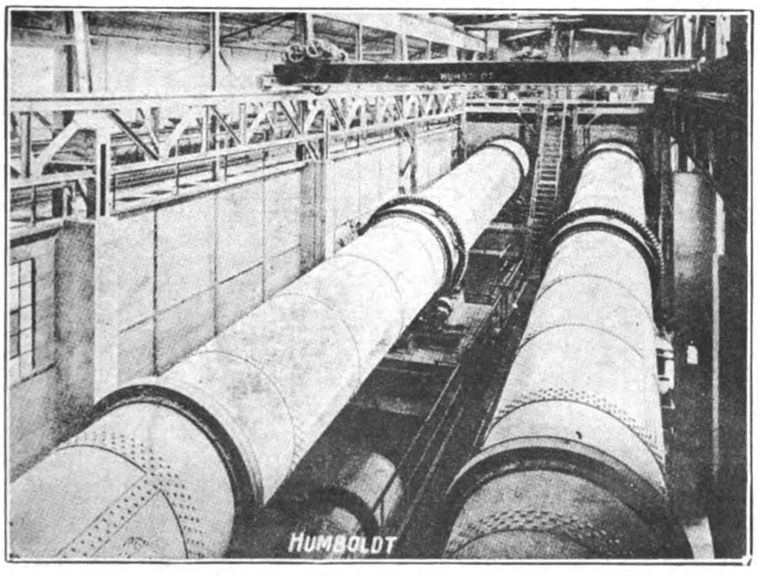
During 1921 and 1922 Japan again increased its exports to China, the shipments for these years being 129,630,000 pounds, or 38 per cent. of the total of 337,771,000 pounds, and 154,971,000 pounds, or 37 per cent. of a total of 423,734,000 pounds. Hongkong increased its exports to China of cement by 179 and 261 per cent., respectively, over exports of the period 1911-1914. For the first of these two years Hongkong exported 62,674,000 pounds, or 19 per cent. of a total import of 337,771,000 pounds of cement into China, while in 1922 she exported 91,331,000 pounds, or 22 per cent. of the total.

The United States steadily increased its exports of cement to China during the years 1919 to 1921. In 1919 it exported 34,000 pounds, or 0.02 per cent ; in 1920, 318,000 pounds, or 1 per cent. in 1921, 526,000 pounds, or 2 per cent ; and in 1922, 438,000 pounds or 1 per cent of the total importation of cement into China.

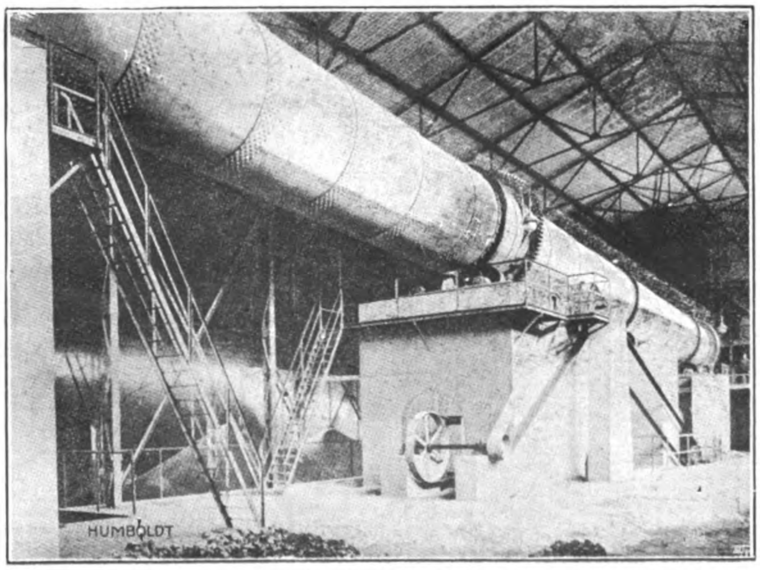
Value of Imports of Cement into China, 1911-1914

Imported from—	1911	1912	1913	1914	Average. 1911-1914
Hongkong	$241,127	$148,822	$96,561	$203,937	$172,612
Macao	28,397	11,075	17,996	26,069	20,884
Indo-China, French	44,962	41,371	57,867	49,537	48,434
Straits Settlements ...	55	37	—	141	58
British India... ...	—	51	83	16	37
United Kingdom ...	2,629	571	1,371	974	1,386
Sewden	—	160	—	—	40
Denmark	—	775	962	—	434
Germany	4,523	20,106	23,811	13,436	15,469
Netherlands ...	12	455	—	—	117
Belgium	1,342	2,809	977	3,397	2,131
Austria-Hungary ...	—	—	—	1,715	429
Russia	13,690	18,719	54,527	107,240	48,544
Chosen	16,281	49	105	28	4,116
Japan...	197,759	87,346	195,235	201,967	170,564
Philippine Islands ...	—	—	284	178	115
United States, Hawaii	—	26	108	182	79
All other countries ...	722	64	51	—	211
Total	551,499	332,385	449,938	608,817	485,660
Average price per 100 pounds	0.53	0.51	0.54	0.51	0.52

Source : Returns of trade and trade reports of China.

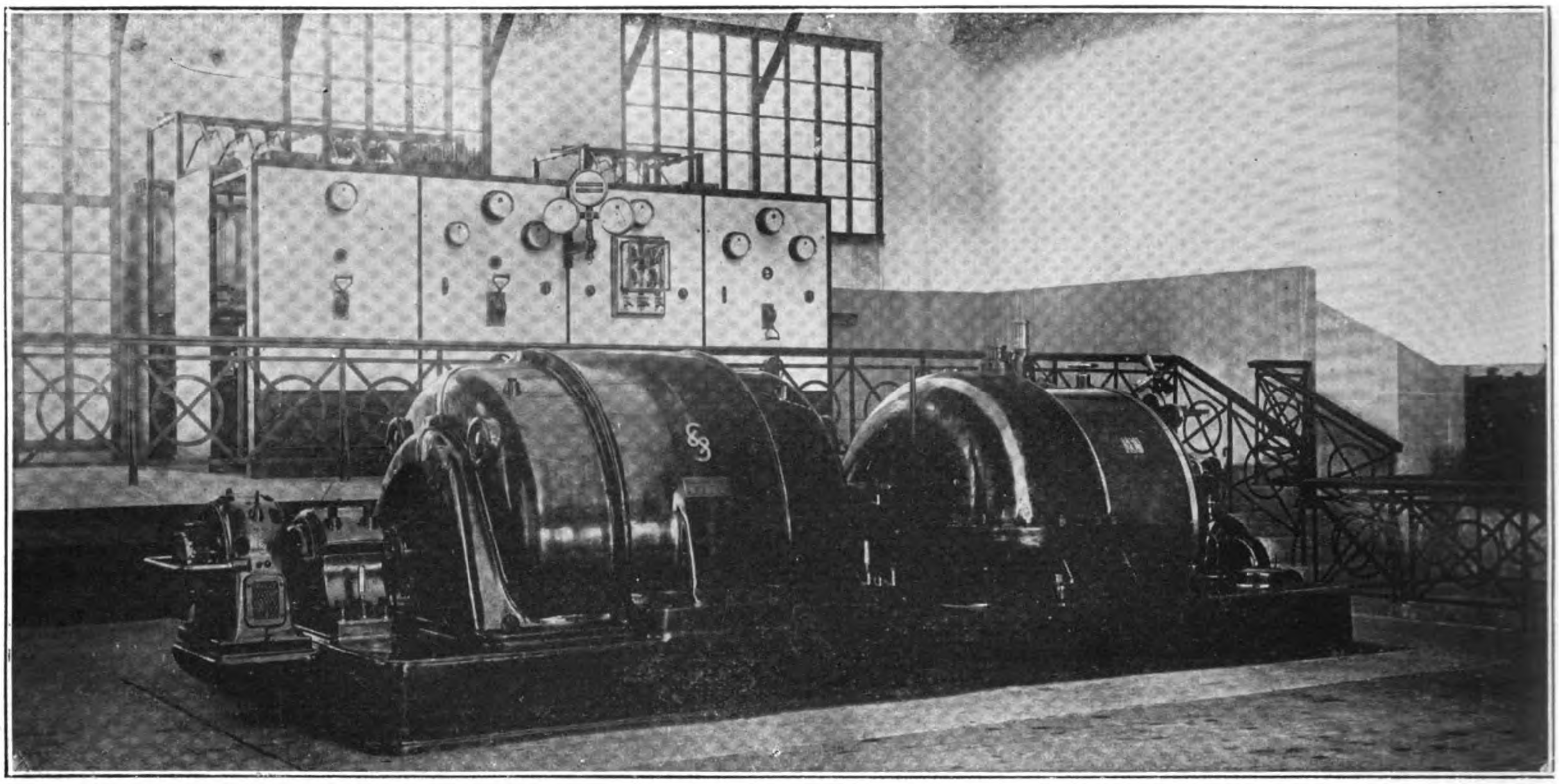


Kiln House with Travelling Crane



Electric Rotary Kiln

Humboldt Machinery in the Ta Hu Cement Works



Shanghai Portland Cement Works Power Plant, 2,000 H.P., M.A.N. Turbine Coupled to 1,440 K.W. 50 Cycles, 525 Volts Siemens Generator

IMPORTS OF CEMENT INTO CHINA BY QUANTITY, 1919-1922
(Quantities in thousands of pounds)

Imported from—	Average, 1911-1914	1919	1920	1921	1922
Hongkong	34,931	20,113	33,667	62,674	91,331
Macao	4,275	20,149	33,106	45,985	38,815
French Indo-China ...	8,539	14,618	42,993	56,291	83,641
Straits Settlements ...	16	—	2	88	1,187
British India ...	1	2	58	3	3
United Kingdom ...	142	145	101	31	238
Sweden	10	—	2	—	190
Denmark	98	—	—	100	1,498
Germany	3,251	—	—	34	1,236
Netherlands ...	27	—	—	—	—
Belgium	449	—	—	3	167
Austria and Hungary	94	—	3,732	—	—
Russia	5,599	6,518	1,130	220	983
Chosen	823	669	29,454	35,933	10,840
Japan...	34,926	40,799	91,225	129,630	154,971
Philippine Islands ...	18	—	—	4	33
United States, Hawaii	4	34	318	526	438
All other countries ...	16	—	1,062	6,280	38,163
Total	93,219	203,047	236,850	337,771	423,734

Source: Returns of trade and trade reports of China.

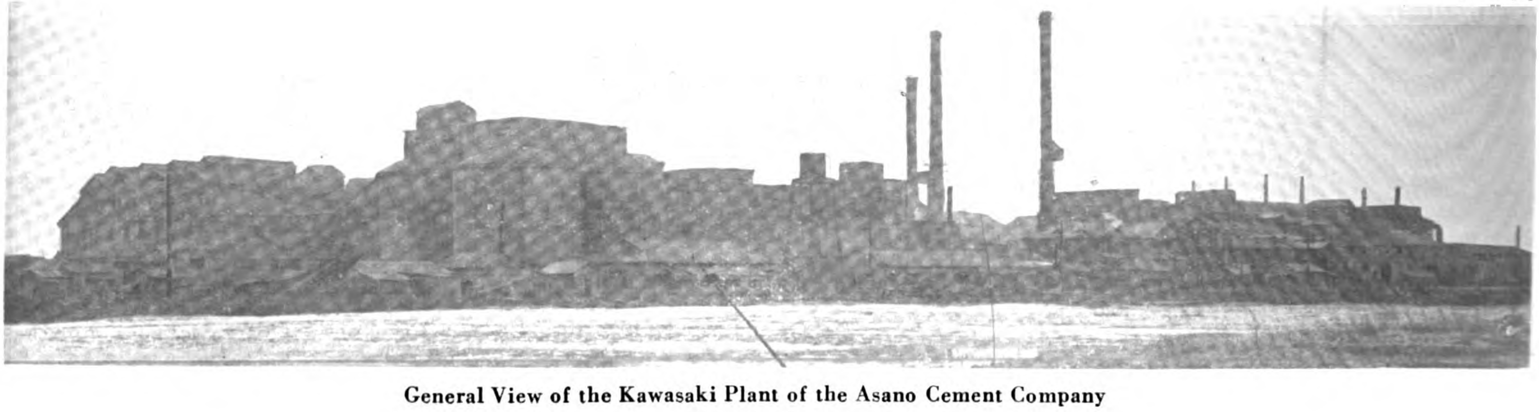
Philippine Islands

Extensive use of cement in the Philippine Islands and its excellent adaptation to construction in the Tropics, originally suggested the erection of a plant in the locality of Manila, and after investigation and the discovery of natural local resources of raw materials the Rizal Cement Co., was origanized in December, 1911. Factory equipment was secured from Europe, and the first cement was manufactured and placed on the market in July, 1915. The plant produced annually about 313,000 barrels, the importation of foreign cement declining greatly. In the second year of production only 100,000 barrels was turned out, and in 1918, When the company was forced to liquidate, it produced only some 50,000 barrels.

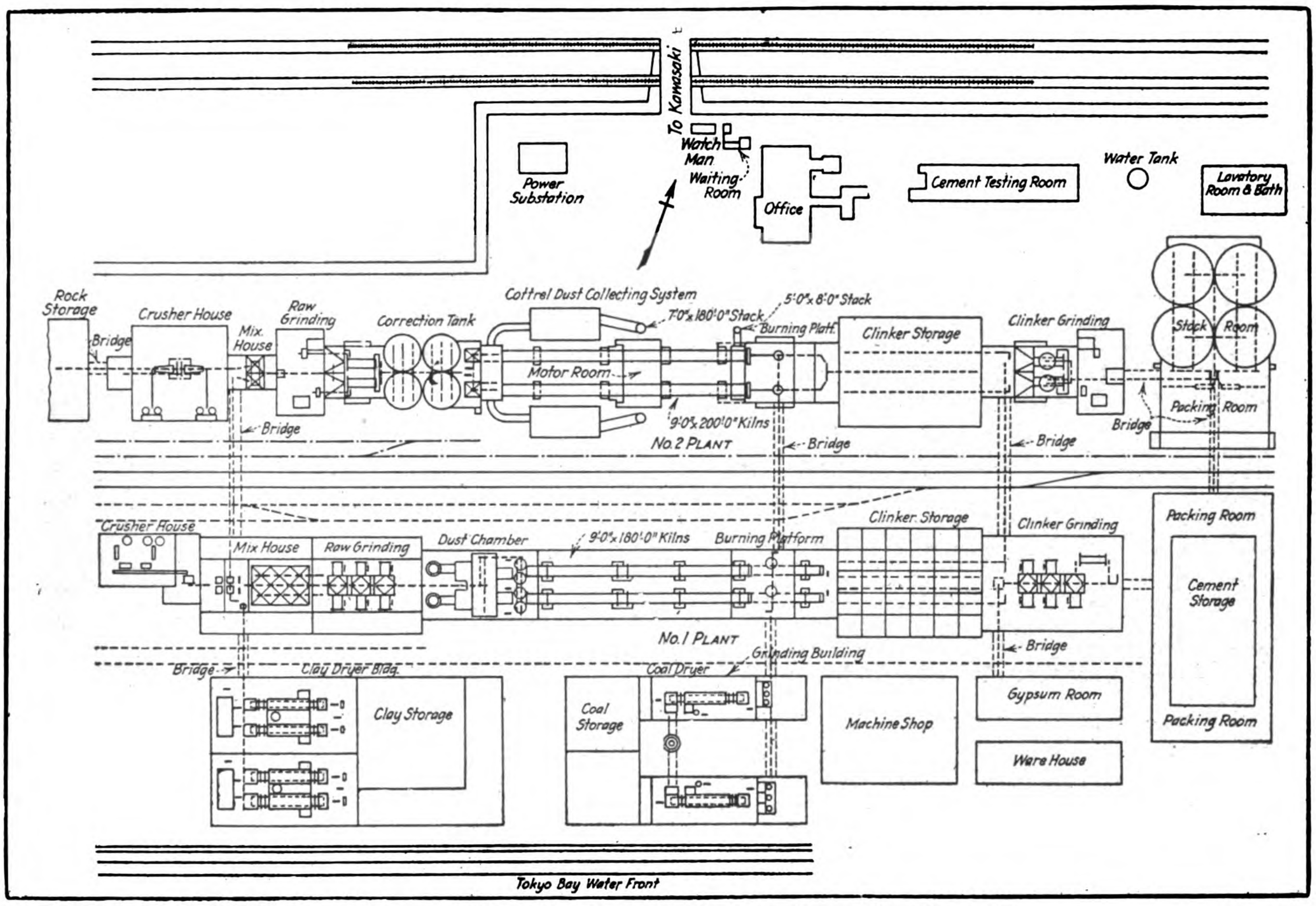
A bill authorizing the organization of a national cement company with a capital of 500,000 pesos was placed before the Philippine Legislature in February, 1919, and was passed with little or no opposition in March of the same year. Nothing further has yet been accomplished, but it is expected that as soon as the National Coal Co., reaches the stage where it will be capable of supplying a large cement plant the Government will take definite action.

Imports

The imports of cement into the Philippine Islands averaged 144,993,000 pounds, valued at $626,740, in the four pre-war years 1911-1914. Of this amount Hongkong exported 64,543,000 pounds

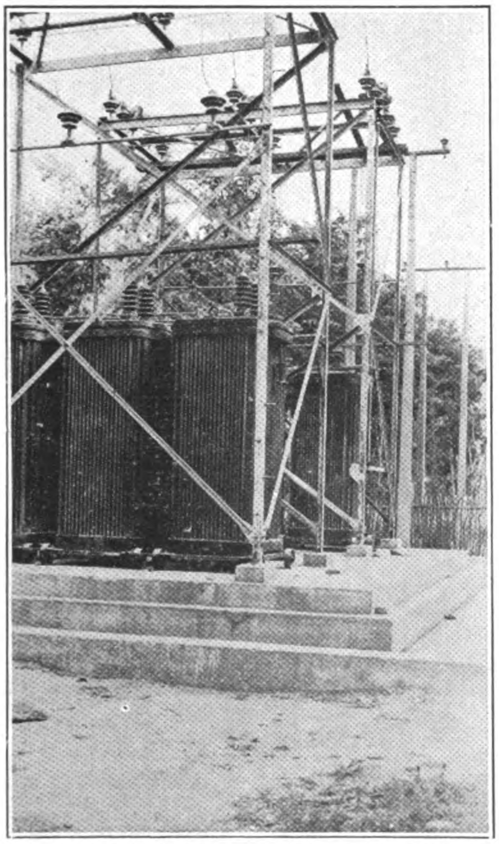


General View of the Kawasaki Plant of the Asano Cement Company



General Layout of Plants Nos. 1 and 2 of the Asano Cement Co. at Kawasaki

valued at $252.079, or 45 per cent. of the quantity and 40 per cent. of the value of the total import of cement. Germany during this period exported an average of 34,450,000 pounds, valued at $167,749, or 24 per cent. of the quantity and 27 per cent. of the value. The United States averaged some 3,842,000 pounds of cement during this period or about 3 per cent. of the quantity and 4 per cent. of the value of the total imports of cement into the islands.



Complete Station Showing 30,000 Volt Transmission Tower at the Chee Hsin Cement Works

In 1919 the imports of cement were about 76 per cent. of those of the four pre-war years, or 110,604,000 pounds. Japan furnished some 43,073,000 pounds during this year, or 39 per cent. of the total imports. The French East Indies was next, furnishing 38,766,000 pounds, or 35 per cent. The United States exported only some 78,000 pounds—a small very proportion when compared with the total.

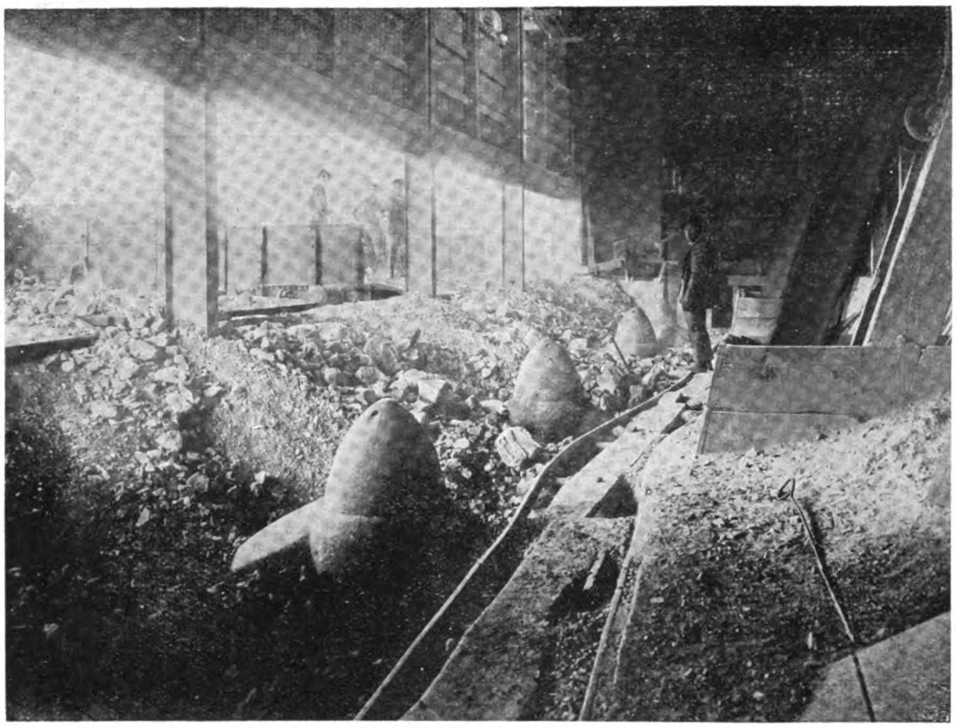
The Philippine Islands imported more cement during 1920 than in any other year covered by this report, the imports being about 31 per cent. higher than the average for the pre-war years. Of a total of 189,554,000 pounds of cement imported Japan furnished 137,575,000 pounds, or 73 per cent., while the United States exported some 10,554,000 pounds, or 6 per cent. of the total.

In 1921 the importations of cement into the islands fell to 109,119,000 pounds, or about 75 per cent. of the average imports during the years 1911 to 1914. Of this amount Japan exported 65,819,000 pounds, or 60 per cent of the total import. The United States exported 4,609,000 pounds, or 4 per cent.

The importations of cement into the Philippine Islands for the year 1922 amounted to some 115,354,000 pounds, or 80 per cent of the average imported in the four pre-war years from 1911 to 1914. Of this amount Japan exported 63,804,000 pounds, or 55 per cent. of the total importation, while the French East Indies, with 29,-666,000 pounds, or 26 per cent. was next in the quantity furnished to the islands. The United States exported some 2,726,000 pounds or 2 per cent. of the imports.

Value of Imports of Cement into the Philippine Islands

Imported from —	1911	1912	1913	1914	Average, 1911-1914
United Kingdom	$7,840	$1,906	$220	—	$2,986
Germany	16,432	80,271	416,844	$157,451	167,749
France	114	181	850	308	363
Austria-Hungary	67	—	—	—	16
Belgium	2,148	1,651	4,605	761	2,291
Russia	1,020	824	—	—	461
China	2,725	124	50,108	99,775	38,183
Hongkong ...	352,177	329,609	199,790	126,739	252,079
Japan	6,384	6,089	48,806	121,351	45,660
British East Indies	19	—	1,277	—	324
French East Indies	117,761	118,403	87,068	43,431	91,666
Spain	—	213	193	—	102



Allis-Chalmers Gyratory Crushers at the Kawasaki Plant

VALUE OF IMPORTS OF CEMENT INTO THE PHILIPPINE ISLANI S

Imported from —	1911	1912	1913	1914	Average, 1911-1914
United States ...	91,979	468	36	119	23,150
All other countries	—	—	1,895	4,947	1,710
Total	598,666	539,749	811,692	554,882	626,740
Average price per 100 pounds ...	.44	.37	.48	.43	.43

Source: Annual Report of the Insular Collector of Customs, Philippine Islands. Import values in the Philippine statistics represent foreign values; that is, actual market values or wholesale prices of imported merchandise, as bought and sold in the usual wholesale quantities at the time of exportation to the Philippine Islands in the principal markets of the country whence imported, and in the condition in which such merchandise is bought and sold for exportation to the islands or consigned to the islands for sale included the value of all cartons, cases, and coverings of any kind and all other costs, charges, and expenses incident to placing the goods in condition for shipment to the islands. Since the fiscal year 1911-12 Government supplies are included in the official statistics.

IMPORTS OF CEMENT INTO THE PHILIPPINE ISLANDS, BY QUANTITY, 1919-1922

(Quantities in thousands of pounds)

Imported from—	Average, 1911-1914	1919	1920	1921	1922
United Kingdom ...	436	16	6	6	12
Germany	34,450	—	—	—	3,048
France	75	—	—	—	5
Austria-Hungary ...	3	—	—	—	—
Belgium	835	—	—	—	—
Russia	102	—	—	—	—
China	8,280	11,558	9,301	9,061	—
Hongkong	64,543	8,905	15,999	2,369	8,202
Japan...	11,359	43,073	137,575	65,819	63,804
British East Indies ...	71	—	—	—	341
French East Indies ...	20,544	38,766	15,820	10,658	29,666
Spain	16	20	398	6	—
Canada	—	—	—	16,547	7,550
United States ...	3,842	78	10,455	4,609	2,726
All other countries ...	437	8,188	—	44	—
Total	144,993	110,604	189,554	109,119	115,354

Source: Annual Report of the Insular Collector of Customs, Philippine Islands.

Straits Settlements

The imports of cement into the Straits Settle-ements averaged some 423,108 casks (one cask contains from 380 to 400 pounds), valued at $1,033,138. Of this amount the United Kingdom and Hongkong exported about equal amounts—155-329 casks, valued at $377,669, from the former and 155,329 casks, valued at $383,597, from the latter. Their share in the import trade of the Straits Settlements was about 37 per cent. of the total.

Figures are not available for the imports of cement into the Straits Settlements for the year 1919, but in 1920 some 458,010 casks were imported, an increase of 8 per cent. over the average amount imported during the four pre-war years. Of this amount the United Kingdom exported some 134,585 casks, or about 29 per cent. of the total imports, while Hongkong exported 117,090 casks, or 26 per cent., and French Indo-China shipped 114,392 casks, or approximately 25 per cent of the total imports. The United States this year furnished about 935 casks of cement or less than 0.5 per cent. of the whole.

In 1921 the Straits Settlements imported 370,402 casks, or 88 per cent. of the average imports for the years 1911 to 1914. During this year Hongkong furnished 138,158 casks, or 37 per cent. of the total imports, while the United States exported only 375 casks.

VALUE OF IMPORTS OF CEMENT INTO THE STRAITS SETTLEMENTS, 1911-1914

Imported from—	1911	1912	1913	1914	Average, 1911-1914
United Kingdom ...	$345,758	$406,561	$449,536	$308,822	$377,669
Hongkong	185,189	465,086	297,542	413,573	383,597
Malay Peninsula ...	247	88	857	2,086	819
Austria-Hungary ...	26,637	15,726	10,247	2,901	13,878
Belguim	13,934	17,664	92,601	14,480	34,670
Denmark	96,367	170,014	275,026	143,766	171,293
Germany	5,862	11,834	52,471	6,200	19,092
French Indo-China	63	3,678	1,392	16,444	5,394
France	—	4,771	—	—	1,193
Dutch East Indies ...	37	9,207	15,888	5,984	7,779
Siam	—	258	258	—	129
All other countries ...	—	—	12,040	9,706	5,427
Total	874,094	1,102,616	1,207,858	947,983	1,033,138
Average price per cask	2.28	2.38	2.65	2.43	2.44

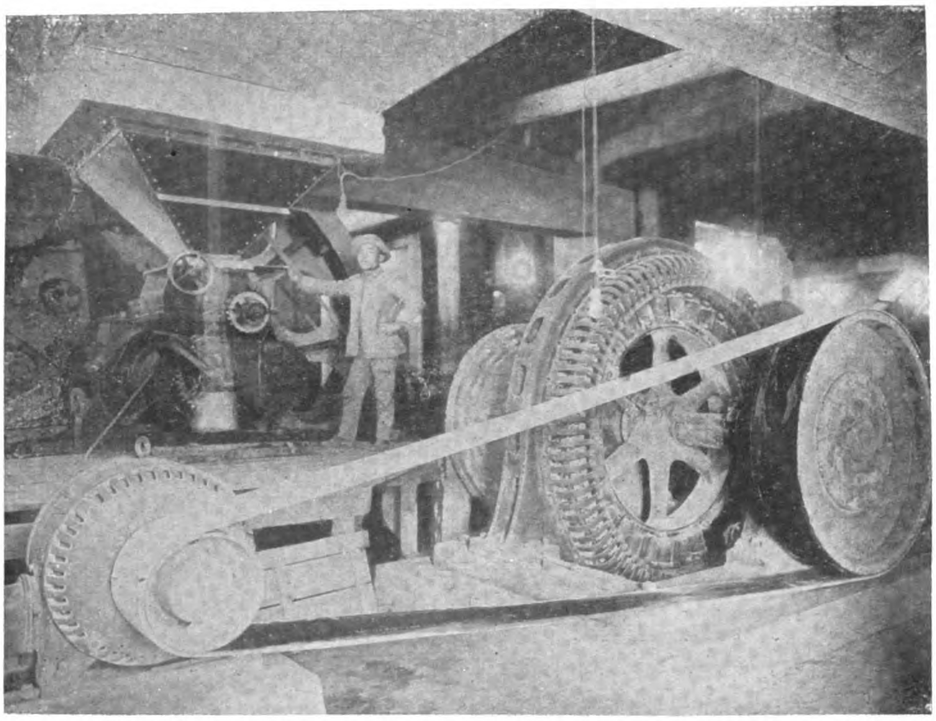
Source: Return of the Foreign Trade of the Straits Settlements.

IMPORTS OF CEMENT INTO THE STRAITS SETTLEMENTS BY QUANTITY, 1919-1921

Imported from—	Average, 1911-1914 *Casks*	1920 *Casks*	1921 *Casks*
United Kingdom	155,101	134,585	80,344
Hongkong	155,329	117,090	183,158
Malay Peninsula ...	317	1,771	464
Austria-Hungary	9,078	—	—
Belgium	14,701	419	3,571
Denmark	71,393	12,000	49,400
Germany	8,223	—	—
French Indo-China ...	2,858	114,392	38,000
France	462	—	33
Dutch East Indies ...	3,250	—	—
Siam	50	8,693	—
United States	—	935	375
All other countries ...	2,346	68,125	60,057
Total	423,108	458,010	370,402

Source: Return of the Foreign Trade of the Straits Settlements.

Note.—No detailed statistics are available for 1922 and 1923. According to the monthly summary of December, 1922 the total imports of cement during that year were 325,983 casks. For the three-month period January to March, 1923, the imports of cement totaled 170,705 casks. The Bureau of Foreign and Domestic Commerce is not imformed as to the weight of a cask of cement in the Straits Settlements. It appears probable, however, that the term represents the " barrel " of other countries and that the weight is between 380 and 400 pounds, probably about the latter figure. The bureau is not in possession of information as to the exact methods employed in computing values of foreign-trade statistics, but they are believed to be substantially the same as those in use in British India.



Allis-Chalmers Synchronous Motor (Driving Compeb Mill through Magnetic Clutch) with Belt Driven Exciter

Dutch East Indies

The Dutch East Indies imported an average of 487,957 barrels of cement during the four pre-war years 1911 to 1914. Of this amount the Netherlands furnished 275,752 barrels, or 57 per cent., and Germany 98,757 barrels, or 20 per cent. The United States did not figure in the import trade in cement in the Dutch East Indies during these years.

In 1919 the cement imports of the Dutch East Indies amounted to about 57 per cent. of the average pre-war figure, or 279,251 barrels Japan shipped the largest part of this supply—204,884 barrels, or 73 per cent. of the total importation—while the United States exported some 2,137 barrels, or less than 1 per cent. of the total.

In 1920 the Dutch East Indies increased its imports to 744,-176 barrels, or 53 per cent. more than the average amount imported for the four pre-war years. Japan furnished 407,465 barrels, or 55 per cent. of the total importation, while the United States figured to the extent of 11,954 barrels, or 1.6 per cent. The importation of cement by the islands in 1921 was 563,162 barrels, an increase over the average pre-war year of 15 per cent. Japan furnished the larger part of this—307,047 barrels or 55 per cent.—while the United States exported some 9,607 barrels, or 1.7 per cent. Values of the imports of cement are not shown in the Dutch East Indian official statistical reports for any of the years covered by this report.

Imports of Cement into the Dutch East Indies by Quantity, 1919-1921

Imported from—	Average, 1911-1914	1919	1920	1921
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*
Netherlands	275,752	430	10,374	38,269
United Kingdom ...	28,508	850	2,704	3,419
Belgium	63,867	—	7,498	1,341
Germany	98,757	10	2,000	38,212
France	2,055	—	—	—
Other Europe ...	860	—	—	—
China	—	44,883	11,250	31,241
Hongkong	1,779	22,111	134,552	35,784
Indo-China	4,000	3,850	16,319	10,465
Japan...	7,839	204,884	407,465	307,047
Denmark	—	—	15,507	14,169
Sweden	—	—	121,452	49,425
Italy	—	—	—	16,470
United States ...	—	2,137	11,954	9,607
All other countries ...	4,540	96	3,101	7,713
Total	487,957	279,251	744,176	563,162

Source : Voornaamste Handelsarlekelen op Netherlandsch Indies.

Siam

The imports of cement into Siam for the fiscal years 1910-11 to 1913-14 averaged some 47,553,000 pounds, valued at $213,135. Chochin-China furnished the largest part of this requirement, 22,610,000 pounds, valued at $89,641, or 48 per cent. of the quantity and 42 per cent. of the value. For this same period Denmark's exports averaged 16,712,000 pounds, valued at $82,841, or 35 per cent. of the quantity and 39 per cent. of the value. The United States exported an average of 199,000 pounds, valued at $1,258, or less than one-half of 1 per cent.

In the year 1918-19 Siam imported 42 per cent. of the average amount bought in the pre-war years above mentioned. The total import of cement for this year amounted to 19,998,000 pounds, of which about 19,762,000 pounds, or 99 per cent., came from Cochin-China. The United States exported about 58,000 pounds to Siam during this year.

In the year 1919-20 Siam imported 17,231,000 pounds, or only 36 per cent. of the average amount imported during the pre-war years. Of this amount Cochin-China shipped 17,181,000 pounds, or 99.7 per cent. the total imports. The United States did not figure in the cement trade of Siam during this period.

In the year 1920-21 Siam's imports of cement amounted to only 31 per cent. of the average of the four pre-war years, the lowest in any of the years covered by this report. Cochin-China supplied some 10,500,000 pounds, or 71 per cent. of the total. The United States shipped only about 7,000 pounds during this year.

Siam's imports of cement for the fiscal year 1921-22 amounted to 39 per cent. of the average pre-war figures, or 18,402,000 pounds, of which Denmark furnished 9,748,000 pounds, or 53 per cent. of the total import, while Cochin-China exported some 4,500,000 pounds, or 24 per cent. of the total.

Value of Imports of Cement into Siam

Imported from—	1910-11	1911-12	1912-13	1913-14	Average, 1911-14
Singapore	$148	$125	$719	$175	$292
Hongkong	32,148	44,848	17,784	24,929	29,927
United Kingdom ...	4,725	4,251	1,481	2,153	3,402
Germany	965	302	109	8,746	2,531
Denmark	64,557	56,543	97,649	112,616	82,841
Belgium	4,919	1,571	247	—	1,684
Cochin-China ...	61,928	91,297	98,978	106,362	89,641
China	—	112	753	445	327
Dutch East Indies	2,780	1,872	34	—	1,173
Netherlands ...	—	—	238	—	59
United States ...	—	—	—	5,031	1,258
Total	172,170	200,921	218,992	260,457	213,135
Average price per 100	.42	.42	.45	.50	.45

Source : Foreign Trade and Navigation of Siam.

Imports of Cement into Siam, by Quantity

(Quantities in thousands of pounds)

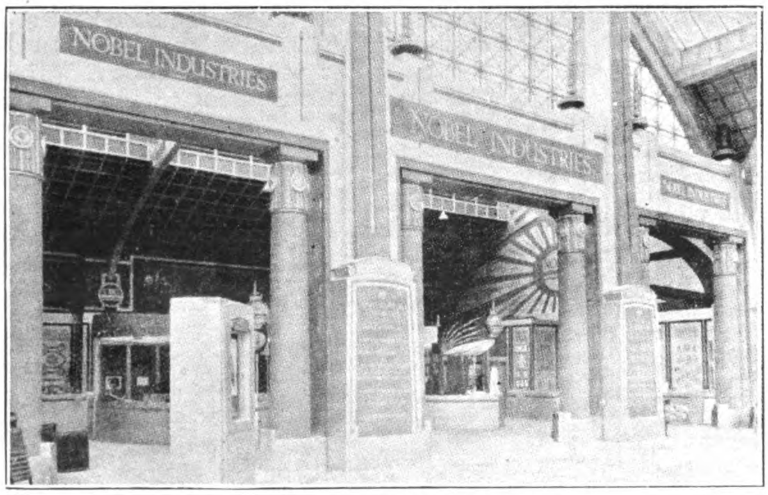
Imported from—	Average, 1910-14	1918-19	1919-20	1920-21	1921-22
Singapore	48	12	—	29	293
Hongkong	5,858	—	—	219	3,405
United Kingdom ...	442	164	41	26	55
Germany	283	—	—	—	—
Denmark ...	16,712	—	—	3,935	9,748
Belgium	886	—	—	—	—
Cochin-China ...	22,610	19,762	17,181	10,500	4,500
China	45	—	—	—	4
Dutch East Indies ...	461	—	—	—	397
Netherlands ...	9	—	—	—	—
Japan...	—	2	9	—	—
United States ...	109	58	—	7	—
Total	47,553	19,998	17,231	14,716	18,402

Source: Foreign Trade and Navigation of Siam.

Nobel at Wembley

Nobel Industries' Exhibit at the British Empire Exhibition, 1925, has been designed to show the whole range of the products of Nobel associated companies and also to give visitors an insight into the manufacture of certain products.

The exhibit embraces numerous types of explosives and gunpowders used for industrial purposes, propellent and disruptive explosives, brass cartridge cases, fuzes for shells, small arm ammunition, sporting cartridges (including an exhibit shewing their actual assembly), metal products in a raw and in a semi-manufactured condition, nails, gas mantles (the latter actually being made, lamps, new collodion products in the form of enamels and varnishes and the effects which can be produced with them; radiators, motor accessories, welding plant, leather cloth for all kinds of upholstery purposes, and many applications of the Lightning Fastener; samples of the fertilizers produced at factories in South Africa and Australia, as well as a variety of chemical products, are also included.



General View of Exterior of Nobel Bay

Nobel products contribute in a larger measure than is generally appreciated to the sum of commodities necessary for modern conditions of life.

For example, the importance of explosives in the development of industry will be appreciated from the fact that they are used for winning coal and metal ores from the mines of the Empire thus being the first agent in the provision of many materials fundamentally and economically necessary to humanity; semi-manufactured goods of non-ferrous metal, such as brass and copper rods, wire, hollow brass and copper ware, brass fittings of all sorts, collodion products, leather cloth and other commodities in the exhibit illustrate this point. Nobel's also own and operate a mint, and are therefore, equipped to execute coinage contracts for Overseas Governments.

Analytical, research and metallurgical chemists, mechanical and chemical engineers and other specially trained experts collaborate continuously in the development of the manufacture of these highly technical products; thus constant attention to the improvement of the quality of existing products, and to the development of new ones, has led to the name Nobel being recognised as the standard of quality throughout the world for the commodities with which it is identified.

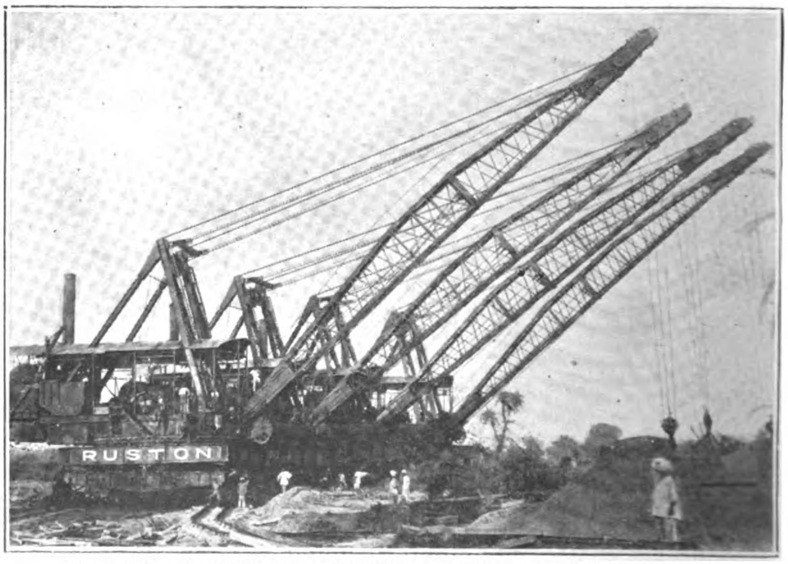
The British Empire Exhibition in 1924 and in 1925 has afforded an opportunity of presenting in concrete form particulars of the products of the associated companies of Nobel Industries in one composite exhibit, and arrangemeents have been made to present visitors with a specially designed medal minted in the coining press in the Nobel Bay in commemoration of this event.

Thornycroft Depot at Singapore

A new sales and service depot has now been established by Messrs. J. I. Thornycroft & Co., Ltd., at Singapore for motor vehicles, motor boats, marine engines and other productions of the company in the Malaya markets. After a lengthy experience in the works in England one of the company's representatives went out to Singapore to superintend their interests and the success of his efforts has resulted in the new depot with a capable staff

Thornycroft Sales and Service Depot at Singapore

of mechanics. Ample stocks of spare parts are carried and users of Thornycroft vehicles will have a first class service at their desposal. The enterprise of Messrs. Thornycroft in establishing depots in all parts of the world, cannot fail to instil confidence in minds of prospective purchasers and they are certain to reap their due reward in the shape of orders for motor vehicles.



Four of the Six 350 Tons "RUSTON" Machines supplied against the World's Largest Order for Dragline Excavators. These Machines are now working on the Lloyd's Barrage & Canals Construction Scheme preparing Waterways having a bed width of 280 feet, and their suitability is indicated by the order placed by the Director-General, India Store Department, for two additional "Ruston" Dragline Excavators.

The Electrification of the Java State Railways

THE construction works in connection with the railway electrification around the city of Batavia were originally planned to be started in 1918. Economical depression delayed the erection of these works which were begun not earlier than 1923 and at a slower rate than was initially intended.

The business section of Batavia is seven miles north from the residences Weltevreden and Meester Cornelis and about seven miles west of the new harbor at Tandjong Priok. On account of this wide distribution and of the necessity of rapid passenger transportation between these points, it has been decided to electrify the network of steam railroads connecting the various points of the district of Batavia. This electrification is to be considered as the first step of an anticipated extensive program, comprising several heavy trunk and mountain lines.

The first sections of the Batavia electrification consisting of a length of 15.6 k.m. (9.76 miles) double track, extending from Tand-

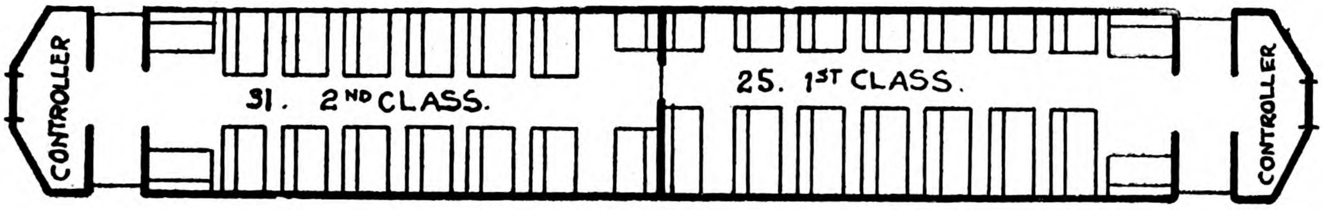


Fig. 1

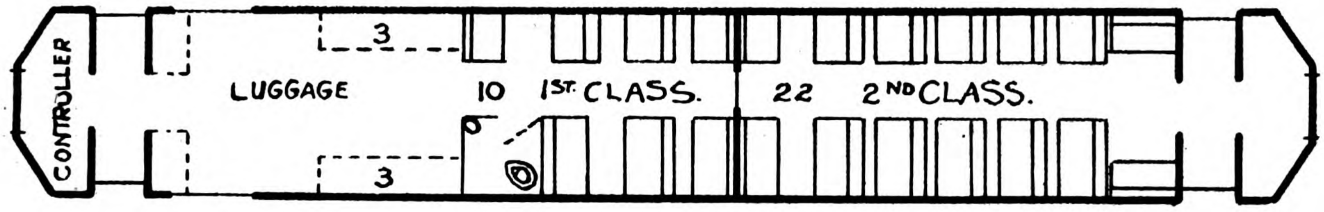


Fig. 2

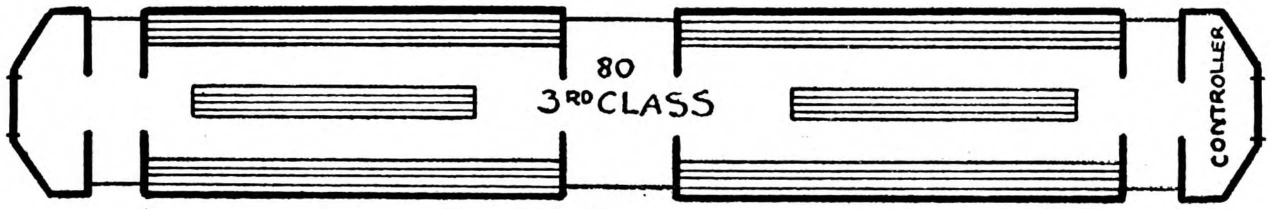
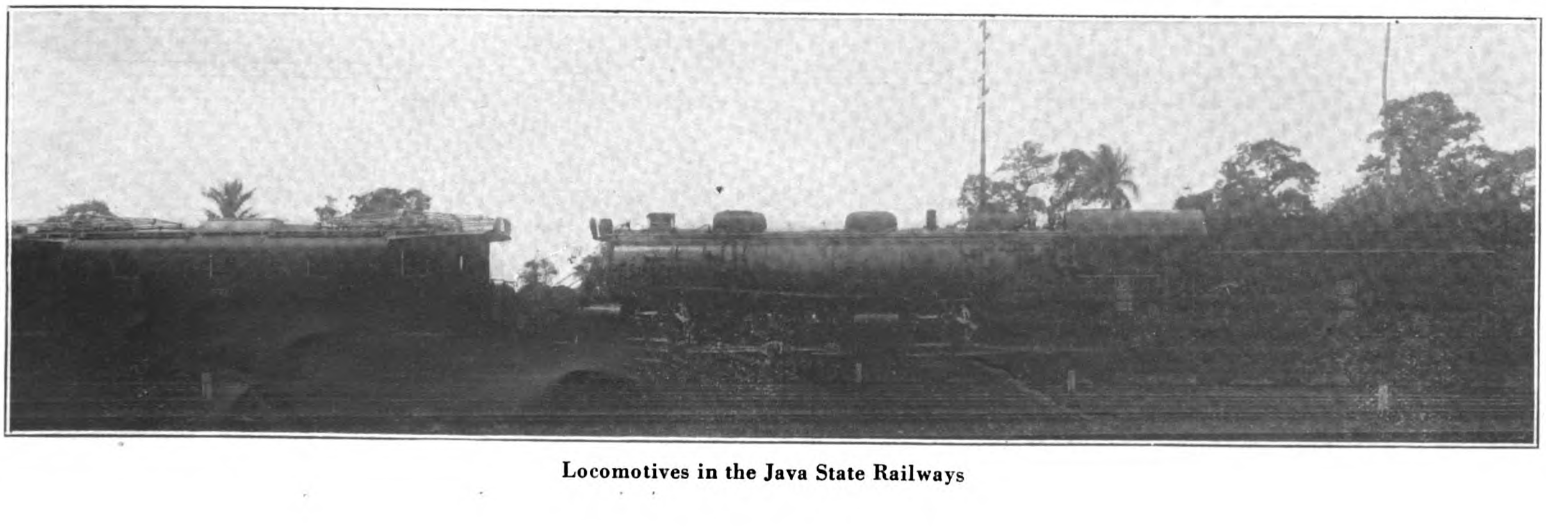
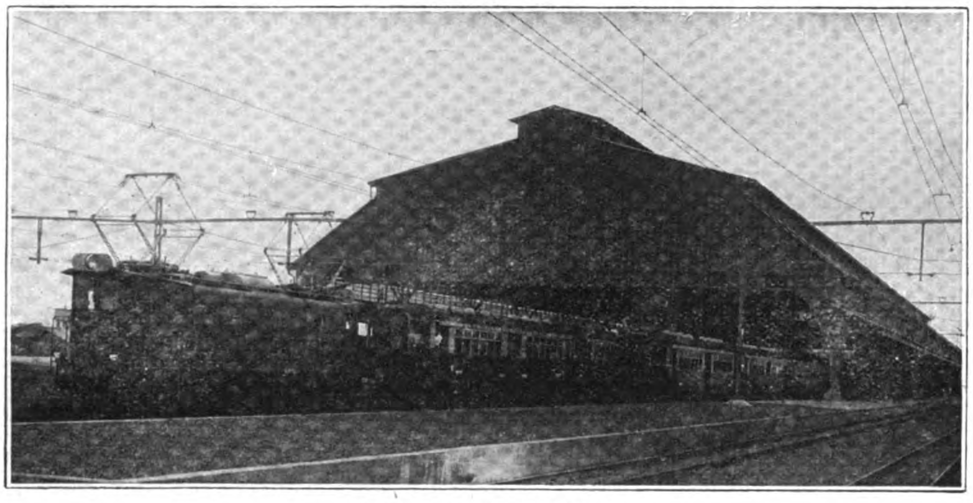


Fig. 3

440 to 500 H.P. Motor Cars with 44 ton Trailers

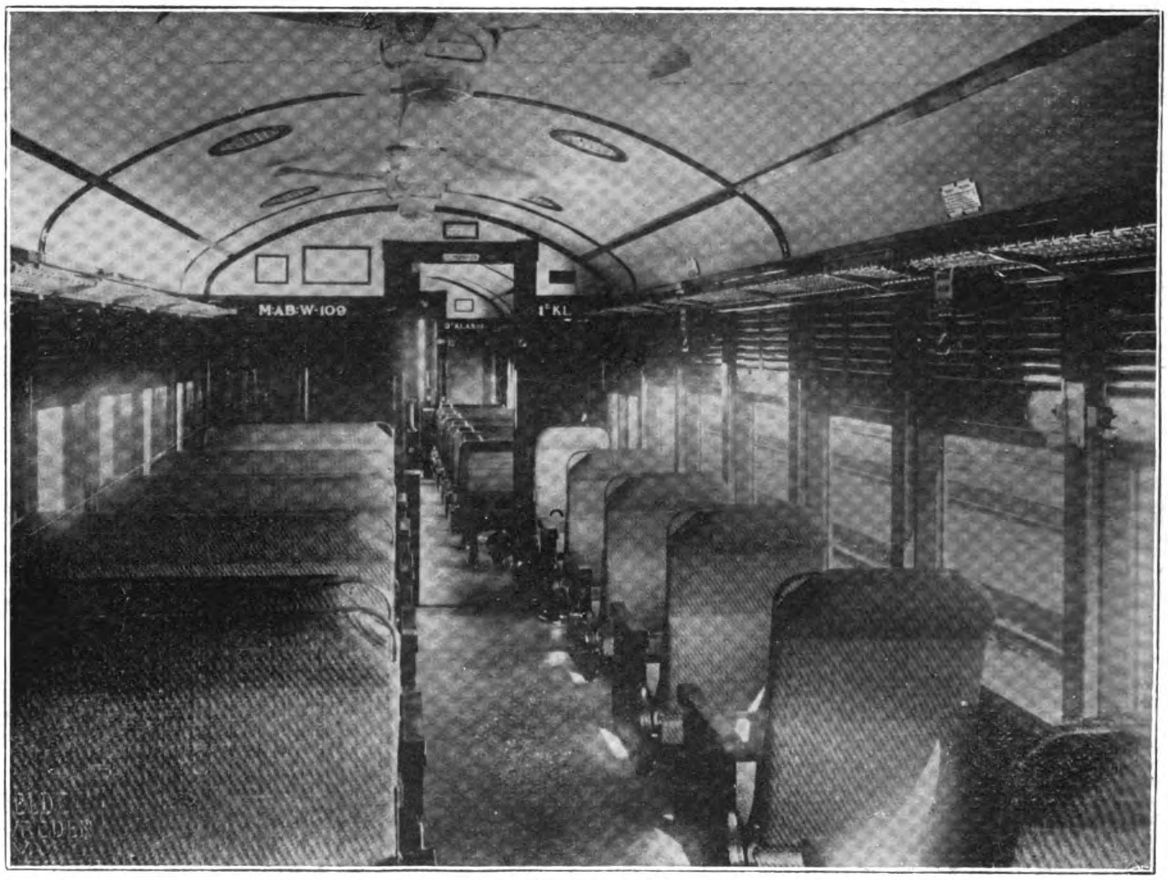


Locomotives in the Java State Railways



At Tandjong Priok Station

jong Priok to Mr. Cornelis, the freight center near Batavia, a length of 2.6 km.(1.62 miles) double track connecting Mr. Cornelis to Manggarai, together with extensive yards, have now been taken in regular service.



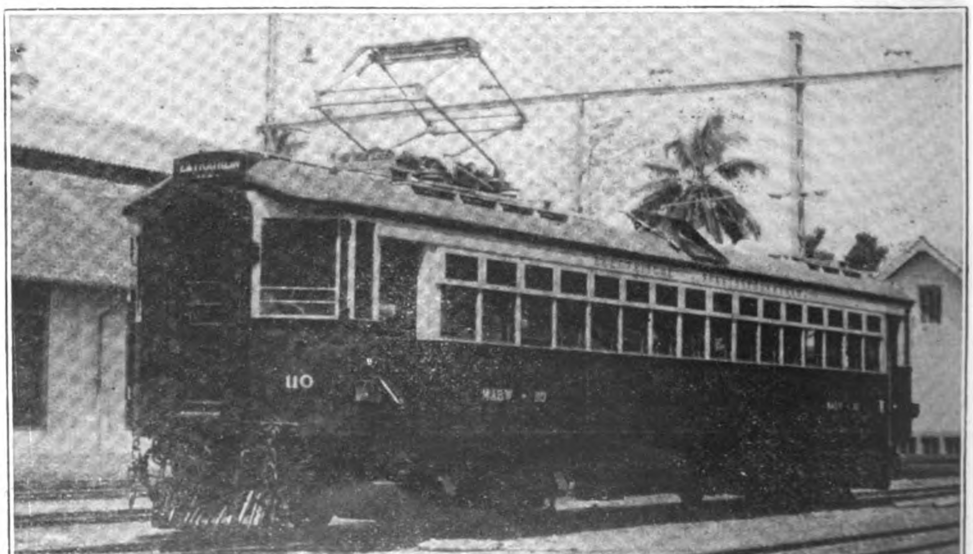
The Interior of a Car

The next section that is rapidly nearing completion and will come into service in the course of this year, extends from Batavia to Tandjong Priok, a length of 8 km. (5 miles) double track. A double track line from Weltevreden to Manggarai, a length of 4.4 km. (2.75 miles) will be completed next year.

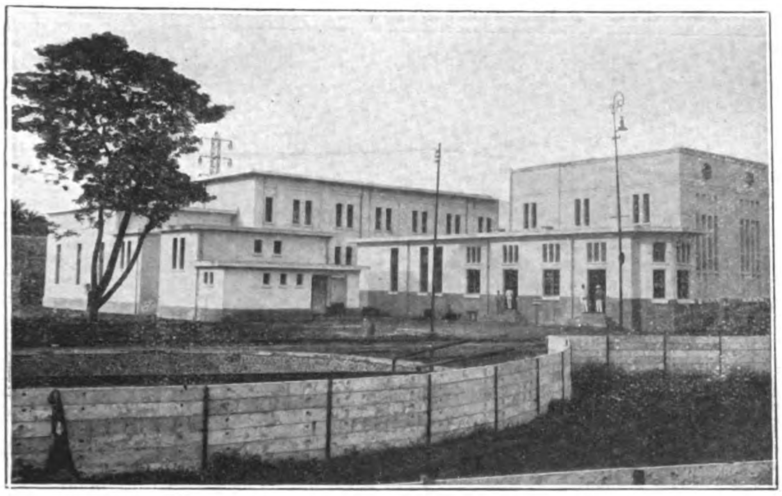
From the hydro-electric power house at Tjitjatih or Oebroeg, 89 km. (55 miles) from Mr. Cornelis, three-phase 70,000 volt transmission lines conduct the power to a substation at Mr. Cornelis and one at Antjol 4.4 km. (2.73 miles) from Tandjong Priok where it is converted to 1,500 volts direct current at which the trains operate.

These substations which are 11.2 km. (7 miles) apart, are equipped with motorgenerator sets, developing each 1,500 kilowatt in two series connected 750 volt generators. Two of these sets have been installed at Mr. Cornelis, with provision for a third unit, by the General Electric Company and three sets at Antjol by The Allgemeine Elektrizitaets Gesellschaft.

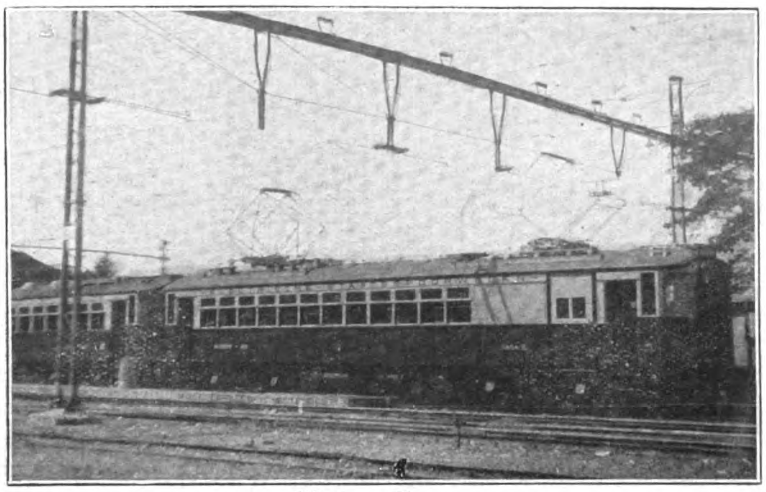
The overhead construction is of the single flexible catenary type of Siemens Schuckert. The average distance between messenger supports on tangents is about 75 meter (230-ft). In curves up to 450 m. (1,500-ft.) radius, messenger spans down to 43 m. (143-ft.) are used without an intermediate pull-off. In sharper curves the distance between supports is 75 m. (250-ft.) with a pull-off pole halfway between supports. On yards messenger spans vary from 75 m. (250-ft.) to 32 m. (107-ft.) according to number of switches and other local circumstances. Cross span and steel bridged supports are used. An extensive use of steel bridge has been made on the Tandjong Priok and Mr. Cornelis yards, while the yards at Manggarai are provided with cross spans, which are slightly more expensive, but have the advantage of causing less interference with the view of the motorman. In order to increase the current carrying capacity, the spans on main track comprise two 107 mm² (0.166 sq. inch) copper trolley wires, suspended from a 150 mm² (0.233 sq. inch) stranded copper messenger; side tracks comprise one 107 mm² (0,166 sq. inch) copper trolley wire, suspended from a 70 mm² (0.109 sq. inch) copper messenger. On yards all messengers are of 70 mm² (0.109 sq. inch) steel cable, except at Tandjong Priok and Batavia where copper cable of 150 mm² (2.33 sq. inch) for main track and of 70 mm² (0.109 sq. inch) for side track is used to prevent corrosion by the sea-air. Trolley wires are at a height above top of rail of 5.50 m. (18.3-ft.) on ordinary track and of 5.80 m. (19.3-ft.) on yards and



A General Electric Company Tram



Meester Cornelis Substation



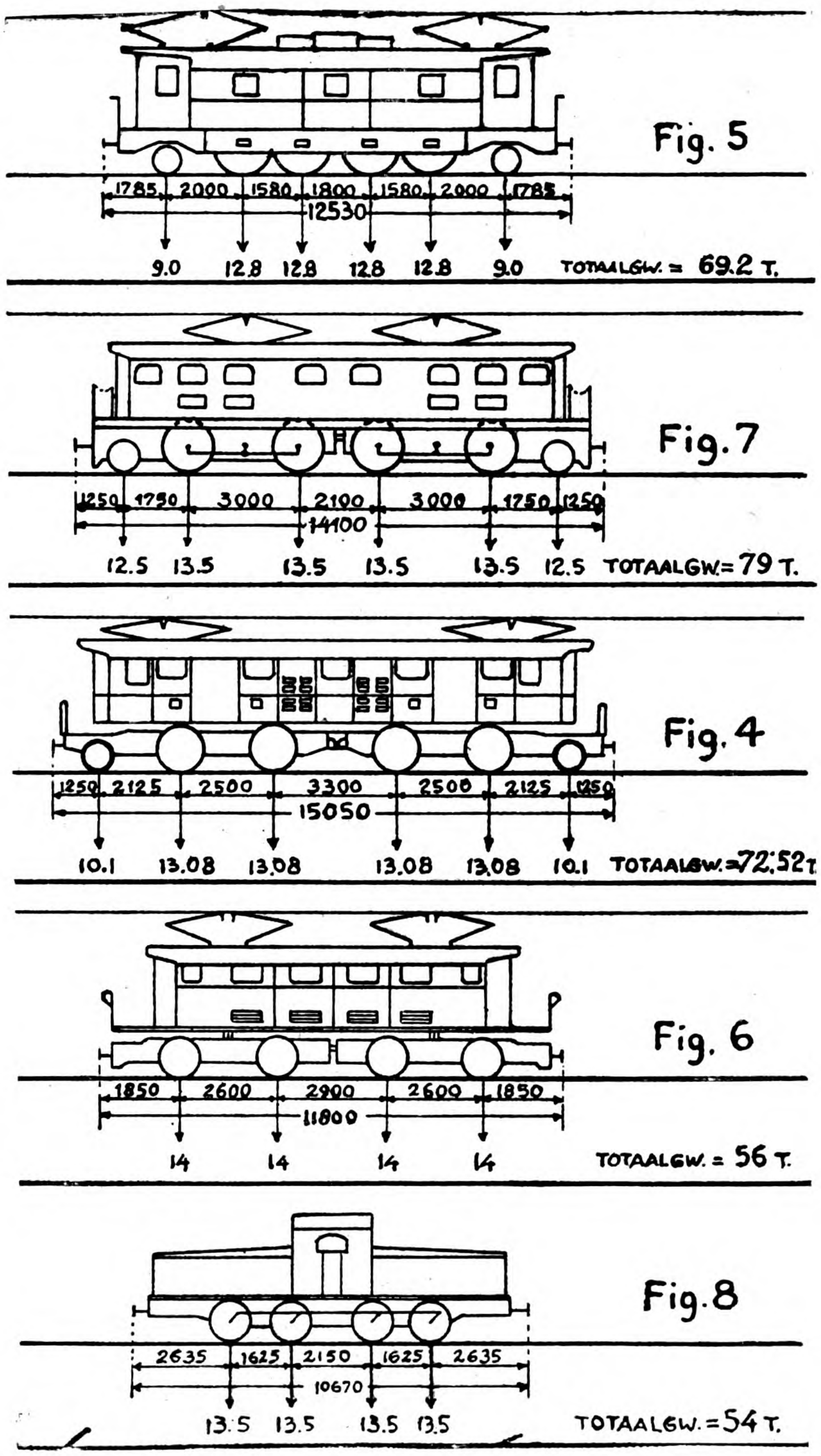
Westinghouse-Heemaf-Werkspoor Motorcar with Luggage Compartment at Meester Cornelis Yard

hangers are spaced 10.50 m. (35-ft.) apart on tracks and 12 m. (40-ft.) on yards.

Motor trains running at intervals of 15 minutes between Mr. Cornelis and Tg. Priok, cover the distance of 15.6 km. (9.8 miles) with five intermediate stops in 22 minutes. The cars with speeds up to 75 km/h (47 miles/h) (90 km./h in case of emergency) operate singly or in train units consisting of one motor car and one trailer and the train assemblage consists of from one to four of these units.

The 440 to 500 h.p. motor-cars weighing approximately 44 tons and trailers weighing 34 tons are equipped with all modern appliances for comfort and safety as fans, reversible seatbacks, entrances with enclosed steps, and devices for ease and economy of operation are provided as automatic acceleration, air-brake system for normal service and rheostatic braking in emergency cases. Ten units have been furnished by the General Electric Company and five units by the Westinghouse Company.

Two 1,200 h.p. Westinghouse-Heemaf-Werkspoor locomotives (Fig. 4) are intended for hauling passenger trains at a maximum speed of 85 km/h (53 miles/h) and freight trains at a maximum speed of 45 km/h (28 miles/h) on level track; they are also intended



Locomotives Built by the Allgemeine Elektrizitaets Gesellschaft

for service on the interurban line from Batavia to Buitenzorg (12½‰ grades) and on heavier mountain trunk lines.

The Brown Boveri Company delivered to 1,500 h.p. locomotives which are specially adapted for hauling trains at high speeds up to 90 km/h (56 miles/h) on level track.

Three locomotives built by the Allgemeine Elektrizistaet Gesellschaft are intended, the one (of 900 h.p.) for freight service on heavy mountain lines at moderate speeds and the two other ones (of 1,600 h.p.)—which have still to be delivered—for passenger service on level lines at a maximum speed of 90 km/h.

Two switching locomotives equipped with an exide storage battery of 275 amp. hours and 360 volts at discharge for out of the way yard work have been furnished by Siemens Schuckert—Werkspoor; maximum tractive effort at starting is 5,600 kg.

Though one type of locomotive may give satisfactory service in handling all freight and through passenger traffic on the railroads within the Batavia district consisting exclusively of level track, it has been deemed necessary to have four types tried out with a view to the extensive electrification program to be carried out in the near future.

A large No 300 Ruston Dragline—one of eight sent out to India—alongside a small ¾ Cubic Yard Crane Navvy on Caterpillar tracks

A Steam Crane Navvy clearing ground for new Sewage Work at Bradford

Design and Applications of Power Shovels and Draglines

By W. Barnes, M.I. Mech. E.

The following lecture was delivered before a large and interesting audience of Japanese engineers of the Koseikai at the Imperial RailwaySociety of Tokyo on October 7, 1925.

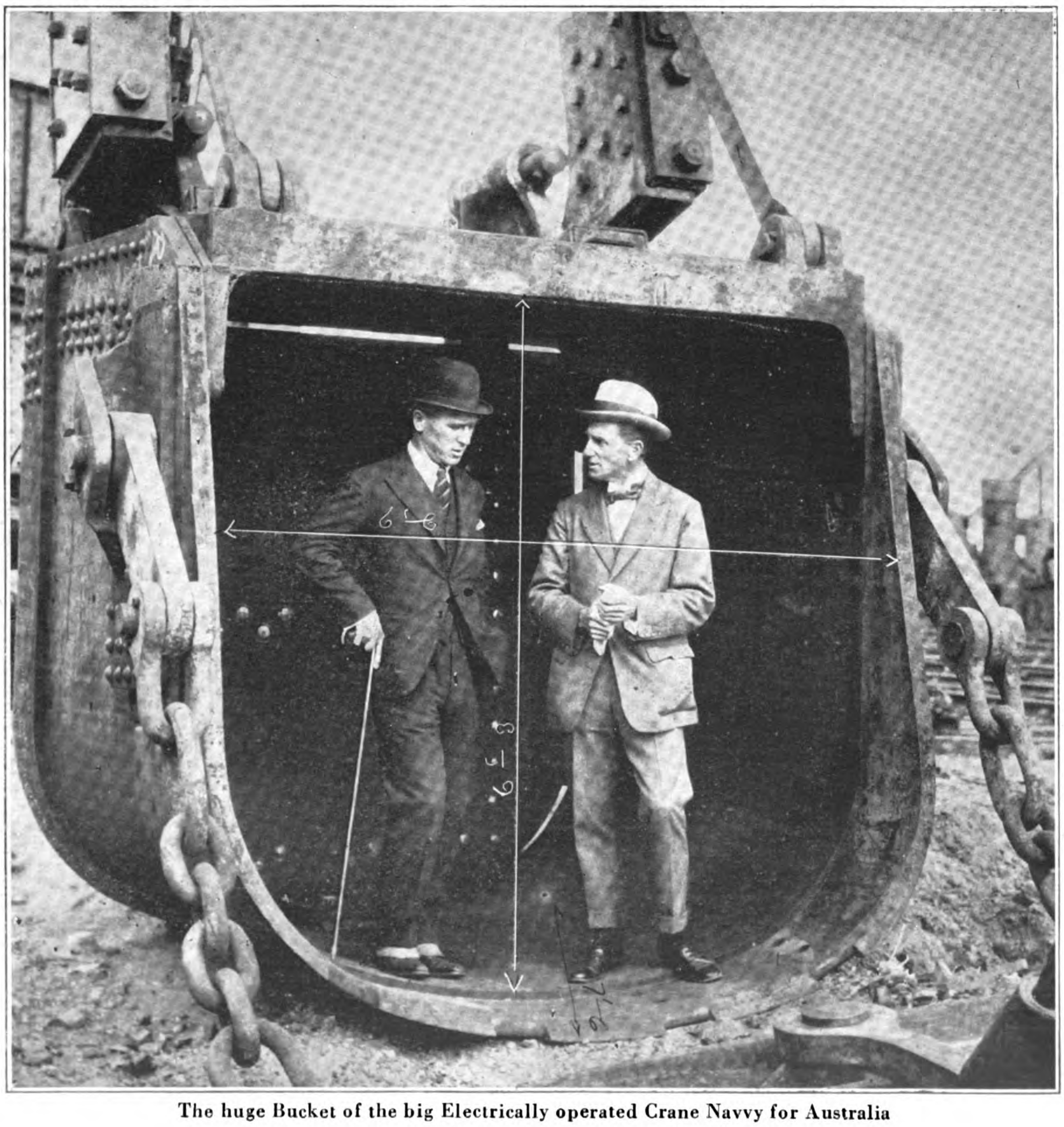
Power Shovels and Draglines

One of the outstanding features in this age of mechanical progress and the use of machinery is the application of the Single Bucket Excavator to practically all kinds of excavation work.

This type of excavator includes three distinct designs:

FIRST. The Steam Navvy as it is called by the English makers and Steam Shovel by the American.

SECONDLY. The Dragline.



The huge Bucket of the big Electrically operated Crane Navvy for Australia

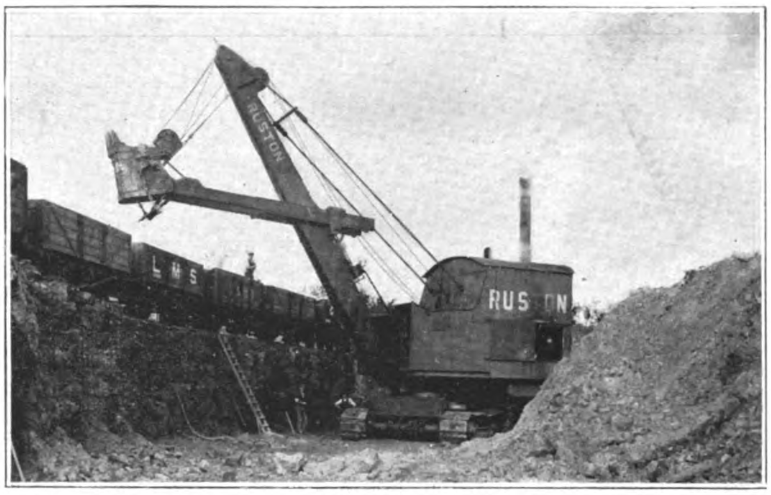
THIRDLY. The Grab, so called by the English, and Clamshell by the American.

These were formerly all distinct machines by which it is meant a machinedesigned for use as a Steam Navvy could not be adapted for use as a Dragline or Grab and so on.

It is now possible, however, to obtain one machine which will perform all three duties without in any way spoiling the efficiency of any of them, a feature which is of extreme value to Railroads, Municipalities, and Contractors as it means three machines in one at a slight increase in the cost of one.

It frequently happens of course, that one class of excava-

A small Steam Crane Navvy with 1½ Cublic Yard Bucket mounted on Caterpillar tracks excavating iron ore



A Steam Crane Navvy on Caterpillar tracks excavating iron ore and loading wagons on the surface of the cutting

tion work is more suitable for the use of a Steam Navvy than for a Dragline or Grab and vice versa and the owner of such a machine whose excavation work is of a varied character is at a great advantage in owning one of these machines, a contractor particularly so, as he can put in lower bids for various classes of work and secure more work as the result.

Before describing the main features of these machines, it will be interesting to look into the history of the Single Bucket Excavator.

The first machine was designed by William Otis of Philadelphia in 1839 and built by John Souther Boston, U.S.A., and was called a Steam Shovel because it embodied all the motions of a man using a hand shovel and applied steam to work it ; in other words the excavating gear consisted of a scoop or shovel on the end of a radial arm, exactly like our present day machines. This was thrust into the material to be excavated and when full was withdrawn from the excavation, swung round and discharged. The carriage or truck and the jib of the Otis machine were constructed of timber and although the design was very good embodying as it did most of the leading features of the present day machines, the construction was comparatively poor and as hand labour was cheap and efficient compared with the present day, very few of these machines were constructed.

The next excavator to come on to the market was the Dunbar and Ruston Steam Navvy in 1875 designed and manufactured by Ruston, Proctor & Co., Ltd., (now Ruston and Hornsby, Ltd.) of Lincoln, England.

The manual worker with a pick and shovel is known in England as a navvy so the English firm called their machine a *Steam* Navvy.

The most useful feature of the Ruston machine was its mild steel construction to replace the wood used on the Otis machine This was such a valuable feature that it is interesting to note a number of these machines are still at work. One of them made by Rustons in 1876 and thus 49 years old is still successfully working day in and out excavating clay for brickmaking at Newcastle, England a proof of the sound construction of the old Ruston Navvy. Hundreds of the Old Ruston Navvies with 2¼ cubic yards-buckets were constructed and between 70 and 80 were used to excavate the Manchester Ship canal.

Other American firms entered the market six to eight years after the Ruston machine, the Bucyrus Co., of Bucyrus and Marion Co., of Marion, both of Ohio, U.S.A.

The machinery of all these excavators inclusive of engines and boilers were mounted an a long framing or carriage supported on flanged wheels for running on rails, the excavating gear consisting jib, bucket arm and bucket being fitted at the front of the machine. The construction was of such a character that it was only possible to revolve or swing the excavating gear through 180 degrees or in other words, half a circle.

This had a certain disadvantage in the fact that the excavating could only be carried out ahead of and at the side of the machine and the wagons could only be filled by running them alongside the excavator.

A Steam Dragline widening and deepening the River Nene at Peterboro in connection with a flood prevention scheme

A Crane Navvy loading basalt rock after it has been blown down from a deep face.

Further the design was such that the jib was comparatively short which somewhat reduced the cutting height of the machine as well as the dumping or discharging radius. Another disadvantage was that when the machine had cut its way the full length of a long face it either had to be travelled back again the full length of the face to enable the succeeding cuts to be taken in the same direction, or the machine turned bodily round including the undercarriage, a somewhat lengthy and costly proceeding unless there was sufficient room to enable the machine to travel itself on rails laid to a more or less half circle.

In the year 1887 Whitaker & Sons of Leeds, England, applied the standard type of excavating gear to the jib of a locomotive travelling crane and called it a Steam Crane Navvy which the Americans translated into Full Circle Shovel because of the fact the machine can revolve through a complete circle.

John H. Wilson & Co., of Liverpool, England, then introduced a Crane Navvy of their own design in 1888 and these machines held the field until the Thew Co., of America brought out what they called the Thew Automatic Shovel.

In 1902 Ruston and Hornsby, Ltd., of Lincoln came into the market with a Crane Navvy and purchased the Whitaker drawings and patents in 1910.

At first the American makers of Steam Shovels, other than the Thew, somewhat ridiculed the Crane Navvy owing to it being somewhat slower in swinging. This is explained by the fact that in the original Steam Navvy and Shovel types only the excavating gear consisting of jib, bucket arm and bucket were revolved, whereas in the full circle machine the whole of the superstructure supporting the engine and boiler as well as the excavating gear had to be slewed.

Its practical advantages however were such that the prejudice was overcome and all the steam shovel makers introduced designs embodying the full circle principle although most of the American makers did not come into line until about 1912.

The chief advantages of the full circle machine are as follows :

(1) It will cut equally well in any position around its centre.
(2) It can also load wagons or dump at any point in the working radius.
(3) The design enables a longer jib to be used than on the old steam navvy and shovel types which makes it possible to take wider and deeper cuts.
(4) It is possible to adapt this machine for use either as Crane Navvy, Dragline, Grabbing Crane, or even, as a Crane and Pile Driver.

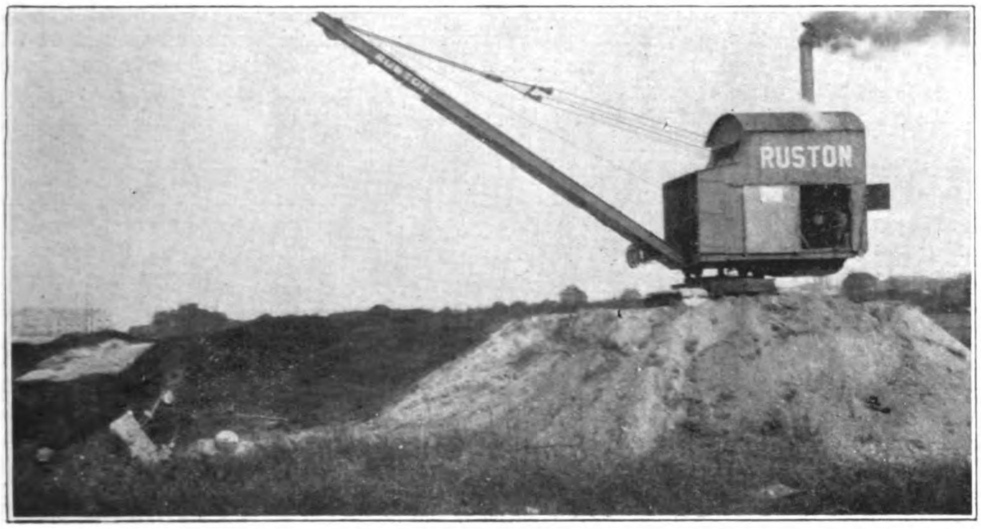
For the above reasons the full circle machine has almost superseded the limited swing shovels, and greatly increased the use and scope of single bucket excavators.

The most recent improvement is the substitution of self-laying tracks or caterpillars as they are more usually called, for flanged wheels and rails.

It is rather interesting to learn and somewhat bears out the old saying " there is nothing new under the sun," that patents for self-laying tracks for vehicles are recorded in the British Patent office as far back as the year 1650, although it is only within the last twenty years they have become a commercial success, assisted doubtless by the tanks during the war which appealed to the imagination of the public.

Although caterpillar travelling gear adds from 20 per cent. to 30 per cent. to the weight and price of an excavator, it is well justified beeause of the saving in the cost of working. Flanged wheels involve much time and labour in laying the necessary rails and sleepers, as well as in leveling the ground to receive them. In other words an average of four men is necessary and 20 per cent. of the working time is occupied in moving the machine ahead for another series of cuts, or transporting it from one place to another.

With caterpillar gear only one or two men are required around the machine and even these are sometimes dispensed with. The



A Steam Dragline removing the old and now obsolete fortefications of Paris

time occupied in travelling is also reduced to 5 per cent. or less of the total working time.

The single Bucket Excavator embodies the following duties:

(1) Digging.
(2) Regulating the thickness of out.
(3) Slewing, by means of which the bucket is swung out of the working face over the dumping point.
(4) Travelling.

The Digging gear on a Crane Navvy consists of a bucket or scoop on the end of a radial arm suspended approximately half way up a heavily constructed type of Crane Jib.

The thickness of cut and the discharging radius of the bucket and arm are regulated by thrusting the arm in or out by means of racks upon the bucket arm, gearing into pinions mounted upon a shaft on the jib.

The racking shaft upon which the pinions are mounted is driven from a small set of reversing engines bolted to the upper side of the jib. The length of stroke upon the bucket arm, that is the variation in the cutting and discharging radius of the bucket varies from 5-ft. 0-in. to 25-ft. 0-in. according to the size of the machine.

The power for digging is obtained from a set of double cylinder engines mounted upon the main or revolving superstructure of the machine. These should preferably be fitted with link motion reversing gear by means of which the steam is but off at about $\frac{3}{4}$ of the length of stroke to give economy without reducing the efficiency of the machine. On some excavators this is dispensed with on the score of cheapness and the steam taken the full length of stroke, in other words the slide valves have no lap or lead.

The Digging motion is transmitted from the main or digging engine to the bucket by means of a wire rope coiling on to a drum driven by means of gearing from the engine, exactly like a simple hoisting or winding engine. The grooves upon the drum and also in the pulleys around which the wire rope passes should be machined to take the wire rope in order to reduce the wear upon the rope and prolong its life. In some machines the groves are cast in and in others the groves in the drum are omitted altogether. This is not good practice, because the rope is liable to overlap and become damaged.

A cut is taken and the bucket filled by allowing it to rest on the ground opposite the cut to be taken with the bucket arm hanging in a more or less vertical position. The hoisting or winding engine is then set in motion and the bucket is dragged forwards and upwards into the face at a speed which may reach two feet per second or more in easily dug material.

The thickness of the cut is regulated by means of the racking engines mounted upon the jib, the ideal method of working being to so regulate the digging that a cut of even thickness is taken from the bottom to the top of the face, so that the bucket is filled just as it reaches the end of the cut or top of the working face.

This thickness depends upon the nature of the material and depth of cut. In heavy plastic clay it may not be possible to cut more than 2-in. thick, but in light loose material which falls to the foot of the face, the bucket can be loaded by thrusting it in a foot or more into the loose heap and withdrawing it when full.

The material is discharged from the bucket by means of a flap door. This is held in position by means of a latch which is withdrawn by the driver by means of a manila or hemp rope when the bucket is in position over the wagon or dumping point.

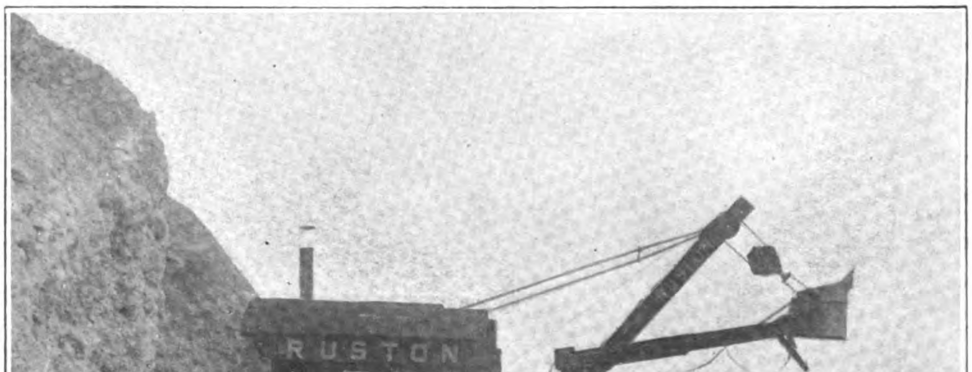
It should be noticed that the radial digging action of a Crane Navvy is upwards and away from the machine which necessitates the machine standing in the bottom of the excavation.

In the more recent type of single bucket excavator known as a Dragline the machine stands on the surface of the excavation and cuts below the level upon which it stands which makes it especially useful for making river cuts, canals or drains or for cleaning out and widening existing ones, as the presence of water in the cutting does not prevent the use of the machine owing to the fact it stands on the surface of the cutting. This feature also makes the machine valuable for the excavation of sand and gravel from below water level. The construction of a dragline bucket is altogether different from that of a Crane Navvy. In both cases a renewable lip plate of special mild steel or manganese steel is fitted to the front of the bucket upon which a number of teeth, usually four, are mounted to assist the cutting action. In all other ways they are different in design. The bucket of the Crane Navvy is, as already mentioned, fitted with a flap door at the opposite end to the open or cutting end by means of which the contents are discharged.

The Dragline bucket is more like a scraper bucket or scoop open at the top as well as to front end and no door is fitted, the excavated contents being dumped from the front or cutting end by allowing the bucket to fall suspended in a vertical position with the teeth and open end downwards.

The cutting action of a Dragline is quite opposite to that of the Crane Navvy. When using a Crane Navvy the cut is taken above the level of the ground, upon which the machine stands, and away from the machine, whereas in a dragline the cut is below the working level of the machine, the bucket being dragged towards the machine by means of the digging rope which coils on the digging drum exactly as on the Crane Navvy.

In a Crane Navvy the thickness of the cut is regulated by means of a separate set of engines controlling the working radius of the bucket, which is mounted on an arm. In a Dragline the racking



A small Crane Navvy digging heavy slag

engines are dispensed with, another drum mounted on the revolving superstructure taking their place. The wire rope from this drum leads over pulleys at the jib head to the bucket to which it is secured. The bucket is hoisted out of the excavation and the thickeness of cut regulated by means of this auxiliary drum. The method of working is as follows :

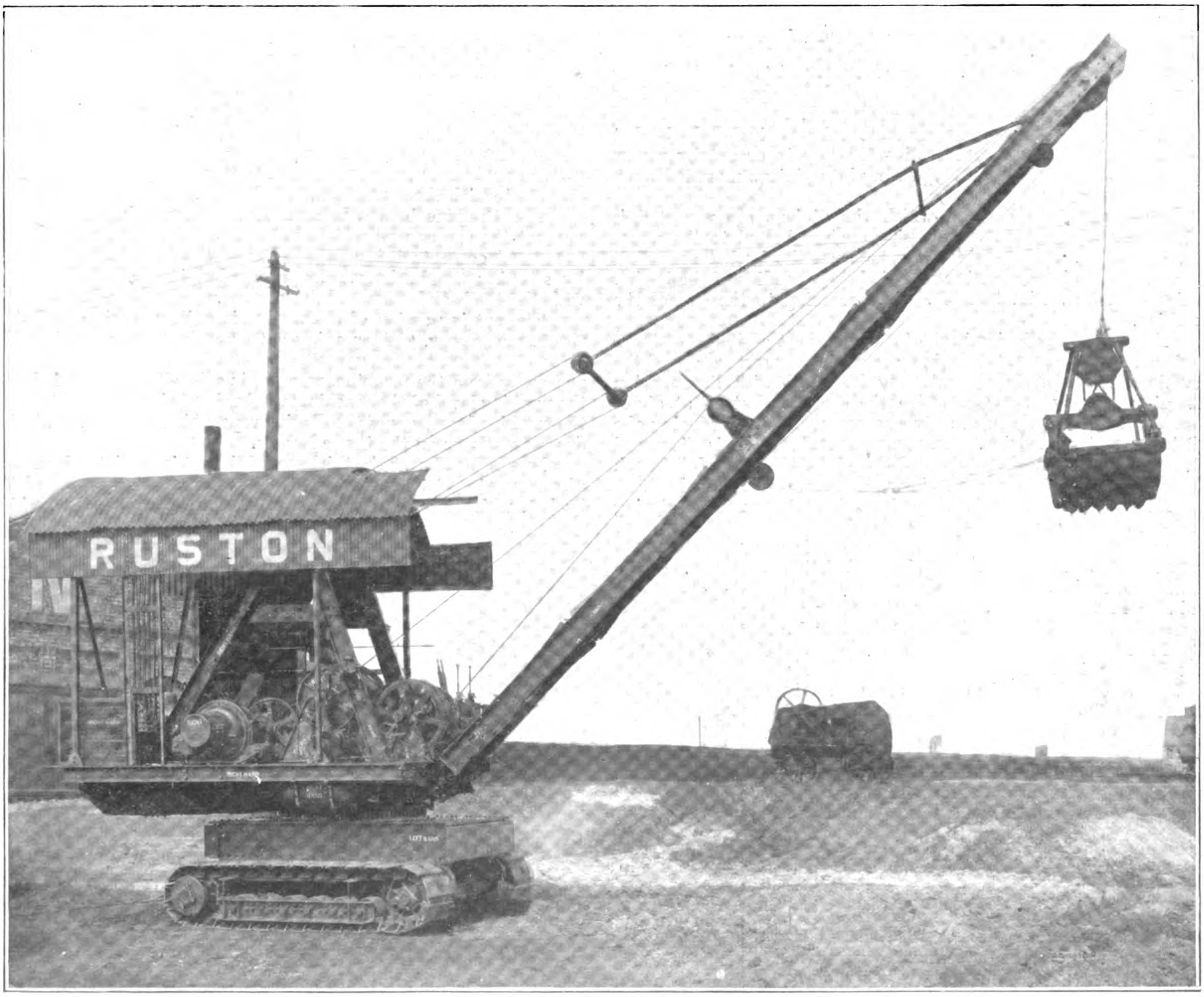
The bucket is lowered out from the jib head so that it rests in the bottom of the cut at the extreme working radius. The digging drum is then put into motion and the bucket dragged into the material towards the machine by means of the digging rope which passes out at the foot of the jib around a set of suitably designed pulleys. The thickness of the cut is regulated by means of the tension on the hoisting rope which passes over the pulleys at the extreme end of the jib, the bucket being slightly lifted out of the excavation if too deep a cut is being taken and the engine show signs of stalling.

When the bucket is full the digging drum is engaged and the bucket and its contents are lifted out of the excavation by means of the hoisting rope. The bucket is discharged by holding it up on the hoisting rope and slacking off the digging rope. This allows the bucket to swing forwards and downwards, the contents being discharged from the open mouth as previously described.

The digging action of a Grab is altogether different from that of either a Crane Navvy or Dragline and can be likened to the closing of the human hand when it is used to pick up a handful of loose material. The bucket really consists of two segments hinged together at the corners. To dig or pick up a bucket of loose material, the grab is lowered on to the material with the full weight of the open grab resting upon it. The two segments are then drawn together and closed by means of the digging rope which passes round a series of pulleys near the upper or hinged end of the grab. The contents are discharged by holding the grab up on the hoisting rope, which coils on an auxiliary drum, and lowering out the digging line or rope which allows the segments to open and discharge the material.

We have now discussed the digging action of the three types, Crane Navvy, Dragline and Grabbing Crane. The modern excavator is so designed that the conversion from one type to another can be quickly and easily carried out.

Supposing the excavator is being used as a Crane Navvy and it is required to convert it for use as a Dragline, the excavating gear consisting of jib, bucket and arm is detached from the front of the revolving superstructure by means of pin joints and a Dragline type of jib which is longer and lighter is fitted in its place. An auxiliary or hoisting drum is then fitted in front of or alongside the digging drum, everything being arranged to receive it, or, the drum can be fitted when the machine is erected in the first place and left in position. In that case, all that is necessary, in addition to replacing the crane navvy jib with the dragline jib, is to couple the necessary wire ropes from the digging and hoisting drums to the bucket. The whole of the change over can be effected in 3 to 4 hours.



An Electrically operated Grabbing Crane. The excavating equipment is interchangeable for use as Crane Navvy or Dragline

The change over from the Dragline to Grab is still more easy as the Dragline and Grabbing jibs are common to both types so it is only necessary to change the buckets and couple up the special rope supplied for use with the grab or vice versa.

The slewing and travelling gears are common to all three types of machines and no alteration of any kind is necessary when the change over from one to another is made, even on the largest machine.

In addition to being readily convertible from one type to another, the modern machine is very fast in working and at the same time easily operated.

In the early type of excavators one engine controlled all the motions and hand operated clutches were used for the various operations of hoisting, slewing, and racking. In the present day machine separate engines are used for digging, slewing and racking, engines being the largest and about 50 per cent. greater h.p. than the slewing and racking engines, which are usually of the same size. The travelling gear is driven from the main or digging engines by means of positive clutches as this gear is only occasionally required. The necessity for making the machine easy to operate can be judged from the fact that a small and medium sized excavator with a bucket up to $2\frac{1}{2}$ c.y. capacity can make 2 to 4 cuts or complete cycles of operations per minute, the exact speed depending upon the size and make of the machine, nature of the material and the skill of the operator.

A cycle of operations comprise digging and racking, slewing the bucket round over the dumping point, dumping, slewing the bucket back into the working face and lowering it in readiness for the succeeding cut. On the latest and best designed machines three hand levers and a foot operated control for the brake are all that is necessary for a crane navvy and two hand levers and two brakes for a dragline or grab. These are detailed as follows :

One lever controlling the regulator valve and hoisting clutch of the main engine.

One for controlling the regulator and reversing motions of the slewing engines.

One fore controlling the regulator valve and reversing motion of the racking engines. (On some machines the slewing racking engines are controlled with one lever.)

One foot pedal for controlling the brake on the digging drum for lowering the bucket.

On a Dragline and Grab the racking lever is dispensed with and a foot pedal to the hoisting drum is used in its place.

Two other levers are required on the machine, one for the travelling clutch and another for reversing the main engines in conjunction with the travelling motion, but these are only occasionally used and are not usually grouped with the three chief levers. In addition to the simple arrangement of levers described above, the digging and hoisting clutches are operated by means of a steam cylinder and the regulator valves of the hoisting, slewing and racking engines are of the piston type, all of which make for easy and quick operation.

A Small Dragline cleaning out small irrigation channels in India

To sum up, the modern excavator is very fast, efficient, capable of large outputs, mobile because of its caterpillar tracks and adaptable to almost all classes of excavation.

The best makes are very reliable and little trouble is experienced with breakdowns as the machine has been built up on the result of many years of actual working experience under many varied working conditions and weak places have been eliminated or strengthened.

When first introduced the modern crane navvy was fitted with a 1 c.y. bucket and weighed about 30 tons. The leading makers now have a full range of machines with buckets varying in sizes from $\frac{3}{4}$ to 8 cub. yards capacity and weighing from 20 to 350 tons each. The size of the bucket, length of jib, cutting effort on the teeth and total weight all have definite relations one to the other. Thus a Crane Navvy with a $\frac{3}{4}$ to 1 c.y. bucket will have a cutting effort of about 6 tons upon the bucket teeth and should weigh about 24 tons when mounted on caterpillar tracks.

It is a mistaken practice to attempt the use of a larger bucket than is warranted by the nature of the material or the available cutting effort upon the teeth, as it will only slow the working speed of the machine and result in reduced outputs.

Again the machine must not be too light, otherwise it becomes unstable and lifts up at the back before the maximum cutting effort can be exerted on the teeth.

It is also a mistaken policy to choose a machine too small for the work which has to be carried out. For instance, a small machine with a $\frac{7}{8}$ c.y. bucket, 6 tons cutting effort on the teeth and weighing about 24 tons will dig material up to fairly stiff clay. For very heavy clay, or clay with small boulders in it, a machine with 10 to 12 tons cutting effort, bucket up to $1\frac{1}{2}$ c.y. capacity, and weighing about 40 tons should be used. For heavy rock work not less than 20 tons cutting effort and $2\frac{1}{2}$ to 3 c.y. bucket should be employed.

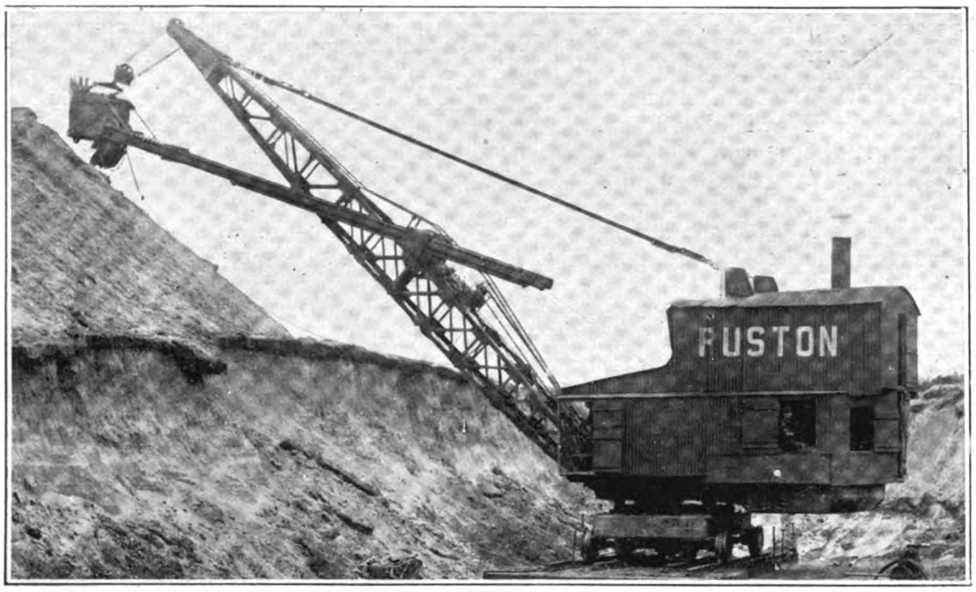
The outputs obtainable will chiefly depend upon the following conditions :

(*a*) nature of the material to be excavated.
(*b*) size of machine and capacity of the bucket.
(*c*) skill of the operator.
(*d*) capacity of the wagons (when these are used to take the excavated material away) and the organization of the wagon service.

The following are fairly representative outputs under good conditions of working with various standard machines having normal jib lengths and bucket capacities.

Crane Navvies.

Capacity of Bucket.	Net weight on Caterpillar Tracks.	Approximate outputs per hour.
$\frac{3}{4}$ to $\frac{7}{8}$ cub. yard	24 tons	35 c.y. in clay to 70 c.y. in sand
$1\frac{1}{2}$ to 2 c.y.	44 tons	60 to 70 c.y. in clay to 120 c.y. in sand
2 to $2\frac{1}{2}$ c.y.	60 tons	50 c.y. in blasted rock 70 c.y. in clay and 150 c.y. in sand



A long Jib Crane Navvy opening up a new quarry in England

CRANE NAVVIES.

Capacity of Bucket.	Net weight on Caterpillar Tracks.	Approximate outputs per hour.
3 to $3\frac{1}{2}$ c.y.	80 tons	70 c.y. in blasted rock 85 c.y. in clay and 200 c.y. in sand

DRAGLINES.

Capacity of Bucket.	Length of Jib.	Weight of machine on Caterpillars.	Output per hour.
$\frac{3}{4}$ c.y.	30-ft.	24 tons	30 to 50 c.y.
$1\frac{1}{4}$ to $1\frac{1}{2}$ c.y.	40-ft.	44 tons	50 to 80 c.y.
$2\frac{1}{2}$ c.y.	60-ft.	85 tons	70 to 100 c.y.
$3\frac{1}{2}$ c.y.	80-ft.	140 tons	100 to 150 c.y.
		on rail wheels.	
5 c.y.	100-ft.	190 tons	150 to 250 c.y.
8 c.y.	120-ft.	350 tons	250 to 400 c.y.

The cost of excavation per cubic yard varies with practically every job according to the nature of the material, the output required or obtained, the cost of labour on and around the machine, the price of fuel or current if an electrically driven machine is used and the general organization costs. Generally speaking a Crane Navvy or Dragline will carry out excavation work at from one half to one quarter that of the hand labour previously used even when the capital charges consisting of interest and depreciation are included.

Labour Required. A driver is of course essential and the greatest care should be taken in choosing him. If not a skilled driver, he should be mechanically inclined and given time to get into the working of the machine and gain speed.

A Fireman is required on a steam machine for maximum outputs but he is of course not required for an electrically operated machine and can be dispensed with on a steam machine, when only a small output is required and the driver has time to do the firing.

The number of men required around the machine varies considerably. For a rail wheel machine from 3 to 6 will be necessary (depending upon the size of the excavator), to level the ground, lay the necessary sleepers and rails in front of the machine, attend to the supply of coal and water and for cleaning up any material which may be spilled from the wagons when dumping. With a caterpillar machine only one or two men are required and sometimes for Dragline work dumping directly on to the bank even these are dispensed with, arrangements being made to fill up with coal and water during the meal intervals.

One of the great advantages of a caterpillar machine in addition to its great mobility and saving of time travelling ahead or from one place to another, is the fact that no sleepers or rails are required and it is not necessary to level the ground previous to travelling forward for another series of cuts after the machine has dug all the material within reach.

Fuel Consumption. The coal consumption varies from 3 to 6 lbs. of coal per cub. yard of material excavated. The question is frequently asked what does it cost to excavate a cubic yard of material. As previously stated this varies with every job and no average can be given but the following is a representative example of a Crane Navvy or Dragline on Caterpillars under the conditions of labor and fuel costs as existing in England, the machine being fitted with a bucket of $1\frac{1}{2}$ c.y. capacity, the material being clay excavated at the *average* of 600 c. yards per day.

One driver	12s.	0d.	per day
One fireman	7	6	—
2 men around machine	15	—	—
25 cwt. of coal	£2 2	—	—
Oil, water, etc.	2	—	—
Total	£4 1s.	6d.	per day

which on an output of 600 c. yards=1.63 pence per cub. yard, loaded into wagons. Reckoning 6 per cent. interest, 10 per cent. depreciation and renewals on 280 working days per year, another .8 pence is added to the working costs, making a total of 2.43 pence, or in round figures $2\frac{1}{2}$d. per cubic yard.

The corresponding cost of hand labor for this work was 10d. per cub. yard against $2\frac{1}{2}$d. for the machine.

When the cost was taken over a month it was found the actual average cost for the machine due to various delays incidental to practically every excavation job worked out at about $3\frac{1}{2}$d. per cub. yard or only one third the cost of hand labor.

A large Crane Navvy stripping iron ore in England

Even in India, and West Africa, where native labor is cheap and plentiful, it is found the excavator scores over hand labor as regards actual workings costs. The machine has further advantages, even in native states, in that much less hand labor is necessary with the accompanying troubles due to strikes and disinclination to work during bad weather, in other words, it makes the user more independent of hand labor, as well as enabling the work to be completed in a much shorter period.

So far only the Steam machine has been mentioned, but electrically operated excavators are becoming increasingly popular for certain classes of work, particularly quarries and open cut mines where cheap electric power is available. They involve the use of motors in place of the usual steam engines and the provision of an electrically operated air compressor to operate the power clutches by means of compressed air. On the medium sizes, automatic contactor gear is fitted which automatically controls the current to suit the load on the motors and gearing. With this arrangement the driver can throw his control lever over to any intermediate position and the automatic contactor gear will cause the motors to accelerate in the fastest possible time without any care on the part of the driver.

In the largest sizes, Ward Leonard Voltage Control is usually employed by means of which separate generators supply power to each of the motors used for digging and slewing and in the case of the Crane Navvy, for racking.

Either A.C. or D.C. current can be used upon the machines with equal success and altho D.C. is generally favoured, there are several places where A.C. current of 6,000 volts is carried directly on to the machine and used on the driving motors at this voltage.

Internal Combustion Engines are also being used on excavators, but their use means dispensing with separate power units as used on the latest steam and electric machines, as only one engine is used, the necessary drives to the hoisting, slewing and racking motions being taken through friction clutches as on the original steam machines before the now almost universal practice of a separate engine or motor for the three motions.

In conclusion it will be useful to mention the various classes of work for which the various types are being employed and learn what we can from them.

Dealing first with the now popular small machines fitted with ¾ to ⅞ c.y. bucket. Up to comparatively recent years the small machine was not favoured, as steam navvies were only considered applicable to big contract, jobs involving huge quantities of excavation such as Railroads, Docks, Harbours, Canals and large Open Cut mines. As the cost of hand labor increased and became less controllable and more independent, the smaller firms or men looked round for something suitable for their needs which they finally discovered in the small machine which is now being applied by:

The Contractor.

(*a*) For the excavation of basements for foundation work of large buildings, etc.

(*b*) Clearing off and levelling ground for the erection of buildings, houses and reconstruction work.

(*c*) Trench excavations.

(*d*) Making new drains and canals, or cleaning out existing ones, the draglines being especially adapted to this form of excavation.

(*e*) Grading new roads.

(*f*) For the construction of large railways, etc.

(*g*) For reservoirs, etc.

The contractor in fact finds this small universal machine one of his best investments as not only is he able to carry out his present contracts cheaper, but is able to put in cheaper tenders and undertake to do the work in a shorter time than with hand labor with the result the man with an excavator secures more work at a greater profit as the bidding is not so close as for hand labor alone, in fact the position in many countries is such that no contractor can hope to secure contracts involving excavation unless he has a small excavator at hand.

The Brickmaker is also finding the Crane Navvy type of machine just what he needs for the excavation of the clay and in some cases for the removal of his overburden.

The Quarry Owners are using the Crane Navvy for almost all kinds of quarry work including the removal of the overburden, and the Dragline for the excavation of sand and gravel from below the surface of the water.

Iron and Steel Companies, Gas Works and Power Stations are making increasing use of the Crane Navvy and Grab for taking iron ore, coal and coke from their stock piles.

Railway Companies are also using the Crane Navvy for making new railways, widening existing ones, removing slips in cuttings, the excavation of gravel, etc., for ballast and the many small excavation jobs, which periodically crop up.

Another useful size of machine is one fitted with 1½ c.y. bucket with about 10 tons cutting effort on the teeth. Several of the largest contractors in Great Britain including Messrs. S. Pearson & Son, Sir Robert McAlpine & Sons, Wilson Lovatts, Edmund Nuttall & Sons, Brims & Co. and Logan and Hemingway are making increasing use of the machine for their contract work as they favour its mobility, speed of working and universal features and are becoming more inclined to the use of this machine than anything larger for the majority of the contract jobs which come their way. Several of them have succeeded in obtaining an output of over 1,000 cub. yards per day with this machine which they say is usually as much as it is possible to deal with.

The Brickmakers, Quarry Owners, Iron and Steel Companies are also purchasing this machine for use when the output from the small machine is insufficient for their needs or in the case of the quarry owner where the stone or mineral is too difficult for the smaller excavator to dig.

The next two most useful sizes have 2 and 3 c.y. buckets with 15 and 20 tons cutting efforts on the teeth. Contractors are employing these for very large excavation contracts, such as railroads, docks and harbors, but the greatest use is being made of them by the *Quarry Owner* who is employing them for the excavation of minerals such as iron ore, copper, limestone and road stone such as granite, basalt, etc. Many hundreds of these machines are successfully handling these materials, in fact the larger machine is by far the most popular machine in Great Britain for this work, and more than double are being employed than all other sizes added together.

Cement Companies are almost all exclusively using the larger machines for excavating their limestone, chalk and clay for the manufacture of Portland Cement.

Finally we come to the largest machine of the Crane Navvy and Dragline type weighing from 90 to 320 tons in weight.

Crane Navvy or Dragline equipments are interchangeable on these machines and all of them are fitted with long jibs to meet the needs of open cut mines, big irrigation and development schemes generally and to a smaller extent the large contracts for special jobs.

The following are the leading dimensions of the usual sizes :

Heaped & Level capacity of the Buckets.	Length of Jib.	Net weight on Railwheels.	Approximate output per hour.
Crane Navvies.			
2 —2½ c.y.	40-ft.	80 tons	60 c.y. in clay 100 e.y. in sand
2½—3 c.y.	60-ft.	150 tons	80 c.y. in clay 140 c.y. in sand
3½—4½ c.y.	75-ft.	220 tons	120 c.y. in clay 200 c.y. in sand
7 —8 c.y.	90-ft.	320 tons	200 c.y. in clay 350 c.y. in sand
Draglines.			
2 —2¼ c.y.	60-ft.	75 tons	60 c.y. in clay 100 c.y. in sand
2½—3 c.y.	80-ft.	140 tons	80 c.y. in clay 140 c.y. in sand
3½—4¼ c.y.	120-ft.	200 tons	120 c.y. in clay 200 c.y. in sand
5 —6 c.y.	150-ft.	300 tons	150 c.y. in clay 280 c.y. in sand

Messrs David Brown & Sons

Messrs. David Brown & Sons (Huddersfield) Ltd., have recently published a booklet "What We Make," which briefly illustrates and describes their various standard lines of manufacture but does not attempt to deal with their exceptional facilities for the design and application of all types of gearing for power transmission.

The earlier portion of the booklet will be of interest to those who may not be acquainted with the David Brown & Sons plant and manufacturing methods, whilst the center pages give a detailed summary of the comprehensive service that is offered to users of all forms of gearing for power transmission.

A Busy Day on the Bean Wharf at Dairen

The Dairen Bean Oil Industry

THE first oil mill in Dairen, Shwang Ho Chan, located in the Chinese Quarter, or Sikangtze Section, was started in 1906. This was followed by Chung Sheng Ho and Nisshin on the Wharves in the ensuing year, Nisshin being a Japanese concern with a capital of Y.3,750,000. In 1908, Chang Pen-ching a leading shipping merchant of Manchuria, started the Chingkee Mill. In the same year, the South Manchuria Railway Company fixed the same freight rates for goods from any part of Manchuria to Dairen, Newchwang and Antung, with the object of making Dairen the trade center. Since then, oil mills in Dairen have grown in number, and Dairen has become the center for the distribution of beans and the center of export for beancakes and bean oil.

A shortage of mill hands was felt when the industry started to develop, and the competition for men led to the organisation of the Dairen Oil Mill-Owners Association, in 1912 so as (1) to prohibit such competition, (2) to restrict the mill output, and (3) to limit the number of mills. Japanese authorities in Dairen rendered support to the Association in not granting any land for new oil mills without the Association's concurrence. Restriction in output was enforced for a certain period of time, but the enforcement was not easily maintained. At present, any member of the Association can freely increase the output of his mill to any extent to suit his own requirements. Originally, the Association aimed at all possible means of developing the industry and protecting the mutual benefit of its members; but now, it is functioning merely to facilitate transportation and to conduct negotiations with other bodies. Since June, 1923 all mills, except seven, have joined the Association.

Nisshin Oil Mill, Dairen

Among the seven non-members, only the Dairen Oil Mill Co.

Interior of the Nisshin Oil Mill, Dairen

and the Jih Hwa are operating regularly, while the other five operate only at irregular intervals. The actual output of the oil mills in Dairen varies a good deal with the maximum output, being subject to demand and supply and other conditions. The operating period in a year averages ten months. Of the 84 mills, only 69 are operating, 58 by Chinese and 11 by Japanese, 15 having been suspended. The industry thrived during the World War, but has somewhat declined during later years. The daily productivity of beancakes in Dairen totals 218,900 whole pieces and 299,376 catties in fragments, or powder form, of which 175,500 pieces are from Chinese mills and 43,400 pieces and 299,376 catties from Japanese mills. Total amount of oil production is 1,149,600 catties. The annual output of beancakes in 1924 totalled 26,400,000 whole pieces and 16,280,000 catties in fragments, 21,878,664 pieces from Chinese mills and 4,521,336 pieces and 16,280,000 catties from Japanese mills. Total oil production amounted to 130,849,745 catties. Oil is obtained by extraction with benzine, the most up-to-date method, only in the Susuki Mill. The other 32 mills, chiefly Japanese-owned, employ hydraulic pressure machines, while 51 Chinese mills employ hand screw presses.

Oil mills in Manchuria operating on a small scale date back nearly half a century, their output being sufficient only for local consumption. Modern mills appeared in Newchwang after the Sino-Japanese War in 1894. Newchwang was the center of the bean oil industry in Manchuria before the rise of Dairen. Mills in Newchwang have again increased during recent years, owing to the limitation of their number in Dairen. Two other important bean oil centers next to Dairen are Putung and Harbin.

New Vessel for Pacific Islands Trade

On July 9, Messrs. Barclay, Curle & Co., Ltd., launched the single-screw motorship *Malabar*, built by them to the order of Messrs. Burns, Philp, & Co., Ltd., for their services between Australia, New Guinea and the Islands of the Pacific. The launching ceremony was performed by Mrs. James Burns from the builders' West Shipbuilding Yard at Scotstoun.

Constructed under the supervision of Mr. W. G. R. Snellgrove, the owners' superintendent engineer, the *Malabar*, whose dimensions are 350-ft. long by 48-ft. 6-in. moulded breadth, and 25-ft. 3-in. deep to the upper deck, has a gross tonnage of 4,500. She is designed to carry about 4,600 tons deadweight, and has been built under special survey to Lloyd's 100 A. 1 fig. class, in addition to which she embodies all the requirements of the British Board of Trade and Australian Navigation Act.

Accommodation is provided for 156 passengers in one, two and four berth cabins, with large airy public rooms, consisting of dining saloon, at fore end of bridge, with auxiliary dining saloon on upper deck, also smoking room and music room, while the main entrance of the bridge deck has an open balustrade well immediately above the dining saloon, and is furnished as a lounge.

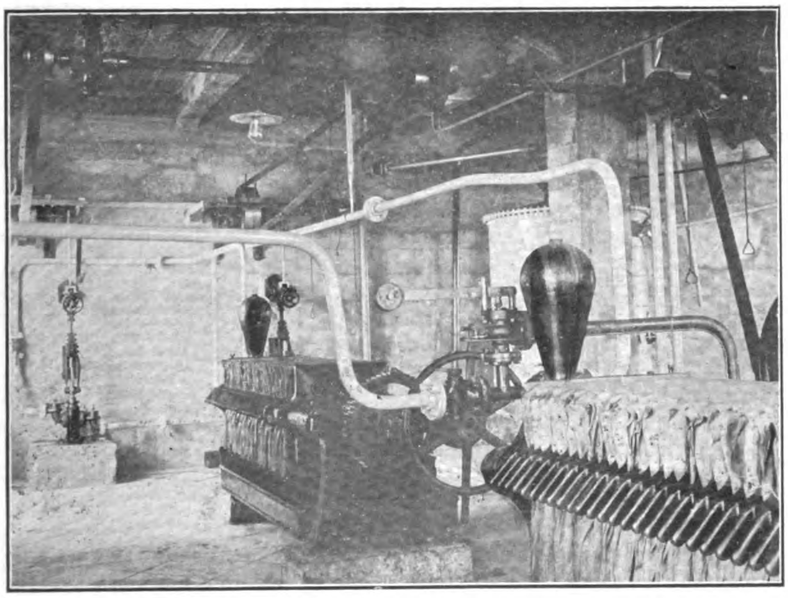
All of the state room and public rooms are tastefully furnished and decorated, and the problem of keeping the rooms cool and airy has been met by the provision of mechanical ventilation on the punkah louvre system. Large insulated store and provision room are provided, and part of the ' tween decks is insulated for the carriage of fruit and frozen meat.

The cargo handling arrangements are very complete, consisting of five large hatches served by 10 electric winches, and 14 derricks working on the Union purchase system. The steering gear and windlass are electrically driven, and the passenger galley range is oil-fired.

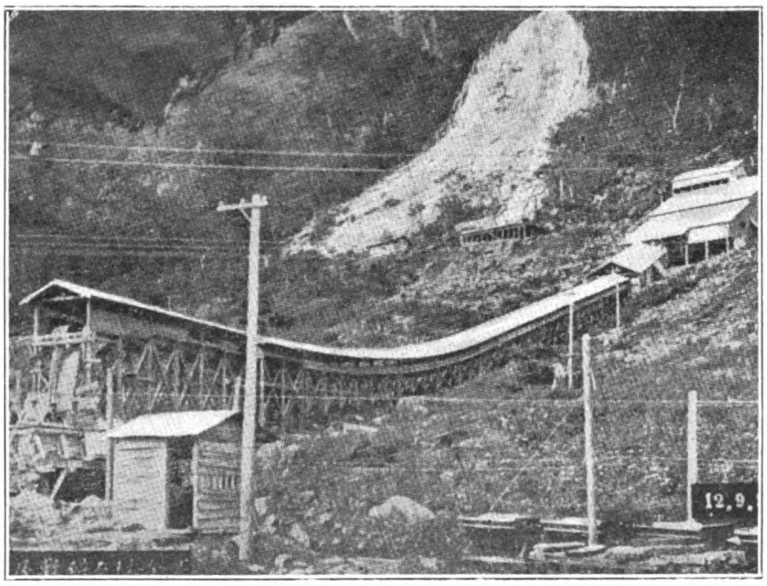
The propelling machinery which is being installed by Messrs. J. G. Kinnaird & Co., consists of one set of Burmeister and Wain type Diesel engines on the four-stroke single-acting principle, having eight cylinders, developing 2,700 b.h.p., and capable of maintaining a speed of 12 knots.

Belt Conveyor System Used by Japanese at Rock Quarry

The accompanying illustration shows a very interesting belt conveyor system in the vicinity of Ketto, Japan, where rock is being quarried from the open face of the cliff for use on the dam of the Shinyetsu Hydro-Electric Co. Through a chute at the end of the conveyor the rock is loaded and hauled, with sand from a nearby pit, in 40 cu. ft. dump cars which are drawn by electric locomotives.



The Fitter Presses



Interesting Belt Conveyor System in Use in Japan—Rock is Loaded and Hauled from a Chute at End of Conveyor, with sand from Nearby Pit

The Launching of the "Taishan"

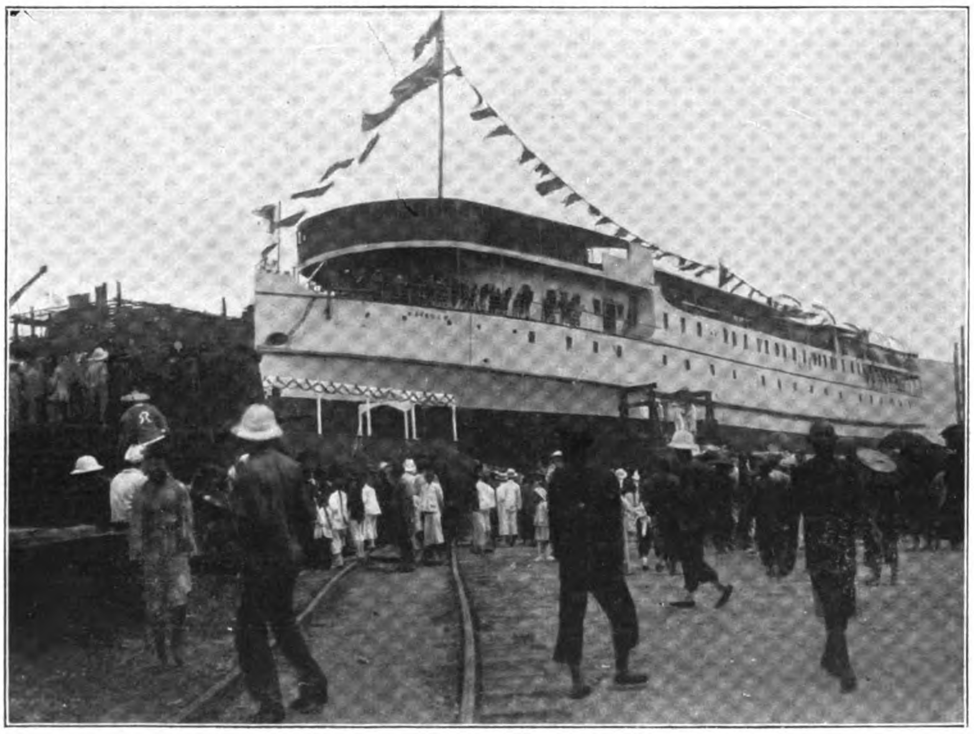
THE following are the details of the s.s. *Taishan*, the new twin-screw steamer for the Hongkong Canton and Macao Steamboat Co., Ltd. for their Hongkong-Canton service, which was launched by the Taikoo Dockyard & Engineering Co. of Hongkong, Ltd. on June 10.

Length over-all	300-ft.	6-in.
Length between perpendiculars	290-ft.	0-in.
Breadth extreme	56-ft.	2-in.
Breadth moulded	54-ft.	0-in.
Depth moulded to saloon deck	22-ft.	6-in.
Depth moulded to main deck	13-ft.	6-in.

The vessel has a double bottom fitted all fore and aft, two large cargo holds and a smaller hold specially fitted up for the carriage of silk. There are three decks, accommodation being provided on the saloon and boat decks for 49 first class passengers and 24 second class. Intermediate passengers are berthed aft on the saloon deck in a large deckhouse while the third class are carried on the main deck.

The first class passengers are accommodated in 23 single berthed cabins, 10 double-berthed cabins and two family cabins of three berths each. Seven pairs of the single-berthed cabins are convertable into double-berthed cabins by means of a communicating door. Four of the staterooms have been specially fitted up as "Cabins de luxe," each having its own decorative scheme; private bath rooms are also attached to these cabins.

The dining saloon, which is situated forward on the saloon deck, has a height of 11-ft. and is entirely free of pillars. Particular care and attention has been given to the design of this room which is about 42-ft. square and will form a special feature of the vessel, everything having been carefully studied to give a light and airy appearance. Normally the saloon can dine 48 persons at small tables for four persons but these tables can be extended so as to accommodate a greater number when required. The floor of the saloon is laid with teak parquetry and the corridors in the first class accommodation have been laid with rubber tiling.



The s.s. *Taishan*, a New Hongkong, Canton and Macao Steamboat Co. Liner

On the boat deck adjoining the main entrance to the cabins, a smokeroom has been arranged and is designed in the old English style with oak beams and panelling, all the fittings being in keeping. The seats are upholstered in leather, and with the comfortable lounge chairs, card tables and other fittings which are being provided, it is bound to be a very popular room.

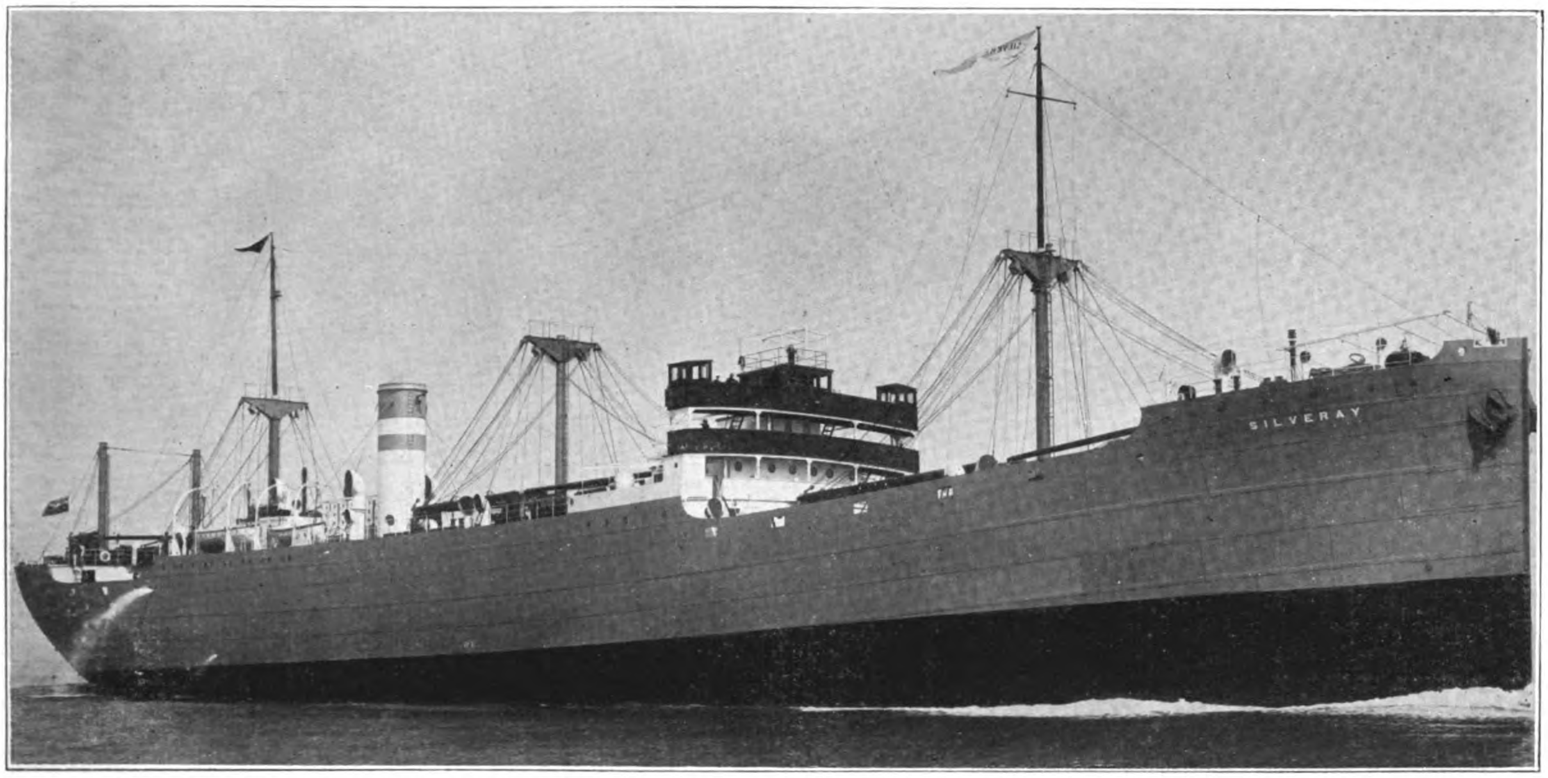
The captain, officers, engineers, wireless room and navigating quarters have been placed on a deck somewhat higher than the passenger deck forming a citadel, which meets all the special requirements of the Anti-Piracy Committee.

The firemen and engine room staff are housed conveniently to the engine room and "grilled off" from the main deck, so that they cannot be interfered with in the event of piracy. Electric light is fitted throughout the vessel and numerous fans provided; hot and cold water service is laid on to all wash basins throughout the vessel.

The propelling machinery consists of two sets of inverted, direct-acting surface-condensing four cylinder triple-expansion engines working on four cranks which are balanced so as to, as far as possible, eliminate vibration. The diameters of the cylinders of each set of engines are 19-in., 30-in., 35-in., 35-in. with a stroke of 27-in. and they are designed to give the vessel a speed of 15 knots when developing collectively 3,500 i.h.p. and running at about 180 revolutions per minute, but are capable of developing 4,000 i.h.p at 200 revolutions so as to increase the speed if desired. Each engine is provided with its own condensing plant, which is kept quite independent of the engines themselves; the condensers, which are of the "Uniflux" type, being placed on brackets at the sides of the ship and each provided with its own centrifugal circulating pump and enclosed forced lubrication steam engine, and Weir's direct-acting single cylinder "Monotype" air pump. The boiler feeding arrangements include one pair of Weir's main feed pumps, one Weir's auxiliary feed pump for use in port, one Weir's direct contact type feed water heater, and two gravitation type feed water filters. Other auxiliaries consist of two large ballast and general service pumps which are interconnected also large independent sanitary and fresh water pumps.

Steam is provided by four cylindrical, multitubular marine boilers each 15-ft. 6-in. diameter by 11-ft. 7-in. long having three "Morison" corrugated furnaces 3-ft. 10-in. internal diameter and they have been constructed in accordance with Board of Trade rules, under Hongkong Government supervision for a working pressure of 200-lbs. per sq. in. They are arranged for burning coal with provision for changing over to oil burning at a future date if desired and work under Howden's system of forced draught. The fan for supplying air to the furnaces is of Howden's make and is driven by an enclosed forced lubrication engine. Electric power for the lights and fans is supplied by two Clarke Chapman dynamos driven by enclosed forced lubrication engines each of 12 kilowatts capacity when running at about 300 revolutions per minute. A Clarke Chapman combined direct grip windlass and capstan are fitted on deck forward for dealing with the anchor cables and warping, and a Clarke Chapman warping capstan is fitted aft. The steering gear consists of a Hastie's "Wilson Pirrie" type steering gear fitted at after end of saloon deck and controlled from bridge by means of a "McTaggart Scotts" telemotor gear.

The *Taishan* being the first vessel the Taikoo Dockyard and Engineering Co. of Hongkong, Ltd. have constructed for the Hongkong Canton and Macao Steamboat Co., Ltd., no effort has been spared to turn out a first class boat suitable in every way for the Hongkong-Canton run.



New motorship "Silveray," recently launched by Messrs. Joseph L. Thompson & Sons, Ltd., for Special Trade between America and the Orient

The "Silveray" for Far Eastern Service

MESSRS. Joseph L. Thompson and Sons, Ltd., of Sunderland have just completed the *Silveray*, a finely modelled motor vessel which they have built for the Way Shipping Company Ltd. Messrs. Stanley and John Thompson Ltd., are London managers. The *Silveray* is intended for special trade between America and the Far East, and will run in conjunction with the ships of the Kerr Steamship Co., Inc., of New York.

Her overall dimensions are 412-ft. length by 57-ft. breadth (extreme) by 35-ft. 4-in. deep from the shelter decks. A topgallant forecastle is fitted about 39-ft. long by 8-ft. high ; in it is accommodation for seamen, carpenter and boatswain, quartermasters, stewards, engine room assistants, etc.

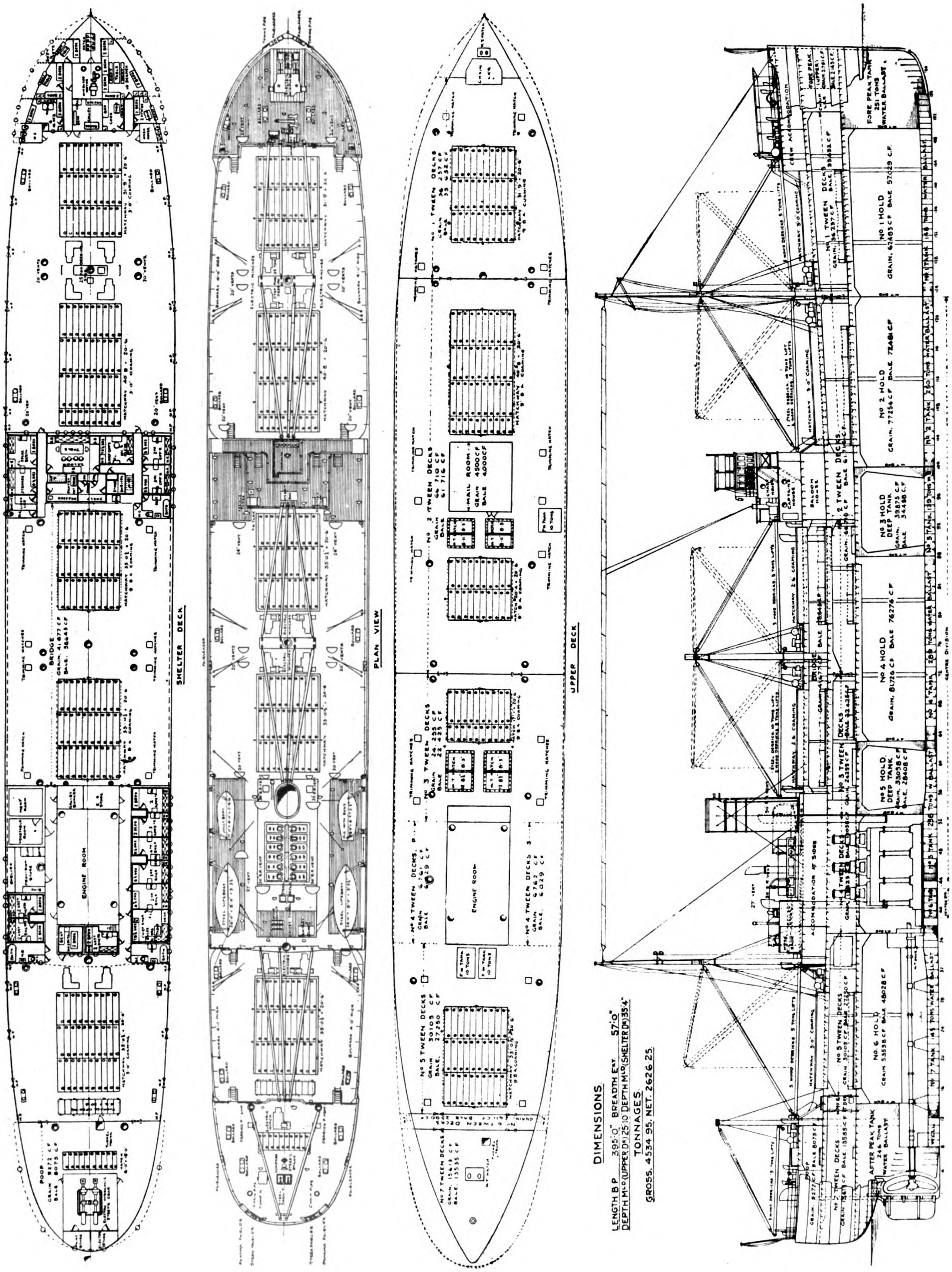
The vessel is built to Lloyd's highest class, on the single deck rules, with an open shelter deck, and will have a deadweight carrying capacity of something like 8,000 tons on a moderate draft of water. The framing system adopted is that of channel sections. There are six oil-tight and two water-tight bulkheads, in addition to four steel division bulkheads in the 'tween decks. The double bottom is built on the cellular principle, and is arranged to carry oil or water ballast right fore and aft. In addition there are two very large deep tanks also arranged for the carriage of water ballast or oil cargo. At the forward end of the vessel an exceedingly large deep tank is provided for the carriage of water ballast or oil cargo, a similar large tank being fitted at the after end. The stern is of the cruiser type. Special attention has been paid to the cargo space, the carriage of light cargoes being kept in view in designing it. The cubic capacity is, therefore, unusually large for the deadweight of the vessel.

Amidships there is a bridge 175-ft. long by 8-ft. 9-in. high, at the forward end of which is a commodious saloon, accommodation for three officers, a spare berth, stewards' pantry, stewards' rooms, etc. The whole of this accommodation has been fitted up in a much improved way, the engineers having a separate berth. Accommodation is also provided for six assistant engineers and two apprentices. There are two large insulated meat and vegetable rooms the temperature in which is regulated by a refrigerating machine installed in the engine room. The refrigerating plant has been supplied by Messrs. J. and E. Hall, of Dartford.

The poop aft is 39-ft. long, the space being partly taken up with the electro-hydraulic steering gear, and store rooms. For the captain's use there is a large roomy apartment on the top of the bridge, together with an office, and accommodation is also provided in this house for the wireless telegraph apparatus and the wireless operators. The chart-house is above the captain's house, and above this again is the wheel house. The bridges in way of this accommodation are cleaded with teak, and have teak shelters at each end. There are three lower masts of steel, the topmasts being of wood. Fifteen wood derricks and two heavy derricks of steel are fitted, the masts having large derrick houses round them, and outriggers in way of the top masts. Two steel lifeboats are carried and two smaller boats, one of which is fitted with a petrol motor.

On a motorship of this description, where the engine room and deck auxiliaries are electrically-driven, too much attention cannot be paid to the electrical installation. On the *Silveray* the work has been entrusted to the Sunderland Forge and Engineering Company, Ltd., of Sunderland, who have recently completed several very large motorship installations. The power and lighting is carried out at 220 volts D.C., and in accordance with up to date marine practice. The main generators are of the Sunderland Forge and Engineering Company's marine type, and are three in number ; each has an output of 65 k.w., and it is arranged for parallel operation. They supply the current to the following auxiliaries :—

Steering gear of the electric-hydraulic four-ram type with two Sunderland Forge special marine type motors and two pumps, an electric windlass with the motor and control gear below deck, the operating hand-wheel only being on the open deck ; three ten-ton worm-geared electric cargo winches, and one five-ton electric warping winch, all of Sunderland Forge manufacture, with special features for the rapid handling of light cargo. All the engine room auxiliaries are electrically driven by the Sunderland Forge special marine type motors, including the large and small compressors, the jacket water circulating pump, the ballast pump, the bilge pump, the general service pump, the auxiliary fuel pump, the clean oil fuel pump and the circulating pump for the auxiliary engine. There are also electrically driven turbine gear, a refrigerating machine, and a motor for driving the gear in the workshop.



Owners: Way Shipping Co., Ltd., London Managers: Stanley & John Thompson Ltd., London Engine Builders: William Doxford & Sons, Ltd., Sunderland Shipbuilders: Joesph L. Thompson & Sons, Ltd., North Shands Sipbuilding Yard Sunderland

In the engine room, on the starboard side, adjacent to the starting platform, the main switchboard is fitted, where it can readily be seen by the engineer on watch. The heating of the accommodation is carried out on the electric system, the radiators being fitted with three heat controls. Particular attention has been paid to the cables for the steering gear. The cables to one of the motors are laid along the deck, and to the other through the tunnel. Should the main lighting fail, and in order that lighting will be always available in the engine room, a number of emergency lights have been arranged, fed from a battery which will be automatically "switched on" when the main supply fails, and "switched off" when the main supply is resumed. A stand-by oil driven dynamo is installed for port lighting purposes when the main generating plant is not in operation.

The propelling machinery is of the Doxford Standard 3-cylinder type, self contained, with lever driven scavenging pump, jacket water, sea water, lubrication oil and general service pumps, driven off the same cross-head. The bore of each cylinder is 580 m.m., and the stroke of each piston is 1,160 m.m., the engine developing 2,650 i.h.p. at 90 revolutions. The engine is a replica of that fitted into three other ships for the same owners, *Silverhelm, Silverfir,* and *Silvercedar,* and incorporates all the latest improvements. The spherical combustion chamber adopted in these later engines has resulted in greater fuel economy ; likewise in the use of heavier grades of boiler fuel oils. It has also materially assisted in reducing liner wear to a figure applying to the best known practice. It is formed in the hollows of the two pistons, the outer edges coming closely together during the combustion period, thus shielding the cylinder surface from the high temperature of combustion. The pistons are made of ingot steel, a material well suited to maintain the high temperature at which these are desired to operate for best fuel economy.

It is now well established that the consumption in the Doxford engines obtained on test bed trials with the engines working against a Heenan and Froude water brake, are more than realized in service. In fact, the consumption in actual service, contrary to our usual practice, are less, because there is no falling off in the mechanical efficiency of the engines, if they have to be operated at less power than is covered by the contract conditions. The reason for the mechanical efficiency not being affected by the variation in power is mainly due to the engine operating on the Doxford patent solid fuel injection system, and it may be interesting to quote a few test-bed figures pertaining to this one particular engine.

While developing 2,200 s.h.p. and turning at 88 revolutions, the mechanical efficiency is 88 per cent., and the consumption on British Mexican boiler oil of .97 s.g. is .4-lbs per s.h.p. hour. The mechanical efficiency is unaffected while running on a lighter oil, such as Anglo-Persian .89, but the consumption is considerably improved, being .37-lbs per s.h.p. hour. The difference in consumption between the two fuels is mainly due to the calorific values.

Owing to the vessel having to trade for lengthy periods in Eastern climates, the air intake for the scavenging pump is led right from the boat deck through a special ventilator, so as to ensure that the engines will obtain air as cool as it is obtainable. The ventilation of the engine room has been likewise specially cared for, being provided with four 30-in. diameter ventilators.

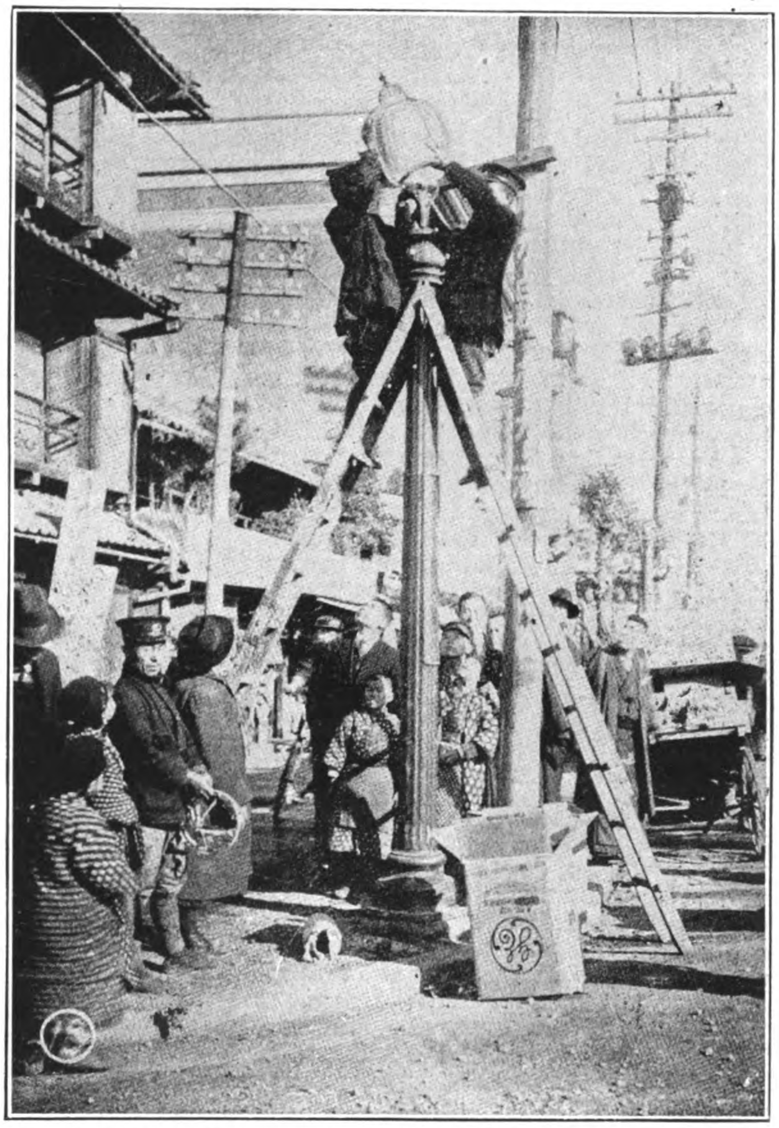
Electric Power Development in Nagoya, Japan

The great development of electric power in the territory sursounding Nagoya, Japan, is shown by the marked increase in the number of hydroelectric power stations sancitioned by the Government. The number of sites, both operating and not operating. increased from 138 in 1914 to 937 by the end of 1923. The total capacity of these plants increased from 85,100 kilowatts to 630,764 kilowatts during the same period.

Daido Electric Power Co. Plans Expanson

A considerable increase occured in the number of kilowatts produced in this territory ; the new Oi Station of the Daido Electric Power Co., for example, having been put in operation in November, 1924, with a capacity of 43,000 kilowatts. The total development capacity of this concern alone in the Nagoya district reached 154,800 k.w. in 1924, and it is making preparations for still greater exploitation of water power in this territory. Its allied company, the Toho Electric Power Co., has now under way in Nagoya the construction of a steam power plant which will develop 50,000 shaft h.p. A very large steam turbine generator has been ordered for this plant from an American manufacturer.

The great development of electric power in the Nagoya district, in addition to being used locally, is drawn upon by the great industrial centers of Osaka and Tokyo. It is also believed that this power will be utilized very largely to supply the current required for the electrification of the Government railways on the



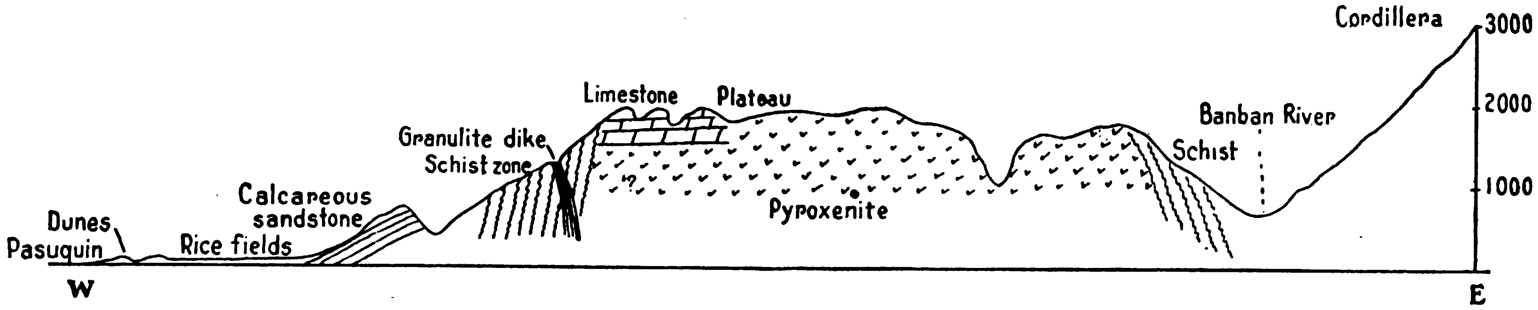
G. E. Madza Lamps used in Lighting the City of Nagoya

Tokaido line. Furthermore, these plants will play a large part in Japan's superpower scheme which is at persent under discussion.

Rural Electrification

A very practical development is the experimenting that has been done in this district and elsewhere in Japan during the past two years in connection with the application of electricity to agiculture. This work has been carried on with the support of the prefectural governments and the encouragement of the Farm Electrification Society. In view of the availability of electric power in this district and its comparative cheapness, it seems probable that it will eventually attain widespread use, especially for irrigation and drainage. The Toho Co., is doing a good deal of propaganda work to popularize this movement.

American manufacturers have in the past received large orders from this district and they will undoubtedly be called upon in the future to supply a large share of the great quantity of electrical machinery and equipment that will eventually be required.



Idealized geologic section from Pasuquin, Ilocos Norte Province, Luzon, northeast to cordillera.

Asbestos in the Philippines

THERE was a very encouraging output of asbestos in 1919, but during 1920 mining operations on the old Dungon-Dungon estate in Ilocos Norte ceased, and so the production for that year is less than for the previous one. The Ilocos Asbestos Products Company evidently has found the undertaking too expensive for its limited capital. This company has a factory in Manila where it has turned out some valuable products in the nature of roofing material, pipe lagging, etc., and it is to be hoped that it will resume operations. The asbestos that has been mined has been largely of second and third grades, but some very fair specimens of chrysotile, as much as 2.5 centimeters in width, have been found.

For more than fifteen years the presence of asbestos in Ilocos Norte has been known. The district was first reported upon geologically by Smith, in 1907 (558). After this date nothing more than brief mention of the district has appeared in the literature, with the result that little is known concerning the progress of asbestos mining in Ilocos Norte. I was detailed in March, 1921, to make an investigation of the asbestos property in the Dungon-Dungon district and to report on the progress of operations. At the time of the inspection, no asbestos was being mined.

Topography.—Many of the hills on the Dungon-Dungon estate are barren, except those capped by limestone, which always support vegetation. The slumped-off topography of serpentine areas is especially noticeable. This section of the country is maturely dissected, and Baruyen River apparently is a rejuvenated stream, as indicated by its many entrenched meanders. The coastal valleys are flat and fertile. Cape Bojeador, near Dungon-Dungon, is volcanic and decidedly wild and rugged.

Because of the topography, the roads in the district are hilly. At present, the roads on the Dungon-Dungon estate, which were not well constructed, are in very poor condition. They can be used by bull carts only, provided these carry no more than 150 to 200 kilograms as far as the main Government road, and then no more than 300 kilograms. During the rainy season the roads are impassable.

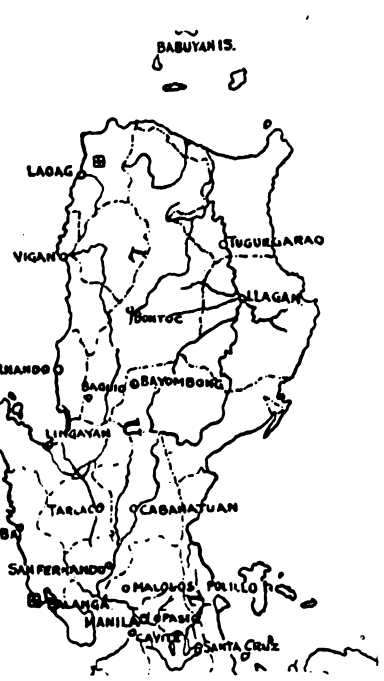
Bangui Bay is an open roadstead and not a satisfactory anchorage; although the waters may be calm to-day, the seas tomorrow may run high. The bay might be a safe harbor during the southwest monsoon. The nearest satisfactory port is that of Diriqui, 26 kilometers from Dungon-Dungon.

Geology.—The Dungon-Dungon district of Ilocos Norte is essentially one of metamorphism; namely, formation of schists, serpentinization, and amphibolization. Resting unconformably on the schists is limestone of Malumbang (Pliocene) age; Baruyen River has cut a deep canon in this formation.

An idealized profile along a northwest-southeast line through Dungon-Dungon (fig. 19) shows the general field relations of the formations existing on the Dungon-Dungon property. There is no reliable map of the district.

Origin and occurrence of asbestos.—The asbestos on the property in the Dungon-Dungon district is thought to have been derived from pyroxenites through processes of serpentinization and amphibolization, for both chrysotile veins and tremolite and actinolite veins are known to exist.

Mining Methods.—The mining of asbestos on the Ilocos Asbestos Products Company's property, near Dungon-Dungon, is entirely by open cuts, where the minerals occur in pockets or ramifying veins. The largest working—nothing more than a good prospect—is the Bed Creek mine, which has produced in the last two years 300 tons of asbestos. The Hill Top mine is the next largest; in the same period it has produced 50 tons of amphibole. Various scattered outcrops of serpentine have netted about 5 tons.



Where Asbestos is found in the Philippines

The material is loosened by hand and by blasting. The asbestos is chopped out by hand from the serpentine; waste is dumped by barrows; the fiber-bearing rock is placed in a shed, separated from its matrix by hand, and the fibre itself is placed in sacks (25 to 30 kilograms) or baskets. The sacks of fibre are carried by bull carts to Diriqui for shipment to Manila.

Amphibole is mined for about 20 pesos a ton. The cost of mining and cleaning chrysotile (crude extraction) in commercial quantity by this method would be extremely high, if not prohibitive. Transportation from the property of Diriqui amounts to from 7 to 9 pesos a ton; and from Diriqui to Manila the last shipment averaged about 22 pesos a ton.

It will be seen that the methods of mining are primitive and, in the long run, expensive. This company should have passed the prospecting stage some years ago and to-day should have some fairly well-developed mines.

Labor is cheap, but poor in quality. Up to 80 centavos a day is paid to the laborers and, in order to get sufficient help, women must be relied upon; according to Mr. Vittali, the manager, they are as good workers as the men. He also states that his experience shows the principal causes of the unreliability of the laborers to be lack of time for mining (most of them being small land owners) lack of endurance, and lack of regular application to work.

Transportation of the fibre is, as has been mentioned, by bull carts. A cart can make the trip to Diriqui in about two days. Travel on the Government road is difficult because of numerous and steep hills. There is plenty of good road metal in the vicinity, so that the construction of a good highway is possible.

Other localities.—Asbestos is reported to occur also in Zambales and in Antique. The Zambales deposit is near Subic, within the Army and Navy reservation. Samples submitted by prospectors are identified as amphibole and chrysotile. A detailed examination of the Antique deposit has not been made.

The New s.s. "Changte"

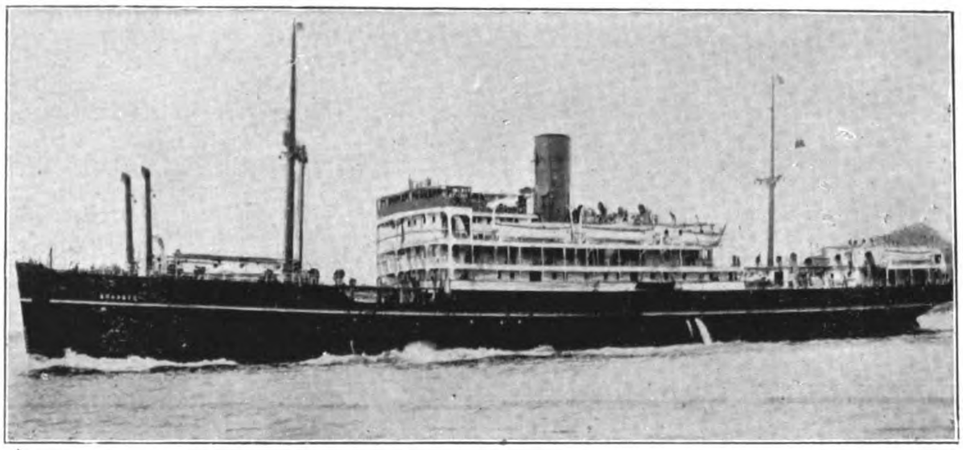
THE *Changte*, which was built by the Hongkong and Whangpao Dock Co., Ltd., and was recently launched, is a Steel Single Screw Steamer having the following dimensions :—

Length Overall	366-ft. 6-in.
Length B. P.	350-ft. 0-in.
Breadth Mld.	48-ft. 0-in.
Depth Mld. to Upper Deck ..	26-ft. 0-in.

and is designed to carry 4,000 tons deadweight on a mean draft of 23-ft.

The vessel is of the two deck type with poop and bridge combined, top gallant forecastle, promenade deck, and boat decks aft and amidships. She is constructed to Lloyd's requirements under special survey for their highest class, and fitted out to satisfy full requirements of Australian Navigation Act as regards Life Saving apparatus and equipment. Australian Fire Regulations, and to comply with Hongkong Board of Trade requirements for a passenger vessel carrying passengers including Board of Trade convention rules for Passenger vessels as applied by the Hongkong Government. The forward hold and 'tween decks are insulated for the carriage of frozen meat and chilled produce and Nos. 3 'tween decks for frozen and chilled produce and ship's stores, total capacity being 49,000 cubic feet.

The Refrigeration being Ammonia Brine Pipe system two machines are installed by Messrs. Haslem Foundry and Engineering, Co., Ltd. Derby, England. Cargo is carried in the forward and after holds and 'tween decks. The facilities for working cargo are, four derricks and four winches fitted each to Nos. 1 and 2 hatches and two derricks and two winches each to Nos. 3 and 4 hatches—winches are of the double acting Cyclops type by Messrs. Clarke, Chapman & Co., Ltd. Water ballast or fresh water is carried in the peaks while the double bottom is suitable for oil fuel as well as ballast. Oil fuel is also carried in a cross deep tank situated forward and sides of the boiler room.



The s.s. Changte

The rudder is controlled from the bridge by telemotor gear which is led to Hastie's vertical combined steam and hand steering gear situated in house on poop deck and directly connected to rudder head.

A powerful Clarke, Chapman windlass is fitted for working the the anchor and cables.

The ship has accommodation amidships for forty first class passengers in single and two berth cabins, fitted with all the latest conveniences with a direct supply of water, electric fans and heaters.

The vestibule is at the fore end of the bridge deck; directly under the lounge, contains the Purser's Office.

The decoration is of Georgina influence, the panelling being of teak painted ivory. At the fore end is a niche in which is placed a writing desk for the convenience of passengers. The ship's library is forward end of the Purser's Office. The main staircase and wrought iron balustre with mahoganised teak handrail, blends with the general scheme.

Opening off the vestibule at the fore end are two cabin de luxe suites each consisting of stateroom, siting room and bathroom.

The staterooms have been treated in the Louis XVI style, the panels being painted grey, and the styles and rails a deeper shade of the same colour.

There is a double wardrobe with mirror front, and ample hanging and drawer space, also a table which serves either as a writing desk or a dressing table. The two comfortable " Silvex " beds invite slumber.

Adjoining each stateroom is the private bathroom.

The sitting rooms are Georgian in treatment and doors communicate with the stateroom and vestibule.

A roomy chesterfield sofa, easy chairs and a table, furnish these rooms and there is also a cupboard which can be used as a wardrobe.

The public rooms consist of dining saloon, music room, smoke room and verandah cafe.

The dining saloon is 46-ft. by 26-ft. and is at the forward end of the bridge 'tween decks, it is decorated in restrained Georgian style, and painted a delicate blue, the beamed ceiling being a soft cream colour.

There are eighteen large sidelights providing excellent ventilation and light, and there is seating accommodation for 56 persons.

Chairs, tables and sideboards, etc., are all of teak stained walnut colour and French polished.

At the after end are the service and entrance doors, and the main staircase leading up to the vestibule and the lounge above.

The polished teak parquet deck with its brown carpet runners help to complete a restful and pleasing scheme of treatment.

The music room and lounge is 34-ft. by 23-ft. and 10-ft. high and situated at the forward end of the promenade deck is of Louis XVI influence, and has been designed primarily as a ladies' room. Its twelve large casement windows give ample lighting and the electric light fittings ensure highly satisfactory illumination at night.

The room is furnished will card-tables, writing tables and easy chairs, and a Collard and Collard grand piano.

The teak parquet deck makes an excellent dance floor, and will undoubtedly be popular with the passengers.

The general colour scheme of ivory, rose and grey, with a touch of gilt in the staircase and the gilt mirror at the after end, give to this room a bright but restful atmosphere.

The smoke room situated at the after end of the promenade deck is panelled with English oak in the Tudor style ; the beamed ceiling being in keeping with the period. There is a staircase leading from this room down to the first class staterooms. The room being furnished with four card tables with black " Vitrolite " tops, two writing tables, and four large easy chairs.

The eight large casement windows excellently light the room, and there are sufficient electric fans to keep it cool on the hottest of days.

Accommodation is provided for thirty second class passengers in the poop 'tween decks in two berth cabins, with public rooms, dining saloon, smoke room and ladies lounge.

The dining saloon is neatly panelled in teak, frame work painted white, with large panels in pale cream, there are eight small square tables with four chairs to each suitably arranged. A large sideboard is fitted at aft end, and a buffet at the forward end these are of teak stained walnut colour and French polished. There are thirteen second class staterooms in close proximity, including seven—two berth and six—three berth, each fitted with white enamel cot bedsteads, open type wash basins, direct supply and with white "Vitrolite" back and shelf, mirror, and cabinet over, large wardrobe, folding chairs, racks and ample hat and coat hooks.

The second class smoke room, entrance and ladies room are situated in a steel house on poop deck aft, the smoke room and

entrance neatly panelled and finished in fumed oak and fitted with writing table, card tables and comfortable chairs.

A double stairway from entrance leads down to dining saloon. The ladies room, daintily panelled in maple and French polished, is arranged with tables and cosy chairs.

Accommodation is also provided for twenty-six second class Chinese passengers in bridge 'tween decks.

Space is also provided for 192 deck passengers in forecastle and lower 'tween decks forward. The Captain, officers and engineers are accommodated in houses on the boat deck amidships.

Crew are berthed in forecastle and after end of poop.

The culinary arrangements are in accordance with the latest practice, refrigerated provision rooms and ice machines, etc., being provided.

There is also installed an electrically driven steam laundry plant.

The vessel is electrically lighted throughout and fans are provided in all public, passenger and officers' rooms.

The emergency lighting set is on the boat deck.

Heating (electric and steam) is also installed to provide additional comfort in winter.

The propelling machinery constructed by the builders is placed amidships and consists of one set of triple expansion surface condensing three crank engines having cylinders 27-in. 46-in. 77-in. by 48-in. stroke.

Steam at 200 lbs. per square inch working pressure is generated in three single ended Scotch boilers working under Howden's system of forced draught. The boilers are 16-ft. diam. by 12-ft. long and are fitted for burning coal and/or oil fuel with the Wallsend Howden system of liquid fuel burning centre firing type.

A Michell Thrust Block of the latest type is fitted.

The engine room and boiler room auxiliaries are all of British make and of the latest type, and include two independent feed pumps and direct contact feed heater, one general service pump and evaporator, one independent circulating pump, one 2,000 gallons distiller together with the following pumps, one sanitary, one ballast, one fresh water and one deck fire pump, an auxiliary condenser with a separate circulating pump is fitted, all pumps have brass water ends with removeable gunmetal liners.

The oil fuel unit consists of a duplex set of pump heaters, filters, etc., of the Wallsend Howden system together with two transfer pumps. All oil fuel tanks are fitted with "Teledep" tank indicators. In the event of burning coal a Crompton's self tipping ash hoist has been installed.

On the official trial carried out, a mean speed of 14.77 knots on a mean draft of 15-ft. 3¾-in. was obtained over the admiralty three mile course at Aberdeen, Hongkong, i.h.p. being 4,090 at 90 rev. per min.

New Orient Liner—The "Otranto"

ON June 9 Messrs. Vicker's Naval Construction Works, Barrow, launched the steamer *Otranto* built to the order of the Orient Line. She is a 20,000 ton vessel, 658 feet long, 75 feet beam and is the third vessel of a similar tonnage added to the Orient fleet within the year. The others the *Orama* and *Oronsay* have already found great favor with the travelling public as fine seaboats. The *Otranto* will carry two classes of passengers only, and will accommodate approximately 600 first class and 1,200 third class. She will be propelled by twin screws driven by two sets of Parson's turbines, capable of developing 20,000 h.p. She will burn oil fuel.

A special feature is the ample dimensions of the public rooms, lounges, smoke rooms, etc., a provision much appreciated by travellers. A very large proportion of the rooms are for one passenger only. Third class passengers will find the *Otranto's* cabins, public rooms and deck spaces little, if anything, below the standard of second saloon accommodation of a few years back.

Apart from the value of these additions to the Orient fleet the three vessels named are notable additions to the mercantile marine of the British Empire, and would be of immense value in the event of war.

The first-class dining saloon has seating accommodation for 260 passengers, while 50 more can dine in the foyer forward of the main saloon, all at small tables arranged for from two to eight people. The saloon is 72-ft. long and extends the full width of the ship. A light and airy spaciousness is achieved by the addition of a large well in the deck space above; wide pilasters running up the full height support the central portion, and have panels of classic figures in bronze in between. The room is designed in a free English classic manner, and carried out in tones of grey and cream. The foyer is designed in character with the dining room, so that it can be used on occasion as an additional dining space, the total seating accommodation being over 300.

The reading and writing room is 32-ft. long and 48-ft. wide having large bow windows on each side. It is decorated in Chinese style in the English manner, the walls being in tones of blue and gold with lacquer panels of Chinese subjects. The cafe at the head of the after stairway is 39-ft. long by 44-ft. wide and acts as something between a dining saloon and a lounge. Here one can obtain light refreshments or find a place of shelter screened from wind and weather. This room is panelled in cedar en suite with the smoking room, the ceiling is of Chinese vermilion with beams of cedar. The bow windows form a distinctive feature of the cafe.

The first class smoking room adjoins the cafe. It is 38-ft. long by 40-ft. wide with bow windows on each side and a raised coach roof over the central portion. It is beautifully panelled in unpolished cedar. The touches of gilt and the carvings to the pilasters and cornices give it a rich and imposing appearance. The lounge is an exceptionally large room, 104-ft. long by 48-ft. wide, and had projecting bow windows, port and starboard, having also a raised coach roof over the forward half. The decoration here is also in the English manner, with large panels in grey blue scheme of color, with colums and pilasters of yellowish scaglioli and ornaments in silver gilt. The dining saloon for the use of third class accommodation extends for a length of about 70-ft. across the whole width of the vessel. In addition there is a lounge and smoking room 24-ft. and 33-ft. long respectively.

There are seven cargo hatches, arranged three forward and four aft. These are served by 19 cargo derricks, which are carried by 2 masts and 6 derrick posts placed suitably in regard to the hatchways. For serving the derricks 16 cargo winches are provided, all of which are electrically driven.

Lifeboat accommodation is supplied for every person on the vessel. There is a total of 37 boats, of which two are motor driven and fitted with wireless equipment. Electric boat winches are fitted for working the davits, thus insuring speed and efficiency if emergency arises. All the boats are stowed at such a height above the deck that a clear space is provided out to the ship's side rails.

Ventilation has received the most thorough consideration and all the most modern methods have been brought into use. The Thermotank company's patent "Punkah Louvre" system has been installed practically throughout in addition to other mechanical and natural means. Hot and cold water services, both fresh and salt, have been provided for the convenience of all passengers and the ship's complement.

The vessel is to be propelled by twin screws driven by two sets of Parsons' turbines and single reduction gearing, each set comprising one high pressure, one intermediate and one low pressure turbine, working in series and driving separate pinions engaging with the main gear wheel. The high pressure turbine is of the impulse reaction type, while the remainder of this turbine comprises four expansions of reaction blading. The intermediate pressure is of the reaction type. The first stage of the h.p. astern turbine is incorporated in the l.p. casing. All turbines run at 1,372 r.p.m., while the propellors run at 85 r.p.m. The total shaft horse-power developed is about 20,000. When running astern the power developed is approximately 70 per cent. of the ahead power. The turbines are connected by flexible couplings to nickel steel pinions which engage with the main wheels on the propellor shafts, the gearing is of the double helical type, the main wheels consisting of cast iron centre parts with forged steel rings shrunk on.

The steam generating installation consists of six double-ended and four single-ended boilers of the ordinary multitubular return tube type, arranged in two compartments working under Howden's system of forced draught, and designed for a working pressure of 215-lbs. per square inch. All the boilers are 16-ft. 6-in. mean diameters, while the length of the double-ended boilers is 22-ft, and that of the single-ended 11-ft. 3-in. Each double-ended boiler is fitted with 8 separate furnaces of the Morison suspension type and has eight combustion chambers, the single-ended boilers have four furnaces and the same number of separate combustion chambers. The total heating surface is 50,544, square feet.

The furnaces are arranged for oil burning only; the Wallsend-Howden oil burning system is installed with two main sets of pumping and heating plant, comprising electrically driven pumps and one small steam driven oil fuel pump for harbour duty.

The New B.A.T. Building in Shanghai

THE British-American Tobacco Co., (China) Ltd., returned to their remodelled home at the corner of Museum and Soochow Roads, Shanghai.

The original structure was erected in 1907 for Messrs. Mustard & Co., who now re-occupy the ground floor. It was a building typical of the type erected at that period in Shanghai's transitional development and served in the major part as a godown. The expansion of the British-American Tobacco Co.'s interests at last demanded the use of the whole space for executive purposes, and the remodelling of the structure to render it as suitable as possible for offices was commenced toward the end of June last year, and but for the delays rendered inevitable during the local war last autumn, and the present unrest, the scheme would have been completed within the year.

B. A. T's. Remodelled Office Building

Many Alterations Needed

The old building itself was stable, but in the course of its life settlements had occurred and countless structural alterations had been effected, so that the task of the architects was not an easy one to render the block modern in effect without entirely rebuilding, which was not desired. The difficulty of meeting the up-to-date requirements of the Shanghai Municipal Council was great, especially as an additional floor was required, but by putting the new floor within a Mansard roof, and installing a sprinkler fire protection system throughout, it was possible to put the scheme in hand.

Elevationally the main lines and proportions were obviously dictated by the old building. Entirely new elevations to the road fronts with a distinct Italian feeling carried out in red and buff granite plaster and colored cement, in place of the grey granite plaster now so common in Shanghai, mark this very attractive building as a new and distinct feature here.

Reinforced concrete has been employed in the rebuilt western end, in the ground floor street fronts, in the light courts, and the cornice which bonds the whole fabric, while structural steel has been employed for the roof.

Internally all office and showroom areas are devoid of decoration, but the entrance halls, landings and staircases are treated classically with black and white ceramic mosaic floors, panelled and coffered ceilings and the walls covered to dado height with dull glazed tiles with a Sienna marble effect. The principal staircase itself is finished with white marble Terrazzo, marble newels to the lower floors, and balustrade in black iron with bronzed enrichments.

All grilles, door panels, etc., are of bronze, and all joinery is teak.

A large strong room is provided on each floor, and the most modern sanitary appliances are installed throughout. The heating medium is steam.

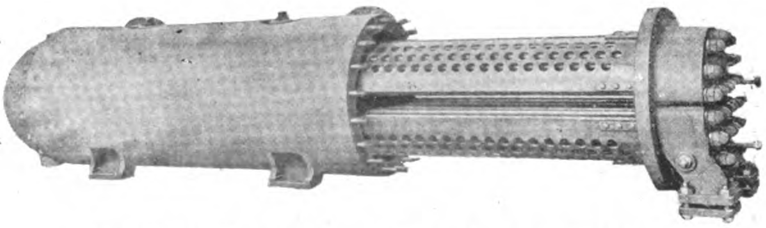
The Different Floors

Ten of the 11 large ground floor show windows and the majority of the ground floor space are available to Messrs. Mustard & Co., and the position of their old entrance to the building is unchanged. The principal entrance for the British-American Tobacco Co., is at the western end of the Soochow Road front, the ground floor containing the compradore's office, stationery department and mailing room. The accounting department is on the first floor, sales departments on the second, while the third is devoted to administration, and the top floor to the advertising and supply departments.

The architects for the building were Messrs. Algar & Co., Ld., the undertaking being the work of Mr. John W. Wilson, L.R.I.B.A., A.M.T.P.I., of this firm and the following were associated in the capacities mentioned :—Messrs. Sing Jin Kee & Co., general building contractors ; Messrs. J. E. Hayes Engineering Corpn., structural engineering ; Mr. G. S. Jensen, Waygood Otis lifts ; Messrs. Crittall Mfg. Co., steel casements and bronze work ; Messrs. Mustard & Co., Inc. Strong room doors, locks and furniture ; Shanghai Waterworks Co., Ltd., heating, plumbing, etc., General Electric Co. of China, Ltd., electrical installations ; Messrs. Mather & Platt, Ltd., sprinkler system ; Messrs. Pilkington Bros., Ltd., glass ; Messrs. Duncan & Co., tiles and Hope's lantern lights ; Mr. N. Belanovsky, Clerk of Works.

Locomotive Feed Water Heaters

The Superheater Company of New York and Chicago have just issued a new Catalog describing and illustrating the theory, construction and application of Elesco Non-Contact type of Locomotive Feed Water Heater. This catalog is a treatise on steam production and its utilization in locomotives. With the aid of diagrams accompanied by text, the increase in efficiency of the locomotive through the application of a feed water heater, is explained and what this amounts to in actual dollars and cents under varying conditions. The lastest designs are illustrated and many typical installations are shown. 24 pages and cover. 8¼-in. by 11-in. Copies of the Catalog may be secured on application to The Superheater Company.



The Elesco Heater Showing Tubes Partia ly Withdrawn

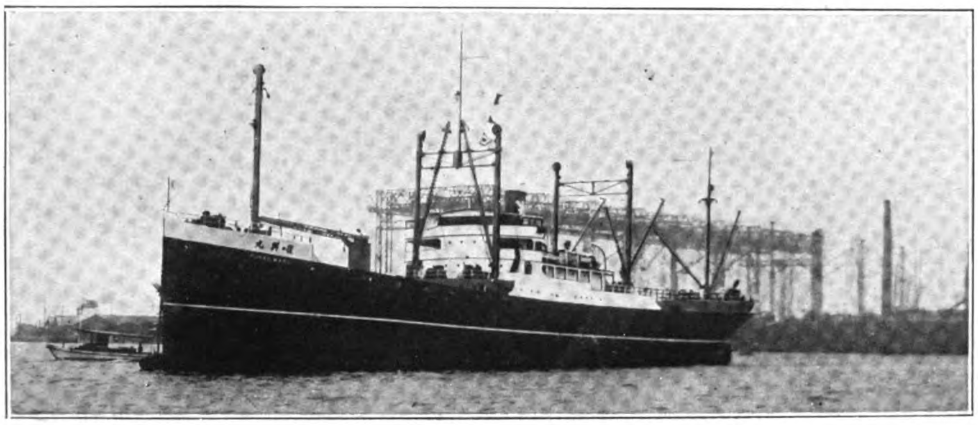
Tubes and Tube Plates Are so Fabricated as to Form a Bundle Which Slides In and Out of Heater Body and Provides for Easy Maintenance and Repairs. When Heavy Repairs on the Tube Bundle Are Necessary, the Bundle May be Replaced by a Spare Without Keeping the Locomotive out of Service.

The Diesel Engine in Far Eastern Vessels

THE increase of Diesel engines in Far Eastern shipping is becoming more noticeable as Japanese and other Far Eastern shipbuilders turn out oil burning vessels.

Three vessels ordered some time ago by the Osaka Shosen Kaisha for their regular service between Japan and South America can hardly be classed as small passenger vessels. They are 430-ft. in length, with a beam of 56-ft. and a depth of 36-ft., and have a large amount of passenger accommodation, in addition to which they carry 6,800 tons.

They are all being built at the Mitsubishi Dockyard, and one is to be fitted with the first Japanese-built Sulzer engine. The machinery for the other two will be constructed by Sulzers in their Winterthur Works. In each case twinscrew plants totaling 4,600 b.h.p. will be installed. The auxiliary machinery in these vessels is of particular interest. Four 250 b.h.p. airless-injection Diesel engines will be fitted, and this will represent the biggest installation of any such plant yet made on a motor ship. The engines are of the new type developed by Sulzers, and compete in price and weight with semi-Diesel motors.



The Fukko Maru

There will be launched in the near future the first of two mixed cargo and passenger ships ordered by the Koninklijke Paketvaart Mij., of Amsterdam, for their regular passenger and cargo service from Deli to Singapore and south of China. The hull is designed to carry a very considerable number of deck passengers, both forward and aft (the machinery being amidships), and the necessary arrangements are made in the 'tween decks.

There are four cargo holds, two forward and two aft of the engine room, while a peculiarity in the design is that the double bottom is not utilized for carrying fuel oil, but fresh water, of which so large a quantity is required when a considerable number of deck passengers are carried. A special deep tank is located forward of the machinery space and comparatively small lubricating oil tanks are arranged in the double bottom under the engine.

Use Electricity

Amidships on the awning deck is accommodation for sixteen first-class passengers in two-berth cabins, and thirty second-class in three-berth cabins, while on the other deck below are a few more passenger cabins. The first and second class dining saloons are located on the awning deck, the former at the forward end of the accommodation and the latter aft.

In the first ship, named the Op Ten Noort, which is being built by the Netherland Shipbuilding Company, Werkspoor four-cycle single-acting machinery will be fitted. There will be two motors of the six cylinder design, each developing 2,330 i.h.p.

In the Van Heutz, under construction at the De Schelde yard at Flushing, which is exactly similar so far as accommodation and dimensions are concerned, Sulzer machinery is to be used. There will be two engines, each developing, as in the case of the other vessel, 2,330 i.h.p., and these are of the normal two-cycle single-acting Sulzer design. They have six cylinders, 600 mm. bore and 1,060 mm. stroke, whereas the dimensions of the Werkspoor engines are 740 mm. and 1,300 mm., respectively. In each case the speed of revolution is about 100 r.p.m.

Efficient equipment in the form of electrically operated auxiliaries throughout will be provided. In each ship there will be two 400 b.h.p. Diesel engines coupled to dynamos, four-cycle engines in the one case and two-cycle in the other, and these will supply electricity for the engine room pumps, the deck machinery, steering gear and all other plant on the ship.

A firm of Japanese Shipowners, the Itaya Steam Ship Co., Hokkaido, has ordered a twin-screw cargo boat from a Sulzer licensee in Japan, the Kobe Steel Works, Kobe. This ship, of about 10,000 tons dead weight, will be propelled by two Diesel engines, type 4ST60, developing together 3,000 b.h.p. at 110 r.p.m. The engines will be built by the Kobe Steel Works.

The Japanese twin-screw motorship *Fukko Maru*, was built by Suzuki & Co. at their Kobe shipyard. The vessel, which was completed in December, has been chartered for lumber from the North Pacific. The *Fukko Maru* is the first motorship under the Japanese flag built primarily for the carriage of lumber, if not the world's first new Diesel craft with this distinction. The experiment involves the question of building high-priced but economically operated tonnage for low-grade and low-rate cargoes. Radical departures from the ordinary in the *Fukko Maru's* construction caused a dispute over her classification in Lloyds, but the was finally rated as 100-A-1. The *Fukko Maru* has her house amidships, but the space on the main deck is otherwise almost unbroken, the masts being employed as ventilators and the winches being situated on the superstructure. There is a mooring post for deck-loads between the No. 1 and No. 2 holds, and beneath this is the only bulkhead dividing the holds. Nos. 3 and 4 hold are divided only by a centre pillar, and there is a centre pillar in No. 2 hold. There are no stanchions in the cargo space. Thus great facility is provide for stowing lumber, both below and above decks. The *Fukko Maru* will carry 3,500,000-ft. of lumber. She is of 6,000 tons deadweight, 3,600 tons gross, or 2,200 net; length, B. P., 350-ft.; moulded breadth, 50-ft.; moulded depth to upper deck, 27-ft., and loaded draught, about 22-ft. The motorship is powerful with twin Sulzer Diesel two-cycle, four-cylinder engines of 800 b.h.p. each. She consumes 7.5 tons of oil per day at her sea speed of 10 knots. Her total fuel oil capacity is 1,500 tons, giving her a tremendous navigating radius.

Road Construction Conference in Hunan

Delegates representing 24 districts of Southern Hunan were invited by the Hunan Authorities to a conference held in Changsha on September 15 to discuss the various issues in connection with the plan of building a network of modern highways in southern Hunan. The program passed at the conference maps out six roads comprising a total length of 1,200 *li* to be constructed for southern Hunan. A sum of $3,000,000 has been voted for the expenses, the average cost of building a *li* of road being estimated at $2,500. The program is to be carried out in five years. Each year about 240 *li* of the projected roads are to be built and $600,000 will be raised by levying surtaxes on various provincial duties. A bank is to be organised to handle the funds in connection with the road building scheme.

Chinese Market for Low-Grade Iron and Steel

EVEN in the most active periods, the trade in low-grade and scrap iron and steel with China is largely a business in small tonnages except in the case of old plates, cuttings of plates and similar materials, orders for which will run from a few hundred tons to several thousand. Profits made on the smaller lots are usually meagre. While the demand for wire shorts is perhaps the best sustained of any, buying by Chinese merchants includes such other scrap or defective materials as bar crop-ends, plate cuttings, second-hand plates, used chain, old wrought-iron horse-shoes, old files, hoop-ends, defective wire rods, old enamelleds igns, old wagon tyres, tinplate wasters, tinplate waste waste and tinplate scrap. In new materials bamboo steel is the one product peculiar to the Chinese trade, with galvanised sheets and black sheets by the crate occasionally in active demand.

Bamboo Steel

Bamboo steel, a large part of China's requirements of which had been supplied by American makers during the war, was previously supplied under popular brand names principally by German mills, which have returned to the Chinese market as the principal suppliers of this material. While the requisite quality of all the second-hand and defective material purchased is softness, so that it may be the more easily forged by hand, bamboo steel ranges from 0.65 to as high as 0.85 per cent. carbon, and is forged and tempered for use in cutting tools of various kinds.

In testing bamboo steel the practical method is to. a great extent substituted for the scientific. No specific carbon content is demanded as a rule, the quality required being a clean break of a bar from 34-in. to 36-in. long, dropped from the height of a man's head. The name of this carbon tool steel is taken from the appearance, the manufacturer rolling the bar with joints and lines that give it the resemblance to sections of bamboo. Although the leading American export interest now ships a small tonnage of bamboo steel to China, the sale of this product under brand names does not seem to have developed among American mills to any extent. The return of Germany to world markets has slowly edged the American product from China, as the market price under keen competition has slowly declined.

Galvanised Sheets

In addition to bamboo steel, China is a purchaser of other material, including galvanised wire, wire nails, mild-steel bars, black and galvanised gas pipe, galvanised sheets and some structural material. With the exception of pipe and considerable purchases of sheets, much of the business of to-day goes to Continental works. In purchasing galvanised sheets the most popular specification is 48 sheets to a 4¾-cwt. crate, measuring 3 by 7-ft., with Nos. 38. 33 and 25 gauges; 4 by 7-ft., also popular, in crates of 560 lbs. Plain galvanised sheets are principally in demand, although corrugated material is occasionally purchased. When the sheets are finally disposed of in small lots from the warehouse, they are generally sold by the picul (133⅓-lbs.). There is also a fair market for stove-pipe sheets.

In the Shanghai market quotations are generally published on the two most popular brands of galvanised plain sheets, Raven, rolled by the Grovesend Steel & Tinplate Company, Limited, Gorseinon, Glamorgan, Wales, and the Apollo brand of the American Sheet & Tin Plate Company. General classifications of English and American sheets are also made. As in Japan galvanised sheets are extensively used for roofing purposes and in the construction of side walls of small buildings, for storehouses and similar purposes.

Nails and Wire Shorts

When a Chinese merchant inquires for nails the exporter correctly assumes that he is interested in purchasing countersunk, chequer-head wire nails of Birmingham wire gauge. The only type of nail consumed in any quantity is the cut nail. Countersunk, chequer-head wire nails are used in sizes of ⅜, ½ and ⅝ and 1-in. to 7-in. in the Northern districts of China, supplied by the Shanghai market, and in sizes of ⅜, 7/16, ½ and ⅝-in. in the Southern districts, supplied through Hongkong and Canton. This difference in specifications between Northern and Southern China also appears in the method of ordering quantities, the North buying by the 100-lb. keg, the South demanding the picul keg of 133⅓-lbs. Since the war the trade in nails, which the American exporter enjoyed during that period and directly afterwards, has to a great extent disappeared with the return to world markets of European steel-producing countries. It is noteworthy, perhaps, that while the earthquake in Japan in 1923 resulted in a rather heavy demand on Chinese stocks of nails, which were the nearest available supplies for the devastated districts in Japan, practically none of the replacement business was received by American works. This turn to European sources of supply since the war is particularly true of structural material purchases, the larger part of which are placed with European works particularly Belgian, at prices lately many dollars a ton below the American delivered price.

Of the so-called second-hand or defective materials purchased, wire shorts, galvanised and plain, are probably in more continuous demand than most of the other products used. A wire short generally consists of a coil of wire, ranging up to 40 or 50-ft., or short of a standard length. Occasionally, a full standard coil will be included where the wire has been found defective. Lots are assorted, various gauges being included in a single lot, as a rule. The most usual assortments of shorts range from Nos. 6 to 16 gauge. Annealed wire shorts are in demand in guages from Nos. 16 to 25. In wire shorts, unlike most other materials, the bulk of the trade is with the United States, where the mills make more serious efforts to meet the conditions. The larger part of the American exports is in galvanised rather than plain shorts, the United Kingdom making a very showing in exports of plain-wire shorts, particularly in the past few years. Shorts are used by the Chinese for a wide range of purposes where American manufacturers, working with modern machinery, regard full coils of perfect wire essential for high rates of production.

Tinplate Waste Waste

Possibly next to the wire shorts as a material in active demand by the Chinese consumer is tinplate waste waste, which has advanced to a position of relative importance in Far Eastern trade in the past year or two. Tinplate waste waste, of lower grading than tinplate wasters, but considerably better than tinplate scrap, consists of assorted gauges and sizes of plate ranging from 10 by 14-in. to 18 by 28-in. and base weights of 70-lbs. to 155-lbs. and heavier, packed as a rule in 200-lb. cases. One of the larger American tinplate mills estimates that it has available under normal

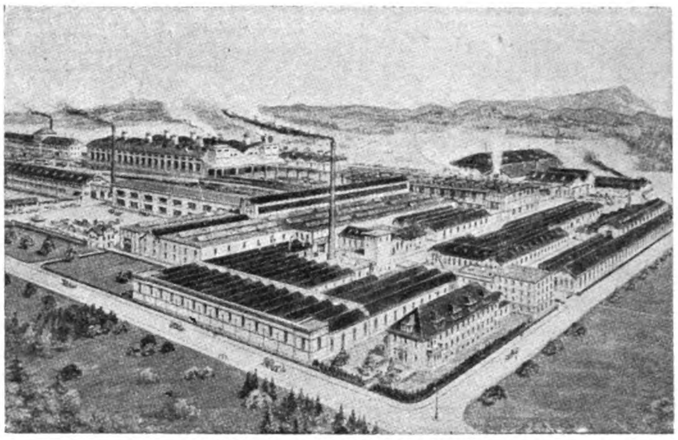
conditions about 200 tons of such material per quarter, and estimates of the annual available tonnage from all tinplate mills in the United States vary from 7,000 to 8,000 tons or more annually.

Tools and Utensils

The majority of the tools, household utensils and agricultural implements used in China, particularly in the interior, where life is more primitive than in the large cities, are hand-forged from scrap, providing a demand by importers in Shanghai and other ports, who distribute to the local blacksmith or householder. In these small lots of all kinds of scrap and defective iron and steel, the prime requisite is sufficient softness to permit working by hand. Second-hand plates, plate cuttings, bar crop ends, hoop ends, and round, square and semi-hard cobbles are popular. From such raw materials the Chinese workman fashions spikes, knives, often with an edge of bamboo steel, digging forks, hoes and numerous other tools and utensils. About the only requirement of a piece of scrap, obviously, is softness and sufficient area free from holes or damaging imperfections to permit its being formed into a tool at a low price.

Exporters deal with an import company operated and largely owned by British, American, German or some nationals other than Chinese. The business, says Mr. George S. Herrick, in an interesting article in "The Iron Age," is handled through foreign and native banks. The foreign banker finances imports up to the time the material leaves for the interior buyer, while the Chinese banker finances deliveries from the time they leave the public wharf until payment has been received from the buyer at such distributing points as Nanking, Hankow, Kiukiang, Changsha, Ichang and Chungking. There are theoretically four days of settlement in a year, the last day of settlement coming on New Year's day, when all accounts must be closed. In practice the jobber in the interior seldom is clear of indebtedness, carrying forward a balance from year to year.

BUHLER BROTHERS
Engineering Works and Foundries
UZWIL (SWITZERLAND)
Established 1860 Employees abt. 2,000

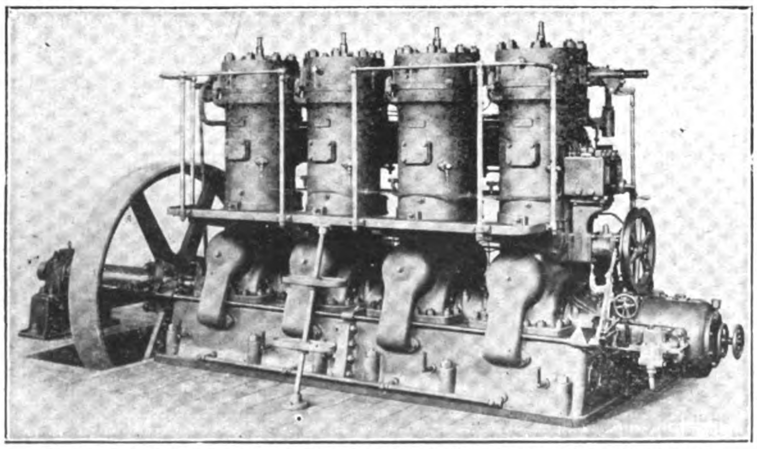


Our Works at Uzwil, Switzerland

SPECIALITIES:
Portland Cement Works
Crushing and Breaking Machinery
Brick and Tile Making Plants
Silico-Calcareous Brick Works
Chocolate and Cocoa-Factories
Paste-Goods Factories
Breweries and Malteries
Briquetting Plants
Powder and Celluloid-Presses
Rice-Mills
Roller Mills for Soap and Paint Manufacture
"Duplex" Newspaper Printing Presses
Conveying Plants of every kind
For particulars apply to the
Far Eastern Office: BUHLER BROTHERS
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

SULZER BROTHERS
SHANGHAI ENGINEERING OFFICE
4 AVENUE EDWARD VII.

蘇爾壽工程事務所
上海愛多亞路四號
本公司常備目錄供給各界
垂詢工程事務亦竭誠酬答



Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fans and Ventilators for all purposes, Fire Engines, Stationary and Marine Diesel Engines, AIRLESS INJECTION DIESEL ENGINES, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

4-CYLINDER AIRLESS INJECTION DIESEL ENGINE

SIMPLE DESIGN; SIMPLE ATTENDANCE; RELIABILITY AND ECONOMY

WINTERTHUR. SWITZERLAND.

PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

JAN 2 1926

THE FAR EASTERN REVIEW

FINANCE ENGINEERING COMMERCE

上海仁記路拾六號

遠東時報

SHALL JAPAN LEAD? no

WHEN IS CO-OPERATION NOT CO-OPERATION

DO THE CHINESE HATE THE JAPANESE?

THE NEW ASIA

FIRE FIGHTING MACHINES IN CHINA

THE NEED FOR TESTING MATERIALS OF CONSTRUCTION

GOLD MINING IN THE PHILIPPINES

CONSTRUCTION WORK ON THE F.M.S. RAILWAYS

PROPOSED TRAIN FERRY SCHEMES

THE UJIKAWA ELECTRIC COMPANY

Vol. XXI | November, 1925 | No. 11

Greensburg, Pennsylvania,

October 1st, 1925.

Mr. George Bronson Rea,

The Far Eastern Review, Shanghai, China.

My dear Mr. Rea:

Many, many congratulations on the splendid work you have done in The Re-construction Number of the Far Eastern Review.

It shows in a most satisfactory way not only what Japan has already accomplished in rehabilitating the devasted area, but it also shows the wonderful work she has in progress and has planned for the future. Furthermore, the re-construction budget indicates that Japan has both the ability and the willingness to accomplish the desired result.

Once again I take great pride in my Japanese friends.

Cordially yours,

Cyrus E. Woods.

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street.

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

TOKYO: The Foreign Agencies Corporation, Mitsubishi Building No. 21, Marunouchi.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum.

VOL. XXI NOVEMBER, 1925 NO. 11

CONTENTS:

	PAGE
SHALL JAPAN LEAD THE POWERS IN CHINA?	679
DO THE CHINESE HATE THE JAPANESE?	680
JAPANESE RAILWAYS ADOPT AUTOMATIC COUPLINGS	681
WHEN IS CO-OPERATION NOT CO-OPERATION	682
THE NEW ASIA	683
SIAMESE GUNBOAT "RATANAKOSINDR"	685
FIFTIETH ANNIVERSARY OF THE LINK-BELT COMPANY	686
A HYDRO-ELECTRIC UNDERTAKING IN NORTHERN KOREA	686
THE COMMERCIAL AND INDUSTRIAL POSITION IN JAPAN	687
THREE NEW P. & O. LINERS	688
GOLD MINING IN THE PHILIPPINES	*689
THE NEED FOR TESTING MATERIALS OF CONSTRUCTION USED IN THE FAR EAST	*700
FIRE FIGHTING MACHINERY IN CHINA	*704
THE UJIKAWA ELECTRIC COMPANY	*706
FAR EAST SHIPPING CO.'S IN A BAD WAY	712
PASSING OF THE "CHINA"	712
ROUND THE WORLD FOR TWOPENCE PER MILE	713
KUNISHIMA WATERWORKS, OSAKA	*715
PROPOSED TRAIN-FERRY SCHEMES FOR NANKING-PUKOW AND WUCHANG HANKOW	*716
THE SIBALOM RIVER IRRIGATION SYSTEM	*719
BRILL EQUIPMENT FOR JAPAN	*720
NEW P. & O. LINER—"CHITRAL"	*721
SELF OILED ALL GEARED SLIDING HEAD DRILL AND TAPPER	*722
CONSTRUCTION WORK ON THE F.M.S. RAILWAYS	*723

**Illustrated with Maps or Photographs*

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allan, Whyte & Co., Ltd. 27
Allen & Co., Ltd., Edgar 11
American Blower Co. 50
American La France Fire Engine Co., Inc. 71
American Locomotive Sales Corp. .. 25
American Tool Works Co. 1
Armstrong, Whitworth & Co., Ltd., Sir W. G. 19
Associated British Locomotive Manufacturers for China .. 49
Attwater & Sons 48
Avery, Ltd. W. & T... 11

Babcock & Wilcox, Ltd. 36
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 17
Bethlehem Steel Export Corp. .. 31
Bliss Co., E. W. 27
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Bucyrus Company 63
Buhler Brothers 726
Butterfield & Swire 44

Canada Carbide Co., Ltd. 70
Chambers Scott & Co., Ltd. .. 14
Chartered Bank of India, Australia & China 48
Chinese Eastern Railway 50

Daido Electric Power Co., Ltd. .. 28
Dai-Ichi Ginko Ltd. 62
Dai Nippon Brewery Co. 34
Diamond State Fibre Co. 75

Dixon Crucible Co., Joseph .. 70
Dodge Brothers 5

Electricity Department, S. M. C. .. 6
Escher Wyss & Cie 16
Etchells Congdon & Muir, Ltd. .. 70
Evans & Sons (Wolverhampton) Ltd., Joseph 2
Exchange Bank of China .. 61

Fairbanks Co. 21
Fairbanks Morse & Co. 73
Fuji Gassed Spinning Co. 10

Gaspary & Co., Dr. 14
Gleniffer Motors, Ltd. 10
Goodell Pratt Co. 73
Goulds Manufacturing Co. .. 14
Green Island Cement Co., Ltd., The 20
Greene Tweed & Co. 17

Hennef Engineering Works .. 75
Hongkong Rope Mfg. Co. Ltd. .. 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co., Ltd. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. .. 58
International Banking Corporation 55
International General Electric Co., Inc. 51
International Labour Office .. 72

Japan Sugar Co., Ltd. 6
Jardine Engineering Corp., Ltd., The 12
Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. .. 2
Kawasaki Dockyard Co., Ltd. .. 33
Kokusai Kisen Kaisha 45

League of Nations 72
Link-Belt Co. 63
London Directory Co., Ltd. .. 50

Mather & Platt, Ltd. 3
McConway & Torley Co. 14
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd... 38
Mitsubishi Marine & Fire Ins. Co., Ltd. 38
Mitsubishi Shoji Kaisha 18
Mitsubishi Warehouse Co., Ltd. .. 38
Mitsubishi Zosen Kaisha, Ltd. .. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. Ltd. 18
Mitsui Bussan Kaisha Ltd. .. 26
Mustard & Co. 14

Nippon Menkwa Kabushiki Kaisha 52
Nippon Yusen Kaisha .. 46, 47
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. .. 24
One Hundredth Bank, Ltd., The .. 59
Osaka Shosen Kaisha 42
Oster Manufacturing Co. 71

Petters, Ltd... 15
Pooley & Son, Ltd., Henry .. 4

Redpath Brown & Co., Ltd. .. 15
Reuther & Reisert, C. 75
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. Under Index

Sale & Frazer, Ltd. 8
Shanghai Dock & Engr. Co., Ltd. .. 32

Shanghai Municipal Council 6
Shibaura Engineering Works, Ltd. .. 7
Siemens China Co. 36
Simons & Co., Ltd., Wm. 13
Smidth & Co., F. L. 41
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. 27
Standard Oil Co., of N. Y. 29
Standard Underground Cable Co. .. 14
Stewarts & Lloyds, Ltd. 16
Sturtevant Co., B. F. 63
Sulzer Bros. 726
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd... 60
Superheater Co., The 71

Thornycroft & Co., Ltd., John I. .. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 10

Ujigawa Electric Power Co., Ltd. .. 72
United States Steel Products Company .. ..23, 37, Back Cover

Waggon-und Maschinenbau Aktiengesellschaft Gorlitz 65
Wallace & Tiernan Co., Inc. 34
Walworth International Co. 4
Westinghouse Electric International Co. 76
Williams & Co., J. H. 3
Worthington Pump & Machinery Corporation 35

Yarrow & Co., Ltd. 21
Yasuda Bank, Ltd. 62
Yokohama Dock Co., Ltd. 34
Yokohama Specie Bank, Ltd. Cover
York Manufacturing Co. 72

Zwickauer-Maschinenfabrik 65

Engineers interested in

Economical Excavation

should file the Ruston Sectional Catalogues which make a complete work on

MODERN POWER EXCAVATION

The latest Catalogue issued is the new edition illustrating the No. 6 Universal Excavator.—The Leading General Purpose Machine.

Send for copy of this and any other Catalogues which may be missing from your set.

OUR MOTTO:—A "Ruston" Excavator for every Excavating Job.

USERS MOTTO:—For every Excavating Job a "Ruston" Excavator.

Ruston & Hornsby, Ltd.

Lincoln—England

AGENTS:—

MARTIN & Co., Calcutta

UNITED ENGINEERS, LTD., Singapore, Rangoon, etc.

L. J. HEALING & Co., Tokyo, etc.

ARNHOLD & Co., LTD., Shanghai.

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, NOVEMBER, 1925 No. 11

Shall Japan Lead the Powers in China?

Japan's Leadership at the Tariff Conference an Acknowledgement of Japan's Pre-eminence in China's Trade

Meeting China More than Half Way but What Will it Avail?

THE Tariff Conference may not reach any conclusion. The delegates are already meeting under fire of contending forces. Feng Yu-hsiang is marching his troops beyond Peking toward Tientsin and in another direction toward Mukden. Chang Tso-lin is sending reinforcements and armaments beyond the Great Wall into China. The delegates who have come to China in all sincerity and friendship, who have sought to help the Chinese people in their transitional period, who have listened to the extreme demands made by China's delegates and have conceded point after point, find themselves with a Chinese Government which is now representative of nothing in China and should the civil war take on a phase which might endanger the persons of the Government now in power and of the Chinese delegates now negotiating, there would surely be an exodus to the foreign concessions in Tientsin. The foreign delegates would one day arrive at the Conference but find no Chinese delegation. They would find that there is no Chinese Government. They would find themselves attending what some one described as Simian Business.

China's Constant Chaos

For years the Powers have been weary of the trouble that is made for them by China. It is not that serious-minded men would continue indefinitely and unchanged the present position of the foreigners in China. It is not that the Powers are unwilling to grant China autonomy and equality. It is rather that the Powers find in the lack of government and stability in China a dangerous spot on the earth's surface which may at any time bring about a world-wide cataclysm. Nobody can altogether disregard the fact that due to China's lack of governmental control of the frontiers, Russia has since 1919 marched into Mongolia and Turkestan and practically organized both into largely independent republics. Nobody can disregard the dangers to world peace in Russia's position in Canton, where a Russian agent, Comrade Borodin, is practically a Czar, who utilizes his power to destroy the business of other nations—nations which are not unfriendly to China but against whom Russia bears an ancient grudge. No nation can disregard the fact that Soviet Russia is utilizing the situation in China to turn this country into a buffer state as between Russia and Japan on one side, and Russia and Britain on the other. Furthermore, nations which at present have no predatory designs on China, nations which hope and desire only to help China and to recognize her equality in the family of nations, find themselves subjected to boycotts and strikes which are financed by Russia, instigated by Russia and from which only Russia derives benefits. Every nation has got to recognize that in this situation, the Bolshevik government is seeking to utilize China as a base for the destruction of British, American and Japanese industrial life that the great foreign trade of these countries might cease and that the workers, who must depend upon foreign trade for labor, might be forced by hunger and discontent to create disturbances in their own countries. That is Russia's aim and China is only a tool.

The disappointment of the Powers, therefore, that so little has been and can be accomplished at the Tariff Conference is very great. They feel that they have done their best and that China is unable by internal conditions and by the promptings of her false friend, Russia, to set her house in order or to utilize the assistance offered by the Powers to set her house in order. After all that has been happening since the Versailles Conference, the Powers are naturally at their wits' end to know what to do about China. If they altogether disregarded China, withdrew their missions and settled down in the Treaty Ports, Russia will utilize such a situation to create disturbances throughout Asia, for Russia stoops to methods which to any other nation would appear to be not only reprehensible but beyond the bounds of ordinary decency. If the Powers intervene in China, they realize that there is not sufficient *esprit de corps* amongst themselves to make co-operation long-lasting. Their only hope lay in agreeing to the leadership of one of the Powers and the granting to that Power of the support necessary to make the task successful.

Mr. Hioki's Leadership

That was done at the opening of the Tariff Conference. The principal speech at that opening session was made by Mr. Hioki, the Japanese delegate. In that opening speech he read China a lesson, as an older brother speaks to a younger. He told China of Japan's efforts to gain equality and how successful but slow they were. He indicated that if China would follow a similar path there was reason to believe that ultimately China would succeed as Japan succeeded. He indicated that the path of success lay in the general direction of internal reconstruction and that it was hopeless to expect that success could be achieved on the basis of internal chaos and international impertinence. His address was a masterpiece of plain speaking in international relations and will rank with Mr. Hughes' statement at the opening of the Washington Conference. The other speeches, in effect, seconded what Mr. Hioki had said. They made it clear to China that they came in friendship and hoped that China would find a way toward the establishment of order and Government so that friendship might result in something tangible. And while they meet, before they have a chance to settle their terms, before a new treaty is written or the old ones amended, China is again thrown into the chaos of civil war, the armies of the various generals again march through the country bringing destruction in their wake, the government is again about to be changed, the chief executive is practically made a prisoner and everything sane and sensible gives way to the horrors and childishness of the militarists' annual game of driving one another about the country.

Russians in all Armies

The presence of Russians in several of the armies, on both sides is ominous. Were Englishmen or Americans or Japanese to be used by the various tuchuns to fill the ranks of their divisions, there would be an outcry in China of foreign interference and the Soviet Government would organize a "Hands-Off-China" Movement not only in their own country but in others, particularly in the United States, where rich and sentimental women get a tremendous kick out of interfering with things they understand nothing about. But, to Chinese and to many foreigners the Russians are regarded as refugees who are willing to act as mercenaries for their daily bread. That is all sheer ignorance. The Russian mercenaries in all the armies are working for the Soviet Government. They win forgiveness for a previous state of "whiteness" by fighting in China, by creating disorders in China. Soviet agents have approached all sides of the present conflict and have offered them assistance asking no promises in return. Only the truly patriotic and suspicious generals have refused their advances, because they realized that when someone offers something for nothing, there is a trick in it. *The trick is that Russia wants disorders in China. Russia wants the fight. Russia wants China to be in chaos. For as long as China is in chaos, Russia can continue the process of stealing Mongolia and Turkestan, Russia can continue her penetration in northern Manchuria. That is not all. Russia wants chaos, because it interferes with foreign trade and therefore lessens the interest of the westerners in China.* It is a long and dangerous game that Russia is playing and one that can have no end other than a war for the extermination of Russia's influence in Asia.

Shall Japan lead in such an enterprise ? It is inevitable that Japan shall view with distrust and alarm Russia's movements in Mongolia. It is inevitable that Japan shall object to Russia's advances into Manchuria. One need only study the history of the two countries, to understand what their national ambitions are and to watch their economic development, to realize that Japan is dependent upon Manchuria and Mongolia for her life. There was a time when the European Powers were suspicious of Japan. There was a time when the United States distrusted Japan. That time is over except in the minds of picayune individuals which live in an atmosphere of racial hatreds. **Japan has met her obligations, has lived up to her treaty contracts and has worked valiantly with the western Powers for the maintenance of the peace of the Pacific and the western Powers will not forget it.** As between Russia and Japan, the Powers will never support the Soviet Government against a people who are orderly, peace-loving, law-abiding, who have paid their way as they have gone and whose constructive genius has won the admiration of the world. The Powers will back Japan. Particularly will the United States and Great Britain back Japan because they feel that in their own countries they have to recognize the racial situation and that therefore it is advantageous to them as well as to Japan, that Japan should have freedom for economic development in the underdeveloped countries of Asia, Manchuria and Mongolia. Furthermore from a trader's standpoint, the United States and Great Britain have always benefitted from Japan's exploitations because wherever Nippon has gone, railroads, roads, mills, factories, industries have gone and the machinery and steel for these enterprises come from the United States and Great Britain. The South Manchuria Railway alone buys more steel in the United States than the rest of China put together. That is a fact which is not to be forgotten. And because of such facts the Powers will back Japan.

What Will China Do ?

Will China recognize that Japan has a right to fight for her life and that it is not to the interests of China that the wonderful developments of Manchuria should fall into the hands of Soviet Russia ? Much depends on China's attitude. If China is fatuous enough to believe that by allowing Russia to continue the present policy and by bending to that policy, the western Powers will be brought to their knees, it simply means that China has lost all sense of statesmanship. If, in the event that Japan has to fight for her life again in Manchuria, China provides an unfriendly rear, things might go very hard on China, for as the world is constituted these days, nations do not allow their rears to be endangered during periods of warfare and they take no chances because of sentimental considerations. China's only hope lies in supporting such a situation as will guarantee the integrity of the frontiers, that is, that Manchuria, Mongolia and Turkestan shall remain integral parts of the Republic of China. Japan would be more than ready to fight for just that principle. Great Britain would be more than ready to fight for that principle. The United States would support the Powers which were fighting for that principle. Therein lies China's path and China's strength.

The American Attitude

If Japan is to assume the leadership in the fight against Soviet Russia, the other Powers which are suffering in China because of Russian activity will have to recognize that leadership and will have to lend to Japan every possible assistance. There can be no question as to the American attitude. It is not generally recognized that as sentimental as the United States is about China, the United States is more sentimental about Soviet Russia but in a different way. The United States simply despises Soviet Russia. The United States is the last Power which refuses to recognize Soviet Russia. American labor is as much opposed to Bolshevism as American capital. Any nation which takes up the cudgels against Russia will have American support, not only support of the Government but the more solid support of the American people. The American people will enjoy the spectacle of little Japan defeating the Great Russian Bear as Japan has already defeated that country. The American people will look to China to do her share in achieving that defeat, as a recompense for all that America has done for China. For the American people will realize perhaps only soon enough that only Japan stands between them and Soviet Russia, between them and a Russified East Asia.

Do the Chinese Hate the Japanese?

MR. ARTHUR BRISBANE, the erudite editor of the Hearst publications, the brilliant son of a liberal father, a man who should know better, continues to sing his songs of hate. He hates the British and he hates the Japanese. He lives and thrives upon these hatreds. They are to him the foundation of his intellectual life. His religion seems to be based upon this sort of hatred.

Under the caption "Today" Mr. Brisbane places the subhead "Kill British, Japanese." Then runs a little paragraph which is as ill-timed as it is motivated by hatred, as mischievous as it is untrue. He says :

A little cloud, about the size of a monoplane wing, shows in the east. Chinese students were parading Peking's streets yesterday afternoon, denouncing the killing of strikers in Shanghai, seeking to enter foreign legations and yelling 'kill the British and Japanese.'

"*That last is the reassuring word, Chinese hate the Japanese most, British next, Germans perhaps next. They don't hate us very much. And most of all, they hate Japanese.*

"*From the western white man's point of view, that's the reassuring thing in Asia. The Asiatic always hates some other Asiatic worse than he hates any European. A really high spirited Mohammedan in India would rather kill three Hindusth an one Briton any day.*"

But who says that the Chinese hate the Japanese most of all ? Who says that the Chinese hate at all ? Except for the Boxer trouble, which was as much anti-Chinese as it was anti-foreign, which was a political move on the part of an alien dynasty to prevent

themselves from being forced into constitutionalism, the Chinese have never shown any indication of hatred against foreigners. The Student Movement of 1919 was definitely not anti-foreign but anti-governmental. The Chinese simply objected to the signing of the Versailles Treaty. In the course of that movement Japan and Japanese goods were boycotted because Japan held Shantung, but the moment Japan returned Shantung and the Japanese policy toward China changed, the Chinese attitude toward Japan changed. It will surprise Mr. Brisbane and others who study conditions in China from scant telegraphic newspaper reports that in the Sino-Japanese friendship association in Shanghai are included as active members men who were most diligent in propagating the anti-Japanese boycott in 1919. They are today pro-Japanese, if anything. They realize that China's safety lies not in chauvinism or in playing with Soviet Russia but in friendship with a powerful and closely related neighbor.

In the present upheaval, Japan has suffered less than Great Britain not because the Chinese hate the Britons more than the Japanese or more than the Americans, but because the controlling nation in the Shanghai Municipal Council, which is international and the chairman of which is an American, happens to be Great Britain, because of the preponderance of British interests in the city. Had the same incident occurred in a city where American or German interests predominated, the attack would have been on the United States or Germany. Some day the Chinese are going to turn on Soviet Russia on account of the Chinese Eastern Railway and the Mongolian situation. Some day they are going to turn on France because of French machination in Yunnan. They will then not hate Russia or France. They will be expressing an opinion after their own fashion on current events. In a country where there is no ballot, no orderly method of expressing public opinion, the people naturally turn to mob expression. That is the easiest way.

The test of friendship is trade. In regard to trade the predominance is with Great Britain and Japan. Japan's trade is constantly growing. The number of Japanese banks in a city like Shanghai is on the constant increase. The relationship between Chinese firms and Japanese firms is friendly. For instance, when the Chinese textile industry found itself in difficulties it turned to Japan for assistance. At first it looked to the manufacturers of the machinery used, American firms, for relief, but the Americans were unable to do anything for them. The Americans were unable to provide them with the loans to pass over a hard period. They went to the Japanese and found the money they needed. Similarly in other industries, the business men of China have found that the business men of Japan mean business. Confidence and friendship are built in that way, not by talk.

The position of Japan in China is a very difficult one because of propinquity and the disorders within China. It is natural that moments of misunderstanding and antagonism should arise, just as Mexico, from time to time, misunderstands the United States and as a Canadian newspaper objected to the crossword puzzle explanation that the United States was the greatest nation on earth. Neighbors and relatives are more likely to misunderstand each other than strangers who meet occasionally and always put their best manners forward. But the future of China and Japan are so interwoven, particularly because of Japan's commercial and economic interest in China and Manchuria that it is fatuous to assume that the people of the two countries can hate each other. Men who read the same language, who are bred to the same philosophy of life, who love the same art, whose food is similar and whose table-manners are the same, men whose every phase of life is similar cannot hate each other. They may quarrel but they can never hate.

Mr. Brisbane's suggestion that the white man can find safety in the Pacific if the Chinese hate the Japanese is another indication of a misreading of Far Eastern affairs. Were the Chinese to hate the Japanese, they would still not love the white man more than they do. After all, the American exclusion of Chinese, even of Chinese merchants and tourists under the new immigration acts, is something which every Chinese views with shame and stronger feeling. The fact that a Chinese women married to an American cannot become an American citizen under any circumstances, that she cannot even live in the country of her husband for more than a statuatory period, cannot be regarded as an act of friendship by Chinese. The fact that the very legislation of Congress against orientals indicates to the oriental that the American Government regards them as inferior, as races lower than the mixed peoples of the Balkans, than the wild races of South America, is not a pleasant thought for a Chinese who ranks his culture as equal if not superior to that of many European nations. Friendship is not erected upon prohibitions and exclusions. There must be affection. There must be faith.

Should the war for which Mr. Brisbane apparently hopes between the United States and Japan ever take place, Americans living in the Far East would be sorry indeed. For after all, our growing trade depends upon peace and to a large extent upon peace with Japan. The United States sells more goods annually to Japan th^n China. The United States probably sells more American goods in China through Japanese and British firms than through American firms. It is all grist to the national mill however the goods are sold and those Americans who at one time thought that the only safe way of doing merchandizing business in the Far East was through local American firms have gradually come to change their minds. The way to do business anywhere is to do it as it can be done. If American goods can be sold by an American, British or Japanese firm, let it be sold by whoever can place the order.

The principal American industry in China is the missionary work, which employs the largest number of Americans in the country and involves the largest American investment here. The missionary cannot thrive on disturbances. He requires peace and a friendly attitude. In 1919 the American missionary made the singular mistake of encouraging his students to be unfriendly to Japan because of the Shantung question. The result has been that every time the students are dissatisfied with something the Americans do, they attempt to follow the same procedure that they did in those days. In a word, the missionary stirred up trouble for himself when he countenanced any form of anti-foreignism. When Mr. Brisbane suggests hatred for the Japanese, he is encouraging a form of chauvinism which is bound to react detrimentally to all foreigners in China, including the Americans.

Mr. Brisbane has a great reputation in the United States and men listen to his words of wisdom because he is reputed to obtain a huge salary for writing them. But his purview of the Far Eastern situation is not wisdom because it comes out of his own head without specialized knowledge and without any experience. Mr. Brisbane has not within recent years visited any Far Eastern countries and he has not viewed for himself conditions here. For instance the last paragraph of his statement is so false as to contradict all that has happened in Asia since the Great War. Mr. Brisbane knows nothing about China, Japan or India. He might speak less like a prophet on a mountain and more like a man of affairs if he saw the situation first hand.—G.E.S.

Japanese Railways Adopt Automatic Couplings

A few years after the nationalisation of railways in Japan, it was decided that steps should be taken to equip the whole of the rolling-stock with automatic couplings. To the end, considerable preparatory work was done in three stages, and on July 17, last some 63,000 vehicles were finally equipped and ready for service with automatic couplings, the actual work of transition being performed in the course of a single day. The amount expended represents the sum of Y.26,900,000 while the Government has also paid some Y.1,500,000 yearly to the private railway companies as a subsidy of half their expenditure in converting their stock of 5,000 vehicles. Prior to the recent change over, automatic couplings were in use on the railways of Taiwan (Formosa), Chosen (Korea) and South Manchuria, these railways being under Japanese jurisdiction, while in Japan proper they had only been in use on the Hokkaido lines of 1,300 miles and on the Tokyo suburban tramway lines. In order to effect the change in such a short space of time, freight traffic movement over the whole of the Japanese railway system was completely stopped, with the exception of a few "perishable" specials, for an entire day, and the vehicles were gathered at 221 stations. There gangs of men were assigned to replace the couplers, from 20 to 25 cars being allocated to each gang, or approximately 3.5 vehicles to each workman. In all, 12,000 men were engaged on the work. It was anticipated that the work would require the whole day, but at many places the transition was accomplished in half that time. As a result, all the stock on the Japanese railways is now completely equipped with automatic couplings, and it is anticipated that, among other advantages, coupling and uncoupling accidents, which have averaged about 220 per year for the last five years, will be greatly diminished.

When is Co-operation Not Co-operation

Since the Versailles Conference and the Organization of the Consortium the Powers have Sought to find Common Working Basis in China.

The Wireless Situation an Unnecessary Stumbling Block

IF the Powers are able to co-operate on such questions as financing Government loans or building railroads, why is it so difficult for them to co-operate on the building of wireless stations in China ? The wireless tangle, which for six years, has kept the Chinese Government and the various Foreign Offices wondering how it would all end, is a mess which could not have happened had there been a well organized, orderly Government in China. The difficulty arose because each Cabinet Department seems to go off altogether on its own in the making of contracts. In 1913, an agreement was made with the Marconi people for the erection of wireless plants which led to nothing becau. e of the Great War ; in 1918, a contract was entered into which gave the Mitsui Company the work of erecting stations in China ; in 1921, a contract was entered into with the Federal Wireless Company of America to erect a plant near Shanghai. The Mitsui Company has actually erected a wireless station outside of Peking which is now ready for occupation. Neither the British nor the American contracts have ever been consumated in any form. The Japanese therefore have a claim that their contract is not only bona fide but has actually been consumated ; they have actually gone ahead with their work and have accomplished something while the American representatives have sat in Peking negotiating and talking and getting nowhere.

Building Without Contract

There is a justifiable doubt as to whether all this wireless talk is really worth while. There is a question in the minds of many as to whether China requires all the wireless stations which are planned to be erected. From the standpoint of China's narrower interests, the plants need not be erected at this time, but the progress of the world moves on unarrested and when a nation does not do things for herself, someone else generally steps in and does them. Wireless stations have been erected in many parts of China to which the Chinese Government at some time will undoubtedly take exception. The American Legation station in Peking, the French station in Yunnan, the wireless equipment of the Fengtien army are all matters about which the Government of China has had little to say, and as long as there is a world need for wireless communications with China, stations will come into existence. It is therefore to the greatest interest of the Chinese Government that these stations should in some way be under its control, even if that control is limited because of the poverty and incapacity of the present Chinese Government.

A Wireless Consortium

The Japanese contract is for 30 years. It stands on its terms plus the fact of accomplishment. The American contract and the methods thus far employed would give the impression of a dog-in-the-manger attitude : if we can't go ahead with the thing, we won't let anyone else do it. The British contract is in effect an option. The French have gone ahead with a plant in Yunnanfu without any contract with the Chinese Government. Thus we have four nations struggling over the control of China's wireless. But why should there be any struggle ? Why should the foreign nations not work together in this matter ? The Open Door Policy cannot mean the right of the United States Government to object to other Powers monopolizing certain concessions in China and then seeking a monopoly for herself. Only a limited amount of business can be done over the wireless from and to China. The Japanese plant outside of Peking is bound to get a certain share of that business. If the Americans build a plant near Shanghai they are bound to get a certain share, but neither plant will be profitable, particularly if they are managed on a competitive basis. It stands to reason that the same arguments which apply in favor of the Consortium apply in favor of a wireless consortium, with of a definite Chinese interest. If the advantages of non-competition apply to government finance and railway building, those same advantages appear when the question of wireless arises. The logic of the situation then is with a wireless consortium and it is difficult to understand the American opposition thereto.

The Chinese Government has apparently approached the American and Japanese Governments with a proposal to merge their contracts and to join with China in a joint building and control of wireless stations in China. It is to be presumed that once an agreement is reached between these principals in the matter of wireless contracts, other countries which have build or which control plants or which have contracts of some sort will be included in the wireless consortium so that the matter is settled satisfactorily to all parties concerned and to the general benefit of China, which is after all the principal consideration in the business. The Japanese seem to take kindly to the suggestion in spite of the fact that they have an enforceable, iron-clad agreement and a plant which is ready to begin operations while everybody else is still talking. The American Government however is taking a rather dangerous view of the situation. They want the Federal Wireless Contract to be gone through with before they will discuss amalgamation. They say that is a part of the Open Door Policy. They say that an agreement must be completed before they will consider any other questions. All that is very fine, but when a Power becomes unreasonable in her attitude, it becomes difficult at times to business with her, and with the situation as it is at present in the Pacific, with Russia intriguing against all the Powers with equal venom, it is not wise nor advantageous to take an unreasonable attitude. It is the sort of stuff that makes for unfriendliness on greater issues.

China's Terms

The terms suggested by China, as reported in the press are as follows :

1. By means of a new loan from both Japanese and America a large wireless station shall be established in China, and its management shall be entrusted to the three Powers, viz., Japan, America and China.
2. The Japanese wireless station at Shuangchiao, China, shall be made a branch of a new station to be constructed.
3. Details of this plan shall be discussed at a joint conference of the three Powers.
4. The fund raised through the loan shall be principally spent for the erection of the wireless station.
5. Regarding the expenditure of the new loan, commissioners shall be appointed by both Japan and America to supervise it.
6. In order to insure good management and maintenance in the future of the wireless station to be constructed, the business shall be subject to close inspection.
7. The personnel and other matters affecting China's sovereignty shall be entrusted to China.
8. As the security for the loan, the income from the new station shall be offered.
9. Regarding other details, they shall be discussed at a joint conference of the three Powers."

If the American attitude is simply based upon the question of the sanctity of agreements, the question might well be asked why the State Department allowed an American company to enter into an agreement knowing than another already existed covering the field. If it is a question of the Open Door Policy, then why not follow the consortium idea ? It is sometimes difficult to follow the mental peregrinations of diplomatists and foreign office officials, but it would appear that there is little sincerity behind the suggestion that the motive for opposition to joint action is the sanctity of agreements or the Open Door Policy. It would appear that there is some deeper motive, some sinister intention to utilize the wireless not in China's interests but to serve the nation erecting the station.

The time is past for that sort of thing in China and nationals of all countries in China oppose the utilization of concessions in that way. That is the sort of thing which has proved so fatal in the past and is responsible for most of the troubles between China and the foreign Powers at the present time.

The War Scare and the Wireless

It would appear that there is an element in the United States which is still somewhat madly following the theory that the day will come when the United States must fight Japan. This element is found at its worst in army and navy circles. It is found in its least significant form in business circles, for the business man understands and places his money behind the assertion that war between the United States and Japan is literal bunk. The army and navy men must always have a bogey. They have got to scare the public to get appropriations through Congress. They therefore keep this anti-Japanese feeling alive and the wireless scheme fits into their propaganda most effectively. They want an American owned and American controlled wireless station in China so that in the event of a war, their communications would be complete. In the development of their theory they altogether disregard the rights of China in the matter. It does not occur to them that in the event of such a war, China might for instance desire to be neutral, in which case such a wireless plant might get China into trouble with Japan. Nor does the possibility suggest itself to them that China might even join Japan, which is always a possibility, and seize the plant either for warlike purposes or to dismantle it. In a word, in attempting to see too far ahead, these gentlemen fail to take into consideration all the possibilities and probabilities of the situation. They have simply hypnotized themselves into following an idea and they fight for it, right or worng.

If the United States is sincere in her desire to help China at all times, a suggestion which one is constantly hearing with regard to Sino-American relations, then the best way to help China out of the wireless mess is to join into the wireless consortium. If the United States is unwilling to follow such a procedure and insists upon China's living up to untenable agreements, then it will be found that China will be forced to follow more keenly her own interests. And at the present time, it will be easier for China to sacrifice the good-will of the Federal Wireless Company than the good-will of Japan or of the Mitsui Company. The relations between China and Japan, between the Chinese Government and the Japanese Government, between Chinese merchants and Japanese merchants are closer and of greater importance than China's relations with the United States, which are largely sentimental and intangible. If the United States wants to apply a practical demonstration of the value of this sentimental friendship by getting China out of a hole of her own digging, then here is a way to do it. And in the end the United States will benefit, for what America wants in the Far East is to build up good-will, friendship, a fine feeling, a sense of dependence upon fair play, so that when the days comes when it is necessary to drive the Bear out of the Pacific, China and Japan will be with the Nations of the West rather than with the Bolsheviks of the North.

The New Asia

By F. R. Eldridge, Chief, Far Eastern Division, U.S. Department of Commerce

AN economic transformation is taking place in the Far East. It forms the basis and furnishes the cause of the social and political changes so manifest on every side. Evidences of this change are everywhere in the Orient to-day, and the new Asia of to-morrow will be as different from the Asia of yesterday as the New World of the Western Hemisphere is from the Old.

The war hastened and accentuated this economic change, but its first causes go farther back than 1914. Its inception was in the sixteenth century, when the first western contacts with the older civilizations of Asia began to revolutionize far eastern thought. Japan ultimately accepted and adopted western civilization; China, until lately, resisted it; and the tropical peoples of Malaya, India, the Philippines, and the Dutch East Indies succumbed to it after a brief struggle.

Japan

Modern industrialism in Japan dates from the expiration of the original Franco-Japanese commercial treaty in 1911. Although most other nations had formally revised their treaties and granted Japan tariff autonomy some years earlier, the application of the most-favored-nation clause in their treaties gave them the same benefits as accrued to France until the French treaty expired. From that time on Japanese industry strove to supply domestic wants from domestic sources, and a policy of economic self-sufficiency has since been steadily pursued.

Lacking in coal, Japan has made remarkable progress in hydroelectric development; having no iron ore, 80 per cent. of China's iron resources have come under Japanese control. Home production of the wool and raw cotton needed in Japan's new textile industry being impossible, Australia and the United States have become steady sources of supply for these.

The abundance of copper in Japan and the presence of plentiful hydroelectric energy have made the electrical industry one of the most promising developments, while cheap and ample sulphur and wood have formed the basis of an encouraging match industry. The glass and paper industries were also favored by a good supply of raw material.

Need for Standardization

As in Europe, these activities began in Japan as household industries. Some of them grew rapidly under Government bounty and support, notably the iron and steel industry during the war, which still has as its basis the needs of the Japanese Navy and merchant marine. The textile industry soon became established on a modern factory basis. Before many industries had emerged from the household stage, however, the war cut off the markets of the South Seas and India from their accustomed supplies of European and American manufactured goods. Japan saw an opportunity to sell textiles, glassware, hardware and utensils, paper, and other products and without waiting to modernize its industrial establishments began to expand its sales abroad.

The difficulty of producing under the household system a standardized article for the huge foreign trade which now developed was soon apparent. Government measures were devised for inspecting articles for export and holding them to certain standards. With several parts of a large order being filled in half a dozen small factories, however, it was obviously impossible to achieve complete standardization. The permanence of the new markets for Japanese goods was, therefore, considerably affected, and as soon as Europe was in position to enter its lost fields Japan suffered a serious curtailment in the export trade of its newly expanded industries. This was one of the principal causes of the slump which took place in May, 1920, in Japan and carried in its trail a price deflation and depression of serious consequence.

Through a series of heroic Government measures, including the formation of the silk pool and the "Wednesday Association" of copper producers, Japan's basic industries were saved from utter demoralization. Market prices are now well above cost of production and are more or less stable. Japanese manufacturers have learned a lesson, however, and a general movement toward amalgamation and concentration in industry is under way.

It is already evident that many of the industries founded on war demands cannot survive even under amalgamation and protection, because of the lack of raw materials, suitable labor, or a market extensive enough to make large-scale production profitable. As a result we may witness a concentrated movement to build up strong units in such industries as electrical supplies, cotton textiles (depending more and more on Korean and Chinese raw cotton), silk textiles of the cheaper grades, certain chemical industries (particularly the electrochemical group), certain types of paper of the better grades, matches, toys, and cheaper glassware, and an abandonment of more ambitious projects in the iron and steel, machinery automotive, railway equipment, and similar fields, except such Government mills and workshops as are deemed necessary for national welfare.

China

The movement begun early in the sixteenth century which culminated in Japan's industrialization was postponed in China until the end of the nineteenth century. Even before Boxer indemnities had virtually absorbed all the revenue upon which the Chinese Government at Peking could dependably rely there was much casting about among officials for revenue with which to meet the ordinary expenses of administration, and as a result many concessions were given to foreign financiers in exchange for substantial loans. With the growth of trade the customs revenue—to which later was added the salt revenue, also under foreign control—was sufficient to meet the interest and amortization on a large number of loans for the building of railroads and the development of mines, forest, and other natural resources.

When China entered the World War in 1917 the postponement of Boxer indemnity payments gave a largely increased surplus to the Government. Unfortunately this surplus, which might have gone far toward reducing China's foreign gold indebtedness at the then high price of silver in which it was being collected, was used for other purposes, and moreover further heavy foreign borrowings, hypothecating practically all of China's available natural resources, were made. As a result the present Government finds itself saddled with an enormous debt, the interest and amortization on some of which cannot be met from available revenue.

Nevertheless, China's foreign trade has continued to increase. Year by year the value of shipments and receipts has mounted, and after the goods have reached the ports they have found their way to interior markets despite many impediments and handicaps. With the manufacture in China of a large share of China's needs in textiles, the foreign merchant in the ports who used to depend upon the textile trade for his " bread and butter " is forced to turn to other classes of commodities. While textiles represent 30 per cent. of China's import trade, the machinery with which to manufacture them in China, the iron and steel necessary to build the modern factories, and the large demands for other manufactured goods, following inevitably in the wake of industrial development, have turned the general merchant into a specialist, because most of these lines need more specialized treatment than textiles.

As these merchants in the ports are not permitted by treaty to reside in the interior they have had to depend upon Chinese distributors to get their goods to the inland consuming centers. The tendency among foreign manufacturers is becoming stronger, therefore, to deal direct with Chinese distributors, although in such lines as machinery, for example, foreign intermediaries in the ports will be needed for some years to come, both to finance and to give service on individual sales. The old general import and export house with hundreds of varied agencies is therefore being transformed into a house specializing in the output of a dozen allied industries, with direct representatives from the manufacturer giving service under the supervision of a local manager, who attends to financing and delivery.

One of the most noteworthy changes in the foreign trade of the Far East is the gradual passing of the old type of general merchant and the opening of an era of specialization in distribution. For years the cost of doing business in the Orient has been greatly increased by the multiplicity of intermediaries. An American product destined for a consumer in Java would be ordered through a Dutch house in Batavia with a head office in Rotterdam, which in turn would place the order with an American manufacturer through its New York agents. When the American goods reached the consumer in Java the laid-down price bore the burden of all this roundaboutness.

The movement to buy direct is being fostered by the dealer in Java himself. He is welcoming direct representatives of American manufacturers and encouraging them to open direct distributing agencies. This development will require careful study, inasmuch as American sales agencies must compete with long-established European houses whose hold on the market is based on experience and adequate shipping and financial facilities.

We sell the Far East only half as much as we buy from it. While America is one of the principal outlets for the products of the Orient and our purchases of its raw products increase year by year, our sales remain stationary. Without the American market for rubber and tin, British Malaya would languish in poverty; and a withdrawal of American's demand for Indian jute, manganese, and shellac would be felt most keenly.

Almost half of Japan's total export trade is raw silk—and America takes 80 per cent. of it. We supply Japan with most of its raw cotton in return; but out share in the import trade of British Malaya, the Dutch East Indies, India, and other tropical countries is negligible. One of our greatest problems is to increase our export trade to these countries.

The key to British and Dutch commercial success in their tropical colonies is in their trading organization. Their general-merchant house could not have survived the long years unless they had bought as well as sold. The policy of American organization is quite different. The American firms as exist in the tropics specialize in either selling or in buying, but few if any of them combine the two under a single overhead expense, as do the more successful European houses.

The latter have found that the demand for any single group of imports into these countries is not large enough to support simply a selling organization, whereas the steady demand for export products furnishes a basis for the maintenance of their staffs and permits them to take immediate advantage of opportunities to sell. Many of our smaller users of tropical oriental products still buy them in London or Rotterdam, notwithstanding the obvious advantages of direct purchases. If they could combine with the smaller exporters in the formation of a single organization in Singapore or Bativia, all would benifit.

Silver

Both the Indian and Chinese currencies are based on the price of silver as a commodity and fluctuate with that metal. The rupee does not suffer the daily fluctuation of the tael, being influenced and stabilized somewhat by Government transactions in sterling; nevertheless the fact is that " wash " sales of exchange are advantageous in both countries. Such sales can be most satisfactorily consummated if buying and selling are engaged in and sales to the interior are counterbalanced by purchases from the interior.

Exchange banks in China provide a way of removing most of the risk in forward transactions in silver, but they do so at a profit to themselves, and the importer who can also export is in a very advantageous position. In China, particularly, high silver means stimulation of imports and low silver stimulation of exports. American firms doing a one-way trade must either speculate in silver or tie up their capital in " hedging " operations in silver exchange. The amount of capital required to do one-way business safely is therefore just as great as if native products were bought with the proceeds of sales, and in the later case a two-way profit would be realized.

How Investment Helps Trade

The many obvious advantages of American investment in the Orient both export and import business deserve mature consideration alike from those who are seeking a market and from the larger users of oriental products. In China many opportunities for investment in industrial enterprises present themselves, but those located in the treaty ports and offering American control seem most promising. Sales of machinery can be more easily consummated if stock in an enterprise is taken in partial payment, but too much care can not be exercised in the management and location of the business so that it escapes the evils of nepotism

and remains under foreign jurisdiction and is not subject to confiscatory taxation.

The taxation policies in many of these colonies also must be carefully examined, as they tend toward assessing "all the traffic will bear"; and local regulations, too, can be irksome. New legislation in the Philippines removing the 2,500-acre limitation on land holdings by Americans and permitting the entrance of indentured Chinese labor for purposes of clearing and planting has been suggested by some observers as a possible encouragement to American investment in Philippine rubber lands. Some rubber is being grown in the Philippines to-day at a cost which compares favorably with the average cost in the British and Dutch East Indies. (See "Possibilities for Para Rubber Production in the Philippine Islands," issued as Trade Promotion Series No. 17 by the Bueau of Foreign and Domestic Commerce, Washington.)

Growth of America's Trade with Asia

The gain (12 per cent.) in our imports from the Far East during the fiscal year ending June 30, 1925 is entirely due to industrial activity in the United States and expanded markets for oriental products in our industries. The following figures show this increase:

United States imports from the Orient

Countries of origin	Value (000,000 omitted) 1914*	1924*	1925*	Percental change, 1925 over— 1924 Increase	1924 Decrease	1914, increase
Japan	$107	$325	$342	5	—	220
China	40	158	147	—	7	268
Straits Settlements ...	26	143	187	31	—	619
British India	74	108	125	16	—	69
Philippine Islands ...	18	90	101	12	—	461
Australia...	17	32	43	34	—	153
Dutch East Indies ...	5	55	69	26	—	1,280
New Zealand ...	5	13	19	46	—	280
Other Asia and Oceania	37	68	81	19	—	114
Total	329	992	1,114	†12	—	†233

*Fiscal years ending June 30. †Net average.

A somewhat lower price level during the fiscal year 1925, bad economic conditions in Japan, and disturbed political conditions in China account for the decline in our export trade to the Orient.

United States exports to the Orient

Countries of destination	Value (000,000 omitted) 1914*	1924*	1925*	Percental change, 1925 over— 1924 Increase	1924 Decrease	1914, increase
Japan	$51	$283	$216	—	24	324
China	26	124	89	—	28	242
Australia...	46	129	132	2	—	187
Philippine Islands ...	27	56	61	9	—	126
British India	11	34	34	—	—	209
New Zealand	9	27	33	22	—	267
Dutch East Indies ...	4	14	15	7	—	275
Straits Settlements ...	4	7	9	29	—	125
Other Asia and Oceania	19	46	36	—	22	90
Total	197	720	625	—	†13	†217

*Fiscal years ending June 30. †Net average.

The oriental trade balance against the United States was $172,000,000 during the 1922 fiscal year. In 1925 it had grown to $489,000,000, our shipments to the Orient amounting to 56 per cent. of our imports from the same source this year.

United States trade balance with the Orient, fiscal year 1925

Countries of origin or destination	Imports from	Exports to	Excess of imports	Excess of exports
Japan	$342,355,610	$216,427,527	$125,928,083	—
Straits Settlements ...	186,873,239	8,745,728	178,127,511	—
British India	124,547,519	33,856,643	90,690,876	—
China...	147,288,503	89,008,726	58,279,777	—
Dutch East Indies ...	69,402,860	15,414,468	53,988,392	—
Philippine Islands ...	100,881,243	61,391,756	39,489,487	—
Australia	43,261,839	131,955,360	—	$88,693,521
New Zealand	19,329,833	32,755,301	—	13,425,468
Other Asia and Oceania	79,639,191	35,063,945	44,575,246	—
Total	1,113,579,837	624,619,454	591,079,372	102,118,989
Balance for the year ...	—	—	488,960,383	—

The Department of Commerce, realizing the growing importance of Asia to American industry, is doing a great deal toward promotion of trade through Government channels. The need for Government assistance in the Orient is particularly pressing because of the missionary character of any new enterprise designed to increase our trade with that part of the world. The Bureau of Foreign and Domestic Commerce is therefore attempting to eliminate so far as possible the risk involved in new American undertakings in the Orient by accumulating information on the correct methods of buying and selling, by keeping abreast of the economic changes in all the countries so as to advise merchants in advance of any impending changes, and by pointing out specific opportunities for the sale of American goods in the best markets.

During the fiscal year 1923-24 the bureau established a new office in Batavia, Java, which is looking into the opportunities for the sale of American machinery and iron and steel products, and also advising definitely on the many opportunities for the investment of American capital in the rubber, tea, tobacco, and tapioca plantations of this rich colony. The bureau has also strengthened its Indian organization by opening an office at Bombay, and its China and Australia organizations by offices at Canton and Sydney.

Besides these major developments, the staffs in all offices have been augmented by the appointment of additional assistant trade commissioners, and the bureau now maintains well-equipped and full-staffed organizations of experts at Tokyo, Peking, Shanghai, Canton, Manila, Batavia, Calcutta, Bombay, Melbourne, and Sydney.

The Orient is rapidly becoming one of the leading sources of raw materials for our factories, and the industrial development in Japan, India, and to a lesser extent in China, is opening up wider markets for our products. Along with this development new methods of doing business, involving more direct relations between our manufacturers and their oriental customers, are being rapidly introduced. Our great buying power in the Far East should be harnessed to our selling effort and made to "pull" for American sales. This can be helped by broader American investment as an aid to both import and export trade. American interest in the Orient is increasing with more intimate and direct relations due to growing trade, and the new Asia which is growing out of the old is becoming a definite field for American enterprise.

Siamese Gunboat Ratanakosinde*

During the month of August the Royal Siamese gunboat *Ratanakosindr* has successfully completed her sea trials, and is now complete and ready for her voyage to Bangkok. On the 7th August a twelve hours' endurance trial was carried through, the vessel attaining a mean speed of 10½ knots, with the machinery developing 50 per cent. of its designed power.

On the 10th August the vessel proceeded to sea for the purpose of carrying out her full power, steering, anchor, and gunnery trials. All these tests were passed through satisfactorily. During six runs on the Admiralty measured course the designed speed was exceeded by 0.982 knots, with the engines developing their designed power. No attempt was made to press the machinery, and it is probable that a speed of 13 knots could have been obtained if desired. The vessel proved to be an excellent sea boat and no noticeable vibration was experienced when the engines were developing full power. On the steering trials it was found that the boat could reverse her direction in the remarkably small space of three lengths, and that she possessed exceptional powers of manoeuvring. During the gun trials two broadside salvos were fired in rapid succession with an entire absence of damage to the structure or fittings. The anchor trials have been successfully carried through and the vessel returned to the Tyne for her final docking and opening up.

All who have visited the Ratanakosindr are impressed with the compactness of the boat, and the wonderful offensive and defensive features which have been incorporated in a vessel of such limited displacement. It is confidently anticipated that when commissioned she will form a valuable, addition to the Royal Siamese Navy.

*See Far Eastern Review September 1925, page 623

Fiftieth Anniversary of the Link-Belt Company

FIFTY years have passed since the incorporation of the Ewart Manufacturing Company, the forerunner of the present Link-Belt Company, in 1875. In commemoration of the fiftieth anniversary, the Link-Belt Company has published an attractive book entitled " Link-Belt 1875-1925."

In this book it is mentioned that the patent of William Dana Ewart, a young implement dealer, from Belle Plaine, Iowa, for the detachable link chain, was dated September 1, 1874. Mr. Ewart first started to build a self binding harvester, but he realized the great need in such a machine for a detachable chain drive that could be repaired in the field ; and he worked out the idea of a chain drive, the links of which could easily be replaced by the farmer, who up to that time had been wasting much time in going back to the barn or black-smith shop for necessary repairs to the " strap-link " chain drives that were used on some of the first crude binders ; or trying to adjust the flat belts, which stretched and tightened under varying conditions of heat or moisture in the field.

Alfred Kauffman, President Link-Belt Company

Late in 1874 Mr. Ewart came to Chicago with a view to arousing some interest in his " detachable link chain," he succeeded in interesting John C. Coonley, a lawyer who was then President of the Chicago Malleable Iron Company. As a result a company was duly incorporated in 1875, under the name of the Ewart Manufacturing Company, for manufacturing detachable link chain. In 1876, the Ewart chains were exhibited at the Philadelphia Centennial.

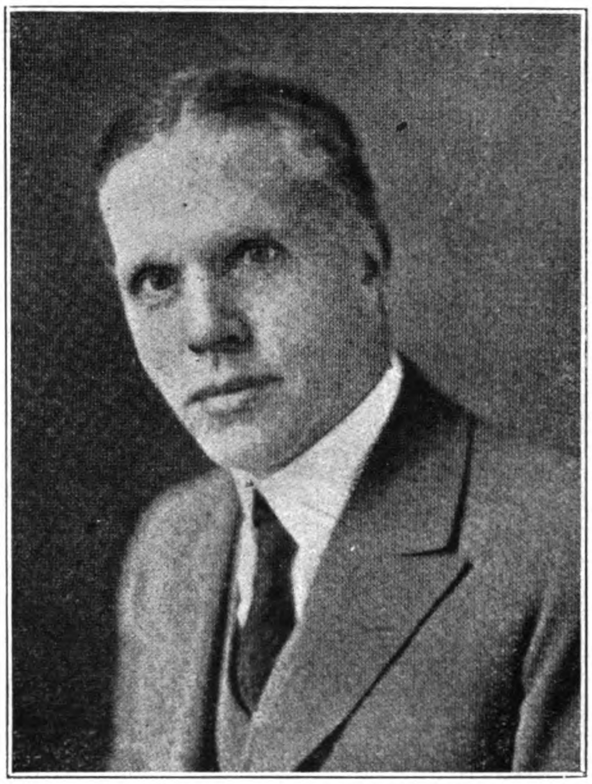
New uses for the invention developed rapidly, and in 1880 the Link-Belt Machinery Company was incorporated " to design, build, and supply accessory parts, and install elevating and conveying machinery employing Ewart Chains," the plant for this company was built in Chicago.

In 1888 the Link-Belt Engineering Company was formed with a plant in Philadelphia. These two plants found increasing numbers of new uses for the chain, with the result that all three plants continued to grow in size until in 1906 a consolidation of the three interests took place, and Charles Piez elected President.

It will be remembered that Mr. Piez was Director General of the Emergency Fleet Corporation during the World War.

Mr. Piez is now Chairman of the Board of Directors, and Alfred Kauffmann formerly Vice-President in charge of the two Link-Belt in Indianapolis is now President of the Company.

From the humble beginning in 1875 this company now operates and owns ten large manufacturing plants, with seven shops and warehouses, and twenty-seven branch offices, and its products now include Elevating and Conveying equipment for all kinds of materials; complete equipment for the handling and cleaning of coal, on the ground and in the boiler house, complete coal Tipples and Coal



Charles Piez, Chairman of the Board, Link Belt Company

Washing Plants, Sand and Gravel Washing and Preparing plants, Sand Preparing and Conveying Machinery for the modern foundry, Locomotive and Crawler type cranes, Silent Chain drives for industrial plants, and for the front end of the automobile—in fact, Link-Belt today builds complete equipment for Conveying handling and power transmission.

A Hydro-Electric Undertaking in Northern Korea

SANCTION for hydro-electric development on the River Choshin, Kankyo Nando, Korea has been granted to the Chosen Hydro Electricity Co., the principal promoters of which are Count M. Soejima and Mr. S. Noguchi, Managing Director of the Japan Nitrogenous Fertilizer Co. The Company whose authorized capital is Yen 30,000,000 aims at erecting three hydraulic power plants capable of generating 121,900 k.w. at Shoko and Toko and also meeting general demands in the northern part of Korea in the future, co-operating with the undertakings of the Japan Nitrogenous Fertilizer Co. The activities of the Company are expected to revolutionize the electricity of Korea which at present demands only 30,000 k.w.

According to Mr. Ichikawa, director of the Japan Nitrogenous Fertilizer Co., the plan of the new undertaking is to build a dam on the Fusenko, a tributary of the Yalu River in Kankyo Nando and to connect the water with the Josenko in the rear by digging a tunnel through the mountain at the upper course of the former river, thus utilizing 4,000 " skaku " of head which is made to cascade the water from the reservoir on the Fusenko down to the Josenko. They will be capable of generating some 100,000 k.w. with which about 200,000 tons of sulphate of ammonia are to be produced annually.

The Commercial and Industrial Position in Japan

APART from the great loss of life and the extensive material damage caused, the earthquake which befell Tokyo and Yokohama on September 1, 1923, was a very severe blow to Japanese prosperity, says "Engineering." The Government was obliged, on the one hand, to vote sums for reconstruction purposes, and, on the other, to make allowance for a reduction in revenue consequent upon the disaster. The decrease in tax receipts due to the catastrophe amounted to 130 million yen, and, in order to avoid serious disturbance of the national finances, public works were postponed, and expenditure was cut down in every way possible. While the earthquake undoubtedly exerted a profound moral effect on the people, the productive power of the nation was not greatly affected because the devastated areas were largely residential, and main industrial centres such as Kwansai and Kyushu remained intact. There was, however, a decrease in exports during 1923 and a considerable increase in imports. According to the Financial and Economic Annual of Japan for 1924 issued by the Department of Finance, exports amounted to 1,448 million yen in 1923, and imports for the same year totalled 1,982 million yen. The figures for 1922 were 1,637 million yen and 1,890 million yen respectively. Thus, the excess of imports over exports, already considerable in 1922, appears to have been further intensified by the earthquake in the Kwanto district.

In the matter of imports it is interesting to note that in 1923 British India supplied more than a third of the requirements in "pig-iron and steel blooms and billets"; China took second place. Imports from Great Britain in this section have decreased rapidly since 1919, and the share held by the United States has dwindled still more quickly. In "iron and steel bars, rods, plates, sheets, wire goods and tubes," trade with Great Britain has increased steadily since 1921, chiefly at the expense of the United States, although Germany and Belgium are serious competitors. The import trade in machinery and machine parts, which was very steady during the years 1920-22, decreased in 1923. The United Kingdom supplied goods to the value of 36 million yen in 1923 and 42 million yen in 1922; the values of goods supplied by the United States were 42 million yen in 1923 and 57 million yen in 1922. Imports from other countries are small in comparison, although here again German trade is increasing. Since 1917, the first year quoted in the annual, United States manufacturers have had the motor-car import trade entirely in their hands. In 1923, cars to the value of 13 million yen were imported, nearly 10 million of which were received from American concerns. Building materials are largely supplied by the United States, the only competitor worthy of note in the year 1923 being Germany. Other imports include raw cotton and cotton goods, foodstuffs, and wool and woollen goods. British India supplies more than half the raw cotton, Australia has three-quarters of the wool import trade, while Great Britain has for years practically monopolised the market in cotton and woollen tissues. Exports consist chiefly of silk goods of all descriptions, together with manufactured articles of a very varied nature and foodstuffs. Some coal is exported, China and Hongkong being the two chief customers.

Agriculture holds an important place in Japan, and large areas are devoted to the cultivation of such crops as rice, barley, and wheat; a considerable income is also derived from the State forests. The silk industry is steadily growing, the total raw silk produced in 1922 being 24 million kilograms as compared with 14 million kilograms in 1913. Tea planting is another important branch of industry. Turning to mineral products, the annual shows that, whereas outputs of silver, copper and lead have fluctuated and, in the main, have diminished since 1914, the production of pig-iron and steel has increased enormously. In 1914 the outputs of pig-iron and steel were relatively insignificant; the figures were 74,049 metric tons and 15,385 metric tons respectively. This tonnage rose during and after the war almost without a break, and for the year 1923 the output of pig-iron was 530,536 metric tons, and that of steel 495,433 metric tons. The quantity of coal mined in 1914 is recorded as 22 million metric tons; the output for 1923 was 29 million tons, showing a steady increase. On the other hand, the production of crude petroleum has decreased from over four million hectolitres in 1914 to less than three million in 1923.

Although introduced at a comparatively recent date, the Tokyo-Yokohama section having been laid down as a government undertaking in 1872, railways in Japan are extending rapidly. In 1905, there were 4,778 miles of track, and a point of interest is that, out of this total, 3,247 miles are owned by 38 different companies. The main trunk lines themselves are controlled partly by the State and partly by private companies. Economic expansion demanded greater efficiency than was possible under these conditions and, in 1906, a Railway Nationalisation Bill was passed; under this measure the government acquired nearly 3,000 miles of privately-owned roads. In 1923, the mileage opens to traffic measured over 9,000 miles, as compared with 6,500 in 1913; in the same interval the number of locomotives increased from 2,700 to 4,300. During the same decade the number of passengers more than trebled, and the goods traffic nearly doubled.

The territories constituting Greater Japan—Korea (Chosen), Formosa (Taiwan), Japanese Saghalien (Karafuto), and Kwantung Province are all undergoing development. Korea is largely an agricultural and pastoral country, but iron and mild steel are also exported, although quantities have fallen off somewhat since 1921. Korean railways are expanding, and the weight and value of traffic of all descriptions are steadily increasing. In addition to gold and silver, zinc, copper, lead, iron, tungsten ore, graphite, coal and kaolin are also found. The country is especially rich in gold, iron, graphite and anthracite. Afforestation is encouraged, and is making great headway; the fisheries are also important. Industry in Korea is, it is stated, in a promising condition generally. The chief products of Formosa are derived from its agriculture, and its fisheries, but in the northern portion of the island are situated deposits of gold, silver and copper; petroleum and coal are also found. The latter commodity holds an important position among the exports of the island. Extensive beds of coal have also been found in Saghalien. Three important seams have been discovered—northern, central and southern. Of these the central is the most extensive; it is 60 miles in length, and is from 3-ft. to 9-ft. thick. Mining operations, however, have only just begun, and are at present conducted on so small a scale as barely to satisfy the needs of the island. Petroleum has also been located, and the matter is being further investigated. The South Manchurian Railway ceded by Russia to Japan in September, 1905, and since conducted by the South Manchurian Railway Company, created for the purpose, is fast increasing in importance, as the following figures show. The passengers carried in 1914 and 1923 were 3,600,000, and 8,760,000, respectively, the tonnage of goods hauled was 5,700,000 in 1914 and 13,370,000 in 1923, while the net income increased from just under 15 million yen in 1914 to nearly 56½ million yen in 1923.

As is the case with the majority of other nations, the after effects of the war, and of the boom period, immediately following it, still exercise an influence upon the commercial and industrial welfare of the Japanese people. There has been no remarkable fall in the price of commodities, and wages are, on an average, three times as they were in 1912, with a tendency to further increase. Moreover, high as the national debt, which in the years 1915-18 stood at 2,500 million yen, reached a total of over 4,000 million yen in 1924. Taxes averaged 13 yen per head of population in the year 1923-24, or about double the pre-war figure. Taken altogether, however, the situation in Japan is one of progress, and the outlook is promising.

Japan's Electrical Imports and Exports

Since the earthquake in Tokio and Yokohama, which caused the destruction by fire of a quantity of the Government's statistical data, the Japanese import and export trade returns have not been issued in very great detail. It is, however, now possible to compare the figures for 1922, 1923 and 1924. The following table shows the

values of Japan's imports and exports of electrical and allied material during these three years. It will be noticed that exports, except those of telephones and electric lamps, have declined progressively, whilst in 1924 imports of electrical machinery were unusually large.

EXPORTS.

	1922 Yen (Thous.)	1923 Yen (Thous.)	1924 Yen (Thous.)
Insulated electric wire.—			
Total	7,816	1,609	1,373
To China	6,712	661	317
„ Kwantung	849	677	889
„ Hongkong	164	63	91
Electrical machinery.—			
Total	3,028	1,185	1,755
Telephones.—			
Total	119	154	143
Electric lamps.—			
Total	1,244	1,335	1,829

IMPORTS.

	1922	1923	1924
Insulated electric wire, submarine telegraphic or telephonic cables	831	443	736
Other cables	485	1,885	717
Wattmeters	1,409	1,252	3,868
Telegraphic or telephonic instruments and parts	1,359	859	4,338
Steam boilers and parts	6,403	2,949	5,473
Steam turbines	1,052	499	2,298
Steam engines	121	140	32
Water turbines	2,979	3,028	1,463
Dynamos, motors, transform rs, etc.	11,947	10,835	20,978
Dynamo sets	877	525	368
Electric carbons	358	314	606

Three New P. & O. Liners

THE *Rampura* is the latest addition to the P. & O. fleet. She is a sister boat to the *Ranchi* which is now almost completed. The *Rampura* is to undergo her trials at the end of March, and considerable interest attaches to her since she is the first vessel ever constructed for the line by Messrs. Hawthorn, Leslie, & Co., Ltd. of Hebburn, and if possible, the builders have enhanced their reputation by her production. The vessel is a very finely modelled and constructed steamer and is handsomely fitted out in every particular.

The *Razmak*, for the same line, recently ran a series of successful official trials in Belfast Lough, when she was taken over from the builders Messrs. Harland & Wolff, Ltd., by Mr. Frank Ritchie (joint managing director with Lord Inchcape) on behalf of the P. & O. Company.

Particular interest attaches to the *Razmak*, since she has been specially designed for continuous service in Indian and Oriental waters. At present she is to be employed on fortnightly trips each way between Bombay and Aden, taking on the Aden-Bombay voyage mails and passengers for India by transhipment from the outward bound fortnightly Australia steamer, and transferring on the Bombay-Aden trip, to the homeward Australia steamer, mails and passengers from India for Egypt, Marseilles, and London. She will alternate on this line with the fortnightly direct steamers in each direction between London and Bombay, thus maintaining the weekly frequency of the Indian mail service.

Her principal dimensions are:—Length 518 feet 6 inches; breadth, 63 feet; moulded depth, 37 feet 9 inches. The vessel has a straight stem and elliptical stern; and is fitted with two sets of quadruple expansion engines of the balanced type, developing 12,000 i.h.p., and burning oil fuel with forced draught under Scotch boilers.

Accommodation is provided on the bridge, upper and main decks for 142 first and 142 second class passengers and the dining saloons are arranged to seat simultaneously the whole of her passengers. The first saloon, music room, lounge, smoking rooms and verandah café are placed forward amidships on the bridge deck, while towards the after end of this deck are the second music saloon, verandah and smoking saloons. The decorative and color schemes of the *Razmak's* public rooms have been designed from suggestions by Lady Inchcape and the Hon. Elsie Mackay and carried out under their supervision. On the upper deck, beneath the forward, three-quarters of the deck is occupied by large first class-cabins arranged on the tandem principle, approximately every fourth one being a single-berth cabin. The first class accommodation includes four pairs of Cabins de Luxe, each arranged for one or two passengers and each including a private bathroom. The after parts of the upper deck and the main deck are occupied by second saloon cabins for two or three passengers, with one or two four-berth cabins to meet passengers' occasional especial need in this respect.

The *Razmak* is to replace the *Salsette*, of 6,000 tons, which was withdrawn from the Aden-Bombay line during the war and was sunk by an enemy submarine in the Channel on July 20, 1917.

The *Razmak's* arrival on the Aden-Bombay station simultaneously with the resumption of fortnightly sailings on the P. & O. Australia mail line is among the final steps towards the restoration of the company's services to the pre-war level. A part of this operation has included the assignment to the through fortnightly line to the Far East of the large mail steamers formerly employed in the Australia service, and these in turn have been replaced by the *Mooltan* and *Maloja* (21,000 tons), the *Naldera*, *Narkunda*, *Mongolia*, and *Moldavia* (16,000 tons), to which will be added shortly, also for service on the Australia line, the *Cathay*, *Chitral*, and *Comorin*, each of 15,000 tons gross. Four other steamers, *Rawalpindi*, *Rajputana*, *Ranchi*, and *Ranpura* for the Bombay mail service, each of 16,000 tons—are in various stages of construction. The *Razmak* left on her maiden voyage on March 13.

The twin screw mail and passenger steamer *Cathay* completed successful trial trips in the Firth of Forth in mid-March, the main speed attained being 17½ knots.

The *Cathay* has passenger accommodation in a style never previously attempted aboard ship. Although of 15,200 tons gross register, and having three decks devoted to the accommodation of passengers, only 200 first class and 100 second class are carried, and are berthed in single-berth and two-berth cabins only, the number of single berth cabins being double that of the double-berth cabins. As a result the space allocated to passengers is in the region of twice the space that would, not so many years ago, have been allotted to them. The cabins, accordingly, are exceptionally large and airy, and are most completely equipped with every convenience and comfort that experience can suggest.

The public rooms, consisting of dining room, drawing room, smoking room, social hall and open air lounge for the first class, and dining room, drawing room and smoking room for the second class are on a corresponding scale; spacious, lofty, comfortably furnished and handsomely decorated, they provide with the extensive open-air promenades every opportunity for the comfort and pleasure of the passengers.

The length of the vessel is 545 feet, the breadth 70 feet, and the depth 46 feet, with a gross tonnage of 15,000. She will carry 11,000 tons deadweight, and of the total cubic capacity for cargo of 600,000 cubic feet, 300,000 is insulated for the carriage of refrigerated cargo preserved at any desired temperature by powerful refrigerating machinery.

The propelling machinery consists of twin-screw quadruple expansion balanced engines and seven large boilers of 220 lbs pressure, burning oil fuel under forced draught. Everything that contributes to safety, comfort and convenience has been installed, noteworthy among which are the most modern systems of handling the extensive number of life boats, the mechanical appliances for working the water-tight doors, the five large electric generating engines and dynamos, and the mechanical ventilation throughout the entire vessel.

The refrigerating plant was installed by J. & E. Hall Ltd., of Dartford. Messrs. Wailes Dove Bitumastic Ltd., have applied their bitumastic solution and bitumastic enamel to the tank tops in engine space and tummnel tops; bitumastic solution and bitumastic covering to the tank tops in insulated holds and evaporator room, and their heat proof cement to the tank top in boiler space. They have also applied their oil fuel bitumastic solution to the double bottom, storage and settling tanks.

The vessel is fitted with twelve sets of Maclachlan gravity davits, handling eleven 29 inch single life boats and a 30 inch motor life boat. Very successful tests of the speed and facility with which lifeboats may be launched by this apparatus were carried out prior to the vessel leaving the Clyde. A special feature of these tests was the efficient performing and controlling of the complete operation of lowering the lifeboats by any one of the Lascar crew.

Gold Mining in the Philippines

By Warren D. Smith

PRODUCTION of Philippine gold is higher than that of all other mineral products, and the industry remains almost entirely in the hands of Americans with some assistance from Australians and New Zealanders, who are first cousins to Americans in the mining business. In other countries the gold-mining business has fallen off greatly, but the Philippines has maintained a steady, though not large, output. The amount of gold produced during 1920 was only a few ounces less than during the banner year, 1916, when gold was actually worth more than it is now.

The Aroroy district leads the others in gold production owing to the continuous operation of its two mines, the Colorado and the Syndicate. Benguet, with a single large producer, alone almost equaling the combined production of the two in the Aroroy district, is second. Paracale, once in the limelight as a result of its rather remarkable, though small, dredging field, is to-day a mere reminiscence of its former self ; only one dredge and a small ten-stamp mill are now operating.

The Benguet Consolidated, in Antamok Valley, has during the past few years, when many gold mines in other parts of the world have had to close down owing to the low purchasing power of gold, steadily paid dividends of from 25 to 35 per cent. At the present writing, the values on the lowest level of the mine are very encouraging, indicating possibly secondary enrichment in the vein. This mine is fast coming to be recognized as one of the notable small gold mines of the world.

The gold produced from Philippine mines during 1920 amounted to approximately 2,500,000 pesos ; of this the Consolidated yielded 1,068,892.30 pesos.

In this chapter I have drawn freely upon an early paper by Eddingfield. (220) As I have since revisited most of the fields discussed in that paper I have accumulated new and fuller data in some cases which call for somewhat different interpretations. Nevertheless, it should be understood by the reader that Eddingfield does not incur any responsibility for modifications of his opinions which may appear in this chapter.

It is certain that gold has been extracted from the lodes and alluvials of the Philippines for centuries, long before the coming of the Spaniards. This is a matter of history and is covered in a later chapter.

Gold deposits have been found in nearly every island of the Philippine group ; there is hardly a stream from which one cannot pan colors, or scarcely an area of igneous or metamorphic rocks wherein either large or small veins of gold-bearing quartz or calcite cannot be found.

In general we find the gold either in lodes (veins or ledges) or in alluvial accumulations known as placers. The latter class of deposits is further subdivided into high-level, or bench, placers and low-level deposits, in the river bottoms. Lodes are deposits in situ ; the placers have been transported from lodes that exist elsewhere.

In the Philippines, as in other parts of the world generally, gold deposits, like most metalliferous deposits, are found in or near regions of igneous rocks ; there are exceptions, where some lodes are near the contact of igneous rocks with sediments, or where the placers are found far down the streams in the flatter areas underlain by sediments.

As igneous rocks are the most resistant of the three classes and stand up as elevated masses, we naturally find the metalliferous lodes in or near the cordilleras. A few are found near old volcanic stocks or plugs, but scarcely any near recently active volcanoes. The gold deposits of the Philippines, like those of western America, are found associated with either andesites or diorites, principally ; but, in one district, Paracale, they are in veins close to the contact of granite-gneiss and diorite-schist. By far the greatest number of veins is found in the andesite. Since there is, in some of the districts, both a later and an earlier andesite, and the paying veins are located in the earlier, it is important to be able to distinguish between them.

The vein matter fills fissures which are in many cases clearly tectonic. Faulting, with strong slickensides and considerable displacement of the veins, is pronounced in many districts. On this point I am not in agreement with Eddingfield, who expressed just the contrary opinion ; later development in some of the districts, which he had not seen, has necessitated changing Eddingfield's statement.

The parallel arrangement of many of the fissures in all the fields, though less pronounced in Benguet, is noteworthy. The best lodes so far found and worked are in northwest and southeast fissures. It should be pointed out that these fissures are coincident in direction with one of the principal axes of the Archipelago.

In only one district (Baguio) has mining reached any considerable depth. In the Benguet Consolidated mine on the C level, at a depth of about 80 meters, the veins are keeping their width and values, and are even becoming richer.

According to Eddingfield, the most characteristic feature in regard to the ore deposits of the Philippines is the abundance of quartz-calcite-manganese veins. This is true also of many of the Tertiary gold deposits of the western United States. A characteristic section of this type of vein in the zone of oxidation consists of (*a*) a band of solid compact calcite, varying in width from 0.5 to 6 meters, often lying next to the foot wall ; (*b*) bands of black, soft manganese, usually mixed with quartz fragments or honeycomb quartz, and often containing pockets of white quartz crystals which in some mines indicate high values ; these bands are found in some cases next to the calcite, in some cases next to the foot wall, and almost always next to the hanging wall ; they vary in width from 0.2 to 4 meters ; (*c*) a band of massive quartz, carrying sulphides and varying in width from 0.1 to 4 meters, usually separated from the calcite by a manganese band.

In some fields oxidation of the ores has gone on to a considerable degree due to the shattered condition of the veins and the inclosing rocks. In these much of the calcite has been dissolved out, leaving a honeycombed quartz. Concurrently, there has been mechanical enrichment of the veins for a short distance with a decrease of values with depth.

In many veins, in the Baguio district especially, there appears to be little or no oxidation and no secondary enrichment, either chemical or mechanical. Eddingfield devoted particular study to the subject of secondary enrichment in veins bearing manganese. Of the quartz-manganese deposits studied he says : " In all of the samples, the richest ore is at or near the surface and the values found so far appear to decrease with depth."

In calcite veins, Eddingfield was of the opinion that there was some enrichment, but of a mechanical rather than a chemical nature. Only recently have indications of enrichment in the Benguet Consolidated mine been noted. The ore appears to be distinctly primary. This mine is now in its lowest workings, D. level, about 100 meters below water level.

Table 38 gives Eddingfield's excellent summary of the types of deposits in the several districts. To this I have added one or two important ones which he did not include.

According to the best authorities gold is deposited from solutions which are generally at high temperatures and are intimately related to deep-seated rock magmas. These solutions are in the first instance ascending, but descending solutions also play a part in deposition. With the gold content they reach fissures where they deposit siliceous and calciferous substances known as quartz and calcite, constituting the veins, or lodes. The fissures cut andesites, diorites, and granites, and even sedimentaries. In the Aroroy district they are in andesite, while in Benguet some are in andesite, others in diorite, and still others along contacts between sediments and the igneous rocks.

Philippine lode deposits appear to be of rather late origin, probably all dating from the Miocene Revolution. In Benguet it seems that the mineralization has continued into the Recent. Traces of gold can be detected in the travertine being deposited in the Itogon Hot Springs at the present time.

TABLE 38.—*Gold-bearing veins.*

Mine.	Type of vein.	Width.	Strike.	Dip.	Vein filling.	Minerals.	Secondary enrichment.	Milling character.
SUYOC, BENGUET.								
		Meters.						
Elizabeth	Fissure	1	Northeast and southwest.	—	Quartz, calcite	Gold, copper, lead, zinc, iron, manganese.	--	
Quien Sabe.	do.	12	North and east	—	Quartz	Gold, pyrites, copper.	—	
Palidan	do.	1-5	—	—	do.	Gold, pyrites	—	
BAGUIO, BENGUET.								
Headwaters	Fissure in andesite.	2-8	North 65° east	50° northwest.	Quartz, calcite, manganese.	Gold, galena, pyrites, manganese.	In manganese streaks.	Concentration in part, principally fine grinding and cyanidation.
Consolidated	do.	10-30	South 70° east	65° southwest.	Crushed quartz	Gold, pyrites, manganese.	On foot and hanging walls and along manganese streaks.	Fine grinding and cyanidation.
Bua	Fissure in andesite (2 veins).	1.5 each	North 70° east	65° southwest.	Calcite, manganese.	do.	In streaks of manmanganese.	do.
Fianza	Fissure in andesite.	2-10	South 70° east	40° southwest.	Quartz	Gold pyrites	Enriched portion has been eroded.	Concentration, fine, grinding, and cyanidation.
Madison	Fissure in andesite and partly contact with diorite.	5-10	South 55° east	85° southwest	Quartz, calcite, manganese.	Gold, pyrites, manganese.	Very marked in manganese streaks.	Fine grinding and cyanidation.
Camote-Clayton	do.	5-10	South 55° east	85 southwest.	do.	do.	do.	do.
Magma	Fissure	50+	North and south.	East	Quartz	Gold, pyrites, sphalerites, etc.	do.	Flotation (?)
Eileen	Fissure in andesite.	3	South 55° east	70° southwest.	Quartz, calcite, manganese.	Gold, pyrites, manganese.	In streaks of manganese.	Cyanidation.
Lincoln Fraction	Fissure in diorite	5	do.	45° southwest.	Calcite	Gold, pyrites	—	
Kelly No. 3.	Fissure in andesite.	3-5	East and west	70° south	Quartz	Gold, gold telluride, pyrites.	Along the walls	Concentration, followed by cyanidation.
Kelly South Slope	do.	4-7	South 80° east	65° north	do.	Gold, pyrites	General near surface.	
Muyot	do.	3-6	do.	do.	do.	Gold, pyrites, copper.	Occasional rich streaks ; values are leached.	Concentration and cyanidation
Tejon Dike	do.	2-4	do.	--	do.	Gold, pyrites	do.	
Emerald Creek	do.	2-8	South 45° west	60° north-	do.	Gold	In seams and pockets, vein much oxidized.	
Major Engineer	Contact shale and andesite.	2-3	North 80° east	80° north	do.	Gold, pyrites	—	
Major	Contact sand, stone, and andesite.	3-6	North 60° east	60° northwest.	do.	do.	—	
Major Electrician	Fissure in andesite.	3-5	North 25° east	57° northwest	do.	Gold		
Copper King	do.	4-6	Approximately east and west.	—	do.	Gold, pyrites, copper.	—	
AROROY, MASBATE.								
Colorado	Fissure in andesite.	5	North 45° west	70° northeast.	Quartz, manganese, calcite.	Gold, manganese	Very marked in manganese streaks and by leaching out of calcite.	Cyanidation.
Eastern Nancy No. 1.	do.	3-10	do.	70° southwest.	do.	Gold, pyrites, manganese.	Very marked in upper workings and along manganese streaks.	do.
Keystone	do.	3-5	North 40° west	--	do.	do.	—	
Tengo	do.	3-5	---	--	Brecciated quartz	Gold, pyrites	In upper workings.	
PARACALE, CAMARINES NORTE.								
San Mauricio	Fissure in schist and gneiss.	1-3	North 10° east	70° southeast.	Quartz	Gold, silver, copper, pyrites, galena.	Along foot wall	Concentration and smelting or roasting and cyanidation.
Tumbaga	Contact andesite and sedimentaries.	Stringers	Northeast and and southwest.	--	Calcite, quartz	Gold, lead, zinc, pyrites.	—	Free milling or concentration.
Longos Point	Fissure in gneiss	10	do.	--	Quartz	Gold, pyrites	--	
Navotas	do.	Stringers	do.	-	do.	Gold, lead, zinc	-	
Nalasvetan	Enriched zone in andesite.	5-10 (pocket)	North 30° west	-	Silicified material	Gold, manganese, pyrites.	Surface	Free milling near the surface.

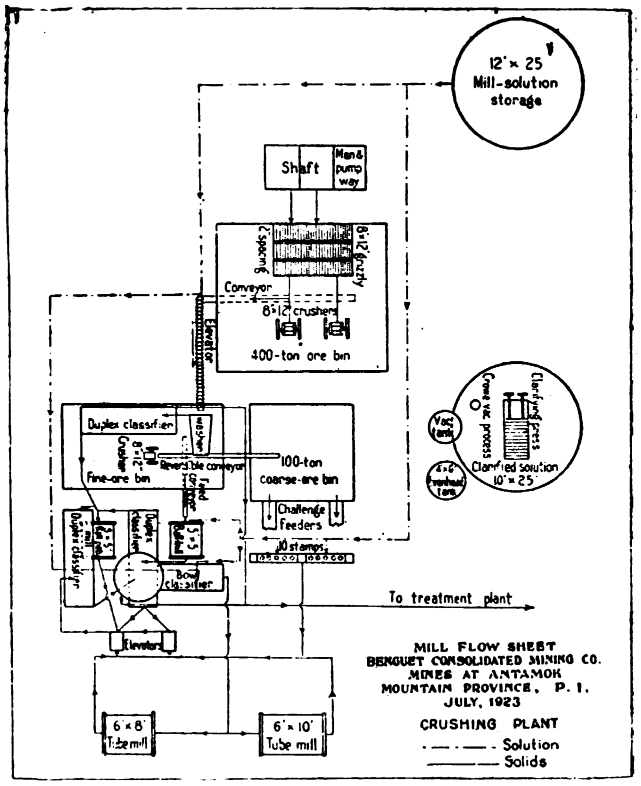
Values, of course, vary. Some very rich pockets running as high as several thousand pesos to the ton have been opened, but as a rule the ores are low grade. The Benguet Consolidated mine, the richest property in the Philippines, has an ore body that averages between 40 and 50 pesos (20 and 25 dollars) per ton. The Masbate ores run considerably less.

The Paracale District (Lode and Placer)

History.—The Paracale-Mambulao gold field has for centuries been known to the Filipinos as rich in gold.

The first mention of this district of which we have an authentic record was in 1571. The Chinese and Filipinos worked the rich streaks and alluvial ground for many years in a crude way, until Spaniards from Mexico taught them to use the arrastre ; a few years before American occupation nearly a score of these crude appliances were in use in the hills of this district. Small but fairly effective dipper dredges made of bamboo (Plate 24), which could handle only a few cubic meters a day, had been set in operation.

A large British corporation known as the Philippine Mineral Syndicate had acquired, just before the insurrection of 1896, extensive concessions from the Spanish Crown. Operations of a modern character were first undertaken on the Tumbaga property. However, these early attempts came to naught, owing to the disturbed political conditions.



MILL FLOW SHEET
BENGUET CONSOLIDATED MINING CO.
MINES AT ANTAMOK
MOUNTAIN PROVINCE, P. I.
JULY, 1923
CRUSHING PLANT
. — . — . Solution
———— Solids

Soon after order had been established in the Islands, discharged American soldiers and others were attracted to this region, and active development began. Finally, with the aid of New Zealand and Australian capital and miners, the district reached its peak of production and prosperity in 1914, when there were nine dredges at work. Since that time there has been a gradual decline, until to-day only one dredge is digging. There has never been any very successful quartz mining in the district.

The district comprises, roughly, 400 square kilometers of country of moderate relief. The topography is marked by a number of hills, which extend outward as spurs from the cordillera and have approximately a north and south trend. Between the hills are broad valleys, to a great extent filled with nipa and man-grove swamps. The whole country is densely wooded. The most elevated point in the district is Mount Bonotan, some 500 meters in height.

Metamorphic rocks are a prominent feature of this area. The formations are pyroxenite, schist, granite-gneiss, shale, sandstone, and andesite, from north to south in the order named. The strike of the sedimentaries is, roughly, north and south, and they now stand nearly on end.

Prior to the Miocene disturbance, which flexed these formations into a more or less vertical position, the section of the strata was probably as follows : At the base a pyroxenite and diorite complex ; above this sandstone, shales, and possibly limestone, with andesite overlying. With the Miocene uplift there probably occurred an intrusion of granite ; exposures of the granite cutting across the basic rock can be seen. Along the contact of the two, gneiss and schist were developed. Later, and probably before the outflow of andesite, there began a period of vein filling and ore deposition. Naturally, the principal deposition took place along the weak zone of the contact and in the fractures adjacent to it. The principal lodes to-day are found normal to this granite-diorite contact. There are also many parallel veins running through this granite batholith. The placer deposits are found along the rivers that cut across these veins and are naturally richer near them.

Mambulao.—In 1908 the ancient workings and those of the Philippine Mineral Syndicate (which were interrupted by the insurrection of 1896) were the only ones in the district, together with a few recent shafts and tunnels driven as assessment work. Shortly after, two companies developed and for a time worked two properties, the Tumbaga and the San Mauricio, which had been discovered and partially developed during Spanish times.

Tumbaga.—The Tumbaga property has only recently exhibited activity, though a few years ago it figured prominently in the local newspapers. It is one of those tantalizing deposits with exceptional streaks of high-grade ore, but apparently without body enough to put it in the producing class.

This property is situated 2.5 kilometers south of the town of Mambulao. The ore body is in a brecciated zone between a sort of arkose (more or less tuffaceous) and andesite. The trend of the ore body is northeast and southwest. In this there is considerable slate, through which innumerable calcite stringers ramify, some of which have been found to carry free gold. It is more than probable that the values will be found to be confined to these veinlets that cut the slate, and not in the body of slate itself as some have supposed. The absolute determination of this point will, of course, considerably affect our ideas as to the size and value of the deposit. The slate body is more or less lenticular and faulted and is about 10 meters wide.

Mr. A. C. Cavender worked this property for a time (from 1910 to 1912) with a small and rather inexpensive plant consisting of the following : Blake crusher, 5-foot Huntington mill, two Johnson concentrators, and the usual accessories. In November, 1909, on a trial run of twenty-two hours, 11 tons of ore produced 93.6 ounces, which represented merely the free-milling part of the ore. The hopes of the early operators of this property have not materialized, and to-day (1922) the plant is idle.

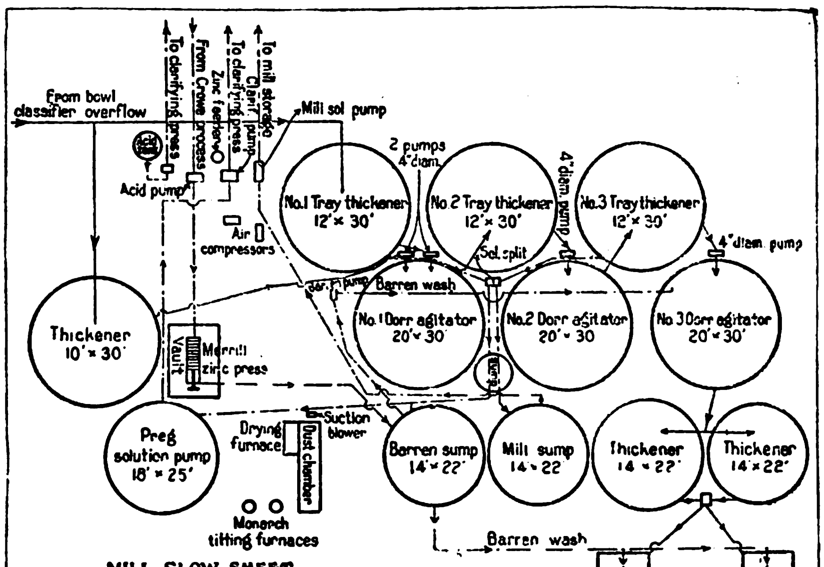
San Mauricio.—This property is located 1 kilometer from Mambulao, on the hill northeast of the town. The ore body is in part a quartz filling, normal to the contact between the granite and the basal rock, which here is more nearly a diorite than a pyroxenite.

In 1909 several hundred meters of drifts and crosscuts were opened. A drainage tunnel 500 meters long, from near sea level, was completed and connected with the main shaft. Besides this development work, a 20-stamp Traylor mill, consisting of the following parts, was erected ; 20 Traylor stamps, Blake crushers, Challenge feeders, 8 Traylor concentrators, and a Richard's classifier. The stamps are 1,050 pounds each, and it is proposed to have them dropped at the rate of ninety-four times a minute through a 5-inch drop. This mill, for completeness, general plan, and the way it has been set up, was a model at the time ; it was, however, not altogether suited to the class of ore to be treated. The ore is basic, having copper, lead, zinc, and gold in gangue. In October of 1909 (?) a severe typhoon raged on this coast and did more or less damage to all the properties. At the San Mauricio mine the head frame was blown down, but no other serious damage was done. The property closed down in 1910.

Other lode properties on which development work has been carried on are the following : Dinaanan, north of San Mauricio ; the Le Duc property, southwest of Mambulao ; and the group of claims known as the Iron King, Gordon, Isla, Guinto, Abe Lincoln, and Navotas, all a short distance east of Tumbaga. All appear to be promising prospects, but nothing is being done on them.

Maliit—Some 6 kilometers south of Mambulao on Maliit Creek is located the only stamp mill operating to-day in the Paracale-Mambulao district. Messrs. Moisson and Mueller are operating a 10-stamp mill on a 3-meter quartz lode which averages about 16 to 18 pesos per ton. The country rock consists of slate and

granite, and the ore body is near the contact. In all there are about 600 meters of workings.



MILL FLOW SHEET
BENGUET CONSOLIDATED MINING CO.
MINES AT ANTAMOK
MOUNTAIN PROVINCE, P. I.
JULY, 1923

The Paracale District (Placer)

Operations in this district (June, 1922) are confined entirely to placers, and only one dredge is working. This field reached its zenith in 1915, when there were nine dredges in Paracale Rive and adjacent streams, busy digging in the gold-bearing gravels and sands. These nine dredges included all the best-known models of dredges employing American, Australian, and New Zealand practices, making this perhaps the best place in the world to study the methods of gold dredging; nowhere else, to my knowledge, could comparative studies be made in such a limited area. These various types of dredges and the methods of operation have been fully described, both by technical representatives of the Government and by some of the company engineers, notably Mr. Kane. (348)

Paracale and Malaguit Rivers are comparatively short and nearly at sea level throughout their length. The Paracale is a good example of a drowned river. These two rivers lie in broad valleys, covered with mangrove and nipa palm, through which the dredges work their way. The mangrove is used for firewood and the nipa is either thrown aside or employed by the Filipinos for house building.

A test hole in a neighboring river, similar in many respects, which will serve to give a general idea of the ground to be dredged, showed the following:

Table 39.—*Strata in a river near Paracale.*

	Meters.
Soil, nipa, etc.	0-1.5
Sand and gravel, with some values in gold ..	1.5-7.6
Heavy black loam, with considerable decayed vegetable matter	7.6-11.5
Gravel " pay-streak "	11.5-12.2

Bedrock, soft, white, decomposed granite gneiss.

Some of the ground, of course, is much deeper than is indicated by this boring and may even be as deep as 20 meters.

The ground in the vicinity of Paracale was unusually rich, yielding as high as 2 pesos per yard over considerable areas, while in several spots values as high as 14 pesos per cubic yard have been reported. The fresh, crystallized gold, showing little or no rounding, would indicate that it had not been transported very far.

This gold has so evidently come from lodes in the immediate vicinity of the placers that one is justified in looking for some paying quartz veins in the district. While some promising prospects have been discovered, there is no lode mining to-day in the Paracale portion of the district.

This district would show much greater progress to-day had some of the early promoters used better judgment. On account of some of their ill-advised ventures it is very difficult now to enlist adequate capital. Another drawback to the development of this district is the comparatively limited dredgeable ground.

The Aroroy District, Masbate

The mining operations of the Aroroy district (Plate 35) have been discussed in various issues of the Mineral Resources of the Philippine Islands. A paper on the geology of that district, by Ferguson, with a geologic reconnaissance map, was published in 1911.(274) The district has lately taken first rank among the gold fields of the Archipelago. A résumé of the history and geology of the Aroroy district follows.

History.—There are remains of mine workings in various parts of the Aroroy district which appear to be very old. Whether they represent the activities of Chinese before the Spanish conquest or are of a later period cannot be defintely ascertained; but it is claimed, in support of the theory of ancient workings, that pieces of Chinese pottery older than the Ming Dynasty have been found near the old tunnels and open cuts.

A story is told of the operations of a Spaniard and an English-man who worked in the district long before American occupation. They had a shaft on the southwest side of Boston Hill and had struck rich, free-milling ore when the Spaniard murdered the Englishman. Some confirmation of the story is the fact that some of the best free-milling ore in the district is now being taken from veins near this site.

One of the first Americans to attract attention to the district was Mr. August Heise, at that time in the United States Army and stationed at Aroroy at the beginning of this century.

In 1904 and 1905 attempts were made to boom the placer prospects on Guinobatan and Lanang Rivers; but, though two dredges were installed there, no tangible results were achieved other than the sale of stock. One of the dredges was destroyed in a typhoon, and the other was later dismantled and transferred to the Paracale district.

In 1907 a small stamp mill was erected on Guinobatan River, a short distance above the present Syndicate Mining Company's mill site. This mill belonged to the now defunct Eastern Mining Company. It was never successful, and the holdings of that Company were later taken over by the Syndicate Mining Company, which has been operating since 1914.

In 1911 a 20-stamp mill of modern design was erected on the claims originally located by Mr. Herbert on the north bank of Guinobatan River, about 2 kilometers below the old Eastern Mining Company mill. This mill has been running steadily ever since, and is one of the most consistent gold producers in the Archipelago. It is known as the Colorado property.

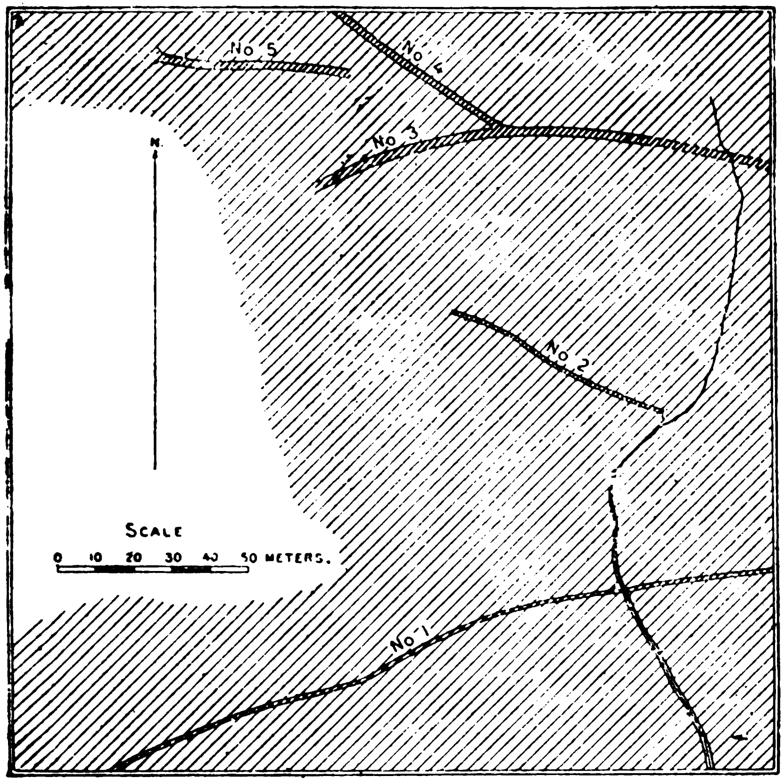
In 1913 a mill was erected on the Keystone property near Aroroy, but this concern has never been very successful and the mill was abandoned for a long time. To-day (1921) the Colorado and Syndicate are the only producers in the district.

Geology.—The principal rocks in the district, in the order of their abundance, are andesite, pyroclastics, quartz diorite, old slates, small amounts of limestone, and alluvium.

On the west side of Port Barrera is a large area of sediments of late Tertiary age. These dip gently to the southwest and, presumably, at one time overlapped the igneous core to the east, possibly extending over the whole area in the form of a broad arch. There are remnants of an older limestone as well on the top of the igneous in one or two localities. A reference to Ferguson's map shows that one of these remnants is found on Aroroy Mountain; it furnished lime for the cyanide plants near by.

To the east of Ambulong Peak (which is near the barrio of Aroroy), there is a fair-sized area of quartz-diorite; it is believed that considerable mineralization will be found in the neighborhood of that formation, as in the case of the Benguet district, where the best values so far have been found.

It has been noted by many who have visited this district that there is a strong system of veins striking northwest and southeast, the principal one being known locally as the Bronco lode. This system of veins is considerably interrupted, faulted, and offset laterally. The faulting would make it appear that there is a greater number of veins than really exist.



Gold veins on the Kelly property

Description of the More Important Properties of the Aroroy District*

The Hayes property.—This property is situated in the extreme southern part of the district. Mr. Hayes, one of the first prospectors in the district, ran some crosscuts in an attempt to intersect the southeastward extension of the main lode of the district, which is locally known as the Bronco lode. No activity on this property is reported in 1921.

The Schwab property.—The next property north of the Hayes claims and on the south side of Boston Hill is being worked intermittently by Mr. Paul Schwab, one of the veteran American prospectors of the Archipelago. Mr. Schwab's mill, a small 1-stamp affair, is not now working. It is claimed that the best free-milling ore in the district is found here.

The Mount Cogran, Tuyo, and Gold Bug properties have all figured more or less in the history of the district, but none is producing at this date.

The Balete and Napuangan, now consolidated under the name of the Argus Mining Company, are two promising groups of claims in the extreme southern end of the district, located on some very fair veins in andesite. A small mill on the Balete property operated for a time, but only development work can be recorded now.

The Keystone Mining Company.—This is the northern most property of the district, located on the north side of Aroroy Mountain. At the present time only development work is being carried on, but a very substantial mill, Chilean using mills instead of stamps, was operated for three years. At present very little of the old plant remains.

The Syndicate Mining Company.—This is the largest producer at present in the district and is the lineal descendant of the old Eastern mine of the early days of the American régime. To the engineer, Mr. T. Uewaki, in charge of surveying and drafting, and the mill superintendent, Mr. Enberg, I am indebted for a map (Plate 35) and the following very complete description of this property and of operations there :

Brief Notes on the Syndicate Mine

The Syndicate Mining Co. is working chiefly three claims on the central part of Karabao Hill reserving the other thirty-one valuable claims.

* In the case of the larger properties, I have purposely used information supplied by the officials of the companies. I have personally checked their statements in the field.

The rocks covering the Syndicate area are almost entirely igneous, consisting chiefly of andesites, diorites, and pyroclastics in which numerous gold-bearing veins are found filling fissures. These veins are affected by many faults having nearly east and west or northwesterly courses.

The country rock in the oxidized zone is much altered near the veins ; producing a brown, claylike rock generally showing traces of its original porphyritic structure.

The highest point on the outcrop of champion vein is 650-ft. above the Guinobatan River level, which is generally considered as the permanent water level in this district.

The veins are developed in six levels, and the total length of tunnels exceeds 30,000-ft.

Among twenty-one different veins known, the principal ones that are in mining operation at present are the seven listed below.

1, 2, 3. The Star veins are composed of a very hard, dark blue quartz carrying irregular amounts of manganese and pyrite, the dark color being due to finely divided particles of manganese oxide.

4. The Bin Crosscut vein is of medium hard quartz, containing limonitic mud and manganese oxide.

Name of vein.	Type.	Width.	Known length.	Strike.	Dip to south-west.	Vein filling.	Minerals.
		Feet.	*Feet.*				
1. Star No. 1	Fissure	5	2,400	North 27° west.	85	Quartz, manganese, calcite.	Gold, silver, pyrite, manganese.
2. Star No. 2	do	4	350	North 30° west.	60	do.	do.
3. Star No. 3	do	6	420	North 40° west.	65	do.	do.
4. Bin Crosscut	do	10	1,700	North and south.	70	do.	do.
5. Nancy No. 1	do	3-20	1,250	North 30° west.	70	do.	do.
6. Nancy No. 2	do	15-65	5,000	North 45° west.	75	do.	do.
7. 89 vein	do	3	350	do.	83	Quartz and manganese.	do.

5. The Nancy No. 1 vein is composed of honeycomb quartz and manganese oxide, forming a well-defined banded structure, and the hardness increases with depth ; it contains much calcite below.

6. The Nancy No. 2 vein which is the biggest one in this district can be traced over 5,000-ft. and the values, as a rule, are found near both walls for a width of 10 to 35-ft. This vein is also composed of quartz, calcite, and manganese oxide, and the calcite content increases with depth.

7. The 89 vein which is a very narrow streak carrying extremely high values is composed of rather softer quartz with a little limonitic mud and manganese oxide, and it contains no calcite.

The ores from these veins are suitable for the cyanide process, containing very fine particles of gold.

The ore is received from the mine by means of a gravity tram with 2¼-ton cars and by a mill level adit ; and delivered to a 65-ton storage bin. From this bin it is fed by gravity to a trommel washer with a 40-inch diameter by 16-feet mixing chamber running on tires and rollers and driven by a rope drive through miter gears and spur and pinion on washer at six revolutions per minute. The washer is lined with plain half-inch curved iron plates and has two flights of spirals made of heavy angle iron to promote discharge of the ore. The trommel is slightly conical the same size as washer and 5-ft. long. It is punched with half-inch round tapered holes.

Water is introduced with the ore in the washer partly at the feed end and partly at the discharge as a high-pressure spray thoroughly to wash the ore and free it of clay and slime. The fines discharge is led by a launder to a Dcrr duplex classifier which is set to discharge practically all minus 200-mesh slimes. The sands from this classifier are dragged forward and discharged to the tube mills, entering the regular cyanide circuit. The slimes are led to a storage tank and fed to an 8-foot Senn Batea pan amalgamator running at 175 revolutions per minute with a ⅝-inch motion. This feature is somewhat of an innovation and was made necessary by the fact that the ore contains an unusually high percentage of clay and slime that prevents it from settling in the thickeners. Before the Senn table was tried the settling and filtering capacity was not nearly equal to the grinding capacity of the mill, the slime at

times requiring over 20 square feet of settling area per ton as compared to about 7 feet for free settling slimes. Since the table has been in operation the settling and filtering capacity is equal to the grinding capacity and has shown an increase of 70 per cent. Extraction on the Senn pan is very low as would be expected due to the very fine state of the gold that passes over the classifier and to the fact that this gold is contained in all the clay and slime washed out of the total ore received. However, only about 10 per cent. of the tonnage passes over the Senn and the heads are very low due to the extremely fine classification; so that the total loss per ton is low and is many times compensated for by the large increase in tonnage and a saving in cyanide and lime necessary per ton milled as well as an increased extraction in the cyanide circuit.

The washed oversize from the washer trommel goes by means of a 16-inch belt conveyor to a storage bin for the crushers, discharging on a 5-foot by 8-foot grizzly with ¾-inch spacings; the oversize going to the crusher bin and the undersize to the ball mill bin. The coarse ore is fed to a 10-inch by 16-inch Blake type crusher set at 1½ inches and running at 230 revolutions per minute. The crusher product goes to a set of 16-inch by 36-inch D. E. W. Co. rolls set at ¾ inch; the product from the rolls going by means of a 14-inch belt and bucket elevator to the ball mill storage bin. The elevator discharges into a small grizzly with ½-inch spacings and the undersize goes by a conveyor belt to a fines storage bin from whence it is fed by a revolving disk feeder to the Abbe tube mill whenever the load of sand will permit.

From the ball mill bin the ore is fed by means of a 30-inch revolving disk feeder to a 16-inch by 6-foot Hardinge ball mill running at 25 revolutions per minute; sufficient solution being introduced for dilution to about 30 per cent. moisture. The ball mill discharge, all of which is minus ¼-inch mesh, is elevated by means of Frenier sand pumps (10-inch by 54-inch) to two Dorr duplex classifiers, the slimes going to two 30-foot Dorr thickeners and the sands going to one 60-inch by 6-foot Hardinge pebble mill and one 6-foot by 16-foot Abbe tube mill. The discharge of these two mills is elevated by the Frenier pumps to the two Dorr classifiers, and the classifiers return the sands to the mills and the slimes to the thickeners.

From the thickeners the thickened pulp is conveyed by diaphragm pumps to three 30-foot Dorr type agitators placed in series. The plup from the final agitator goes to three Kelly type filters. The filters are loaded by a 6-inch Byron Jackson sand pump and the cake formed in from seven to ten minutes by means of a montejue and an air compressor at 45 pounds pressure. After the cake is formed, the excess pulp is returned to the agitator and barren solution introduced into the filters from a storage tank through a 5-inch Goulds centrifugal pump at 35 pounds pressure for a period varying from thirty to sixty minutes and dependent on the tonnage being handled. After the barren wash, water is introduced and a wash of two to five minutes used. The filters are then run out and the cake sluiced to waste. The filter cycle ordinarily takes two hours.

The total effluent solution from the filters is pumped by a low speed centrifugal to No. 6 thickener and clarified by settling, thence it goes to the mill solution pump and is elevated by a 7-inch by 8-inch Goulds triplex pump to the mill solution tank, forming the solution used in the grinding and classifier circuit.

The clear overflow from the thickeners goes to a 15-foot fiber clarifier, thence to a 15-foot sand clarifier, and thence to five 6-compartment zinc boxes where the values are precipitated. The barren solution from the zinc boxes is elevated by a 7-inch by 8-inch Goulds triplex pump to a barren-solution storage tank at the head of the mill whence it returns to the filters for the barren-solution wash.

The zinc boxes are cleaned and dressed weekly, and the resulting shorts and precipitates are roasted and dried; fluxed and smelted in a No. 275 "Case" tilting furnace and the bullion shipped to Manila offices.

The present capacity of the mill under proper operating conditions is about 200 tons per 24-hour day. Owing to extreme variations in cost of materials and supplies no milling costs can be given as they are so variable as to be of no value.

Power is furnished by two 150-horsepower Mirrlees Diesel engines and one 165-horsepower Busch-Sulzer engine: all direct connected to direct-current generators, generating current at 110 volts. Motors are used for all drives and the average power consumption at present, including one 35-horse power aircompressor making air for the mine, is from 2,000 to 2,100 amperes.

The Colorado Mining Company.—The Colorado mine was discovered, very soon after the American occupation, by Mr. Herbert, and ore from it has been milled fairly continuously since 1911 until it closed down this year (1922). To Mr. Lloyd Robert, the superintendent, I am indebted for the following description of this property:

The Colorado mine exploits a number of lodes on Bagadilla Mountain, of which No. 5, Sub 2, 8, and 9 are the most important. All of these are parallel in strike, and all except the Sub 2 in dip. Sub 2 vein dips in the opposite direction.

In addition to these, there are a number of veins intersecting No. 5 vein, and usually called split veins. Of these the 7 Split, the Split vein, and the Tabios Split are the most important. These, in general, carry narrow veins of higher-grade ore.

No. 5 vein has been the most important of all veins and has been opened for a length of 2,300 feet and depth of 800 feet. In places it has had widths of 30 feet in pay ore.

All the main lodes are cut by a fault which has a right-hand throw of 65 feet. A number of parallel smaller faults are known but the dislocation in these is small.

The vein filling is quartz, in parts carrying considerably manganese. Practically no other metals occur, and no sulphides are found. The gold is rarely visible, and the ore is not free milling in any profitable percentage. It is, however, readily amenable to cyanide treatment. The values are extremely spotty but the range is not great, anything over 50 dollars being exceptional.

The ore is passed over a grizzly with 2-inch opening and oversize is crushed and stamped in three batteries, of 1,250-pound stamps. The crushed product, together with the grizzly undersize, passes to a ball mill, 5-ft. by 6-ft., and thence to two tube mills in close circuit with two Dorr classifiers. The undersize from the classifiers, of which about 90 per cent. will pass a 100-mesh screen, goes to a Dorr thickener, 14-ft. by 28-ft. The thickened pulp goes to two Pachucas in series and thence to an 81-leaf Butters filter. The overflow from the thickener is passed into two more Dorr thickeners which act as settlers for the almost clear solution, and they, in turn, overflow to a small sand filter clarifier and thence to the zinc box supply or gold tank. An average of 350 tons of solution is precipitated per day.

Cyanide consumption averages 0.65 of a pound per ton, and zinc about the same. Lime, 15 pounds per ton; strength of solution 1.5 pounds per ton, KCN, and 1.3, CaO. Tube mills use mine rock, and require 20 to 30 pounds of rock per ton of ore. Ball consumption 2 pounds per ton.

Accurate drip samples are taken of zinc-box flow, and flow is measured by a Bristol recording gauge. Heads are calculated from the value precipitated per ton and the filter tails. They are partially checked by a rough and unsatisfactory sample taken above the batteries.

Many improvements have been made in this district in late years; chief among them are a new road from Aroroy to the southernmost large mill, the Syndicate, and a branch from this road to San Agustin Bay, where landings have been made for the Colorado and Syndicate properties. There is now an excellent steel bridge over Lanang River, as well as a schoolhouse on the Colorado property for the children of the mining population. There are also churches and cinematograph halls. Boats between Manila and Aroroy ply with greater regularity than formerly, and there is telephone and telegraphic communication. The district seems to be in excellent condition, and prospects are very promising for successful operations on some of the properties for some years to come. There are many veins on the properties of the two operating companies, as yet unprospected, which may prove to be of workable value.

The Baguio District

The heart of the Baguio mining district (Plate 15) is situated less than 8 kilometers east of the former summer capital of the Philippines, from which it gets its name. It lies about 270 kilometers almost due north of Manila near the southern end of the great Cordillera Central. The elevation varies from 900 meters at Antamok to over 1,500 meters on the surrounding mountain tops.

A railroad has been projected to connect Aringay and Baguio; some of the grading has been done; from Baguio wagon roads will terminate at the several properties. At present there is an automobile road about 14.5 kilometers up Bued River Cañon from Damortis, near the northern terminus of the Manila Railroad.

This is a region of high relief and great erosion due to torrential precipitation. Pine is the dominant tree, but it is growing scarce in the vicinity of the mines.

Water is the chief source of power, but larger installations are needed than are available at present.

American miners have been prospecting in this district for fifteen years, but only during the years 1908 to 1911 and 1915 to 1921 has successful mining been carried on by organized companies. In 1909, there was a severe typhoon, which wrecked the Benguet Consolidated mill, and in 1911 the district suffered other setbacks, so that there was practically no production from 1911 to 1915. One 3-stamp mill continued milling rather steadily throughout much of that interval, and in 1914 the Benguet Consolidated Company rehabilitated its plant and is to-day operating very successfully. Several of the properties that were once well known in the district and gave some promise of realizing a future, have for the time being at least become negligible features. These are the Acupan, the Bua, the Major, and the Headwaters. Other prospects, such as the Muyot and the Kelly groups, are expected to become mines some day ; but so far only development work has been done on them. Others, from which some people have hopes of realizing fortunes, will probably never come to fruition.

Prior to American occupation, the veins of this district had been worked by Igorots, Filipinos from neighboring provinces, and Chinese. Some of the old workings are rather extensive and have been of great help to prospectors in locating veins. They are similar to the workings found in other parts of the Islands where only the rich stringers were gouged out and are, consequently, so narrow that an American would find it almost impossible to go through them. One of the drifts in the Kelly mine cut an old Igorot stope filled with waste that had become cemented as hard as the wall rock.

Geology.—The geology of this district, has been described by Eveland, (237) by Eddingfield and Smith, (603) and by Dickerson. The last-named author deals largely with physiography. Eveland was the first to make a systematic geologic reconnaissance of this region, and the essential results of that survey have been corroborated by later work.

The principal formations in the Baguio district are quartz-diorite and granite intrusives, some Tertiary sediments, andesite flows, tuffs, and agglomerates. The oldest sedimentary formations in this area appear to be the Vigo group, conglomerates, sandstone, shales, and limestone of middle Miocene, which are exposed at places well down in Bued River Cañon, and in Major and Copper King Creeks. These are cut by both andesitic and quartz-diorite intrusions, and in the southeast end of the area the latter is cut by a hornblende granite. Above the whole, stratigraphically, and in some places actually superimposed and in contact, is the later andesite consisting of solid and agglomeratic flows. In the western part there is, overlying all of the foregoing, the Malumbang limestone of Pliocene age. Following the folding and intrusions, which began probably with the Miocene but which culminated toward the close of the Miocene and continued into the Pliocene, extensive mineralization and vein filling took place with quartz, calcite, and manganese as the chief gangue minerals, carrying gold and silver with, possibly, some tellurium, and small amounts of mercury in some places. This deposition of silica and calcite continued through the Pleistocene, and has not altogether ceased even now. This region, like most parts of the Archipelago, is profoundly faulted and fissured. Not only were all the fissures of the country filled, but much of the overlying andesite and tuff were silicified by the siliceous solutions, giving rise to the especially characteristic Baguio formation which is well shown near Government Center in Baguio City.

The Benguet Consolidated.—The Benguet Consolidated mine (Plate 33) is the richest gold mine in the Orient. It is located in Antamok Valley, about 12 kilometers southeast of Baguio. To the president, Mr. A. W. Beam ; the superintendent, Mr. O. L. Kettenbach, and Mr. M. F. Dodd I am indebted for the following information about the property and its history :

In 1902, Mr. H. Clay Clyde discovered this bonanza. Like the majority of discoverers of payable mines, however, Mr. Clyde realized almost nothing from his find. He, together with Messrs. M. A. Clarke and Nels Peterson, organized the Benguet Consolidated Mining Company a year later. The first plant, which consisted of three stamps, amalgamating plate, and leaching tanks, with a capacity of 25 tons per day, was erected by Mr. Clyde M. Eye, E. M., in 1905. Gradual additions were made to the plant so that, four years later, the company boasted of six stamps and sufficient additional equipment to increase the handling capacity of the plant to 40 and 50 tons of ore per day.

In 1909, the flood at Antamok, Benguet Province, where the mines are located, destroyed the cyaniding portion of the plant. Mr. Nels Peterson repaired and placed in commission the milling section of the plant the following year, and it was operated by him until the latter part of 1911, when the remaining portion of the plant was swept away by flood.

For the purpose of building a modern, up-to-date milling and cyaniding plant with a capacity of 50 to 60 tons per day, sufficient capital was raised locally during 1914, and Mr. Eye returned to supervise its erection and to remain as operator. Since the erection of the present plant, the operations of the Benguet Consolidated Mining Company have been very successful. The handling capacity of the plant is now from 120 to 130 tons of ore per day. Shareholders in the Benguet Consolidated receive regular quarterly dividends of 50,000 pesos and an additional 50,000 pesos in July and January of each year.

The developments underground are now so satisfactory that plans are under way to enlarge the plant so that it can handle 175 tons per day. Production will then increase to 1,500,000 pesos per year. Over 1,000,000 pesos worth of gold bullion was produced by the Benguet Consolidated in 1920.

The Benguet Consolidated Mining Company is a *sociedad anónima* organized under the laws of the Philippine Islands in 1903 The present capital of the company is 700,000 pesos, Philippine currency, divided into one million shares of a par value of 70 centavos each. The original capital of the company was 1,000,000 dollars, but this was reduced to 1,000,000 pesos in 1916, and on March 25, 1921, the capital was further reduced to 700,000.

The company owns approximately 420 acres of mineral-bearing land, of which 285 acres are held under patent, and 135 acres under location. Its holdings cover about 8,000-ft. along the strike of the main Benguet lode.

From the commencement of operations in 1906, until the end of 1920 we have mined and treated 143,793 tons of ore, of an average value of 38.50 pesos per ton, at a saving of 90 per cent. of the gold and silver content, or a total saving of 4,983,750.62 pesos, Philippine currency. During 1920 we treated 35,565 tons of ore at a production of 1,068,892.30 pesos, Philippine currency, and a net profit of 456,668.58 pesos.

Total dividends paid to the end of 1920 amount to 1,250,000 pesos.

Estimate of ore reserves, January 1, 1921.

	Tons.	Pesos.
Positive	27,100	860,000
Probable	38,810	1,417,840
Possible, exposed incompletely on one side..	67,000	2,370,000
Total	132,910	4,647,840

Since the foregoing ore estimate was made we have cut the foot wall vein on Level " C," thus bringing into the " possible " column a large tonnage of ore not counted in the estimate.

In connection with the ore estimate it is interesting to note the production from Level " B," which is approximately 120-ft. on the dip below Level " A." Exclusive of ore taken from Level " B " through the old mine, the amount of which was considerable but unknown, Level " B " has produced 59,212 tons, and still contains in positive, probable, and possible ore 42,910 tons, or a total for this level of 102,122 tons. The pay chute opened up on Level " B " is more than 1,400-ft. long, with high values in the face of the drift west on the hanging wall vein. This drift has been discontinued for the reason that it is near Antamok Creek and not far enough below the creek to make it safe to continue.

The ore is a mixture of quartz, iron sulphide, altered diorite, and clay, with quartz predominating. Although a very small percentage of the gold is free none is visible. The ore treatment consists of crushing, stamping in cyanide solution, grinding in pebble mills to pass 100-mesh, and a nine-day cyanide treatment. The pulp is passed through an Oliver filter before final discharge.

Electricity is used for power and lighting. It is furnished by two small hydro-electric plants having a combined capacity of 375 K. V. A.

The geology of the mine, as described by our mine superintendent, Mr. O. L. Kettenbach, in his last annual report, is as follows :

" The main Consolidated vein is formed by two main fault fissures and a third series of adjustment cracks, formed, I believe,

with one exception, contemporaneously with the second of these main fissures.

" In the first two fissures were deposited the main hanging wall and foot wall veins. Of these two the hanging wall vein is by far the older, non-mineralized inclusions being practically absent within it while abundant in the foot wall vein. The fault movements producing both fissures were intense, as is evidenced by the cleanly defined hanging wall of one and foot wall of the other, together with the abundance of clay selvage on both and the intensity of slicken siding which is occasionally seen.

" The advent of the footwall fault in such close proximity to the hanging wall fault created a zone of weakness beginning at the former and extending to the latter. Adjustment cracks and planes always follow major fault movements and I take the numerous cross veins in the mine to have been formed in cracks or secondary fissures caused by these movements.

" These two fault systems are by no means parallel, and the mineralized solutions working along each produced, first, a zone of enriched ore in close proximity to each fault plane, and, secondly penetrated the brecciated mass lying between the two and mineralized it in a ratio varying directly with the distance separating the two fissures.

" The remarkable persistence of values, both laterally and vertically, particularly in the hanging wall fissures, leads one to the belief that the mineralizing solutions were at least fairly deep seated and abundant in their supply."

At present (March, 1921) the company is driving a 3,500-foot drift along the hanging wall of the lead, the entrance to this being in Antamok Cañon to the east of the present workings about 3,500-ft. This is primarily intended for drainage, but it will also be used thoroughly to prospect the lead by means of crosscuts and raises run from it at regular intervals. The old native workings, known as the " Fianza gold mine," are included in the ground to be explored by this drift.

The old mill and the process as used at the Benguet Consolidated mine have been fully described.* The flow sheets for the present mill are shown in figs. 21 and 22. The capacity of the new mill is 250 tons daily. The crushers are Joshua Hendy Hercules type 8 inches by 12 inches. Their individual capacity is 100 tons daily of coarse rock to 1 inch. Ball and ball-pebble mills are of Allis Chalmers make. The former reduces 175 tons daily of 1 inch feed to 3/16 inch product. The latter reduces 60 tons of about 3/8 inch feed to sand. Stamps are Joshua Hendy make. They weigh 1,050 pounds each and drop 106 times per minute. They are run intermittently only. Their full-time capacity is 50 tons of 1.5-inch feed through a 0.5-inch screen. The tube mills are of Denver Engineering Works make. Combined they reduce about 100 tons daily from 3/16-inch feed to 92 per cent 100-mesh discharge. The Crowe process and precipitating machinery is by the Merrill Metallurgical Co. Its capacity is 600 tons solution daily. Thickening and agitating machinery is of Dorr Co. make. Filters are made by Oliver.

The Bua Mine.—This property is situated just across the river from and below the Benguet Consolidated mine.

In 1909 this mine and mill were in full swing and gave promise of becoming a real producer, but since the typhoon of October, 1909, the property has not been operated. The Bua property before it closed down was working two veins at Gomok, one a quartz vein from ½ to 1 meter in width, the other a rhodochrosite vein 1 to 2 meters wide striking north 10 degree east and dipping 65 degree to the south. There were several hundred meters of underground workings in this mine and a well-equipped mill. At the present time everything has been abandoned.

The Headwaters Mine.—The Headwaters property on the upper Antamok had a fairly elaborate equipment, consisting of stamps, tube mills, Pachucas, and a Ridgeway filter; unfortunately it had three serious handicaps; namely, insufficient ore, very little timber, and lack of cheap power. The failure of this company gave a severe setback to the district. At the close of 1921 development work was resumed on this property.

The Camote-Clayton.—The Camote, adjoining the Benguet Consolidated property on the southeast, is one of the largest ore deposits in the district and seems to be a continuation of the Minnesota lode, on which the Benguet Consolidated mine is located, as well as of the well-known Fianza ore body between the two. The vein where it is opened on the Camote property is manganese and calcite and is said to average about 8 meters in width. A large amount of ore has been developed and between 500 and 600 meters of workings have been driven. This ore is said to " catch 6.50 dollars on the plates alone." Mr Reavis operated a small mill here for a time, but this has been abandoned.

The Kelly group.—The late J. E. Kelly developed through a long period of years a group of claims near the head of Gold Creek, just west of the Benguet Consolidated property. This group on the north slope has four veins: No. 1 particularly shows as a strong high dike on the bank of a stream; No. 2, North 60 degree west, dipping 60 degree to the north; No. 3, south 60 degree west; and No. 4, north 34 degree west; the outcrops of these veins are well marked. Considerably more than 1,000 meters of drifting and crosscutting has been done on the veins which vary in width from 1 to 3 meters. The values, while encouraging in spots, are not consistent. The ore carries no free gold, but has more or less telluride. On the south slope Mr. Kelly had cut four more veins with from 500 to 1,000 meters of workings. These veins generally run east and west and vary from 0.6 to 10 meters in width (fig. 23). About half the gold in this group is free milling. These properties might be worked in consolidation with others, but alone they present some difficulties.

Other groups are the Major, Lorenzo Pau, Antamok Valley, and Muyot. As most of these are on veins which cut the upper andesite, they will probably never prove as valuable as those located on or near the contact of the quartz diorite and older andesite of Antamok Valley.

Acupan.—There is a group of claims located north of the barrio of Acupan, on Batwaan and adjacent creeks, which have been developed for some years. During 1915 and 1916 there was a small 3-stamp mill operating, but this has since been shut down.

I examined this property very recently (June, 1922) and do not hesitate to say that it is at present the most promising and nearest to development of any of the properties in the district not now operating. Besides a considerable amount of ore already developed, its main vein, a true fissure vein in the diorite, promises to be persistent and to yield good values with depth. Fair power can be readily available. The tenor of the ore is about 16 pesos in the body above water level. It should improve with depth.

Demonstration.—This mine is located on the old Copper King group of claims and is being developed under the direction of Mr. H. P. Whitmarsh. There are two veins which lie close to the contact of andesite with Tertiary sedimentaries. One of them is a quartz-calcite-manganese vein, and the other is refractory, carrying copper, lead, and zinc. A 5-stamp demonstration mill has operated for a time on this property; hence the name.

The Ascension group.—Nothing further has been done on this group since the regrettable murder of Mr. Calvin Horr by an Igorot, in 1918.

The Magma.—On Dunglay Creek, in the extreme southeastern corner of the Baguio district, about 1 kilometer from the barrio of Acupan, is one of the largest bodies of quartz I have seen anywhere in the Philippines. Unlike most of the veins in this district, this one strikes nearly due north and south and dips to the east. Mr. H. P. Whitmarsh, who has for so long been a prominent figure in Benguet mining, is developing this property and reports very encouraging assays. Mr. J. D. Highsmith discovered the lode. The country rock is quartz-diorite, which a later granite has intruded. The property gives every promise of a bright future.

Other Districts

Palidan Slide, Suyoc.—This is an enormous slide in more or less soft, decomposed, mineralized diorite and andesite which the Igorots have panned for gold for years untold (Plate 21). Several Americans have from time to time worked the stringers in this slide, and for a time Mr. Gillies treated the ore in an arrastre.

Igorots are reported to have taken out from 40,000 to 80,000 pesos worth of gold in a single season. The method is similar to that employed in other countries, and is known as " booming."

Several quartz veins, none very wide, are being developed at several places near Suyoc, the best looking of which appears to be the one at Dugong, about 3 kilometers west of Suyoc. I secured some exceptionally rich hand specimens in May, 1922.

Binalonan, Pangasinan.—Mr. Geo. Mentzer has operated a small stamp mill intermittently in this locality for some years, but with only nominal success.

Placers

The principal gold-bearing alluvial areas in the Archipelago are Paracale and adjacent rivers from which the cream has been taken, on the north coast of Camarines Norte, and the east coast of Mindanao near Lianga. The last-named areas are being dredged, or preparations to dredge are being made, at the present time.

On Binabay River, Mindoro, some gold placers have been prospected from time to time with indifferent results.

In past years there have been attempts, some successful, many not so, either to dredge or to sluice along Iponan and Cagayan Rivers in Misamis, along the Cansuran in northeastern Mindanao, along Lanang River in Masbate, along Agno River in Pangasinan, in Nueva Ecija, and at several points on the east coast of Luzon.

Placer types.—Philippine placers are of two general classes; namely, high-level, or bench; and low-level, or those in the valley bottoms, whether occupied by running water or not. No beach placers, as far as I know, exist in the Philippines.

Origin.—Philippine placers, like placers in other parts of the world, have originated from the erosion of lodes some where on higher ground, either near or distant.

Age.—All the placers that have been dredged in the Philippines are, without much doubt, the result of erosion since the last great uplift in the Archipelago; that is, since the Pleistocene.

Values.—In the early days of the boom in Paracale, about 1910, some ground was found to run as high as 2 pesos per yard, while the average was 25 centavos.

Placer districts.—In addition to the placer areas already mentioned in connection with Paracale and Aroroy districts, the following more or less well-known fields either have been prominent in the past or promise to merit some serious interest in the near future:

Near Peñaranda, Nueva Ecija.
Umirey River, east coast of Luzon.
Cagayan and Iponan Rivers, Misamis, northern Mindanao.
Cansuran River, northeast Mindanao.
Lianga, east coast, Mindanao.
Binabay River, Mindoro.
Placer, Surigao, Mindanao.
Curuon, Zamboanga Peninsula, Mindanao.

Of these only the Lianga is being worked on an up-to-date scale to-day.

Penaranda.—The gold placers of Nueva Ecija have not received much attention, although they have been known and worked for sixty years or more by foreign capital.

It is reported that a Spaniard, fifty years ago, worked placer ground at a point about halfway between Cabu and Peñaranda on the Sapang Bujoy. A map of Luzon, by d'Almonte, published in 1883, has marked upon it six points in this district where gold had been found, one on the Sapang Bujoy, two on the Macabaclay, two near the junction of the Rio Chico and the Sumagbac, and one near the head of Santor or Cornell River.

An Englishman about 1890 did some work near the head of Cabu River at Bakas. At that time also, a company was formed in Manila which started work on the Macabaclay with a crude sluice. Its operations were terminated by the insurrection of 1896 and no more work was done until Mr. Dorr, who had been employed by this company, resumed work in 1905.

No other records of work done by white men previous to 1909 could be found; but Filipinos have worked the gravels for ages by hand panning and hundreds of them at present have no other occupation.

A number of men from Manila formed a company in 1909 and located claims on almost every stream between Cabu and Gapang. They tested the ground near Peñaranda with a boring machine. These boring tests were reported as showing 33 centavos per cubic yard. Pan tests in other localities gave much higher values, ranging from 50 centavos to 1 peso. Such ground when worked on a suitable scale will give good returns on the money invested.

One of the most interesting features in all parts of this region is the presence of platinum in small quantities. Filipinos were ignorant of its value and always threw it away when they separated it in their pans. It is probable that iridium or other rare metals may also be found, as stated by Goodman. The only other region in the Philippines where platinum has been encountered is at a point about 64 kilometers south of the Nueva Ecija district, and the indications are that both deposits are derived from the same source.

The gold is bright yellow and is reported to be 958 fine. It occurs almost invariably in thin disks or flakes, varying in size from a fine dust to rare fragments as large as a 10-centavo piece; it averages about 0.5 centimeter in diameter. This would lead to the assumption that the gold came from a schist or gneiss, or a much-squeezed quartz vein. The only rock of this character so far reported in this region is the gneiss mentioned by Goodman, but extensive exploration has never been made.

The area in which paying amounts of gold can be found is very large, extending from the eastern cordillera to the Rio Grande de Pampanga, between Santor River and a line 8.4 kilometers south of the Rio Chico, about 1,550 square kilometers. There is a bed of sand and gravel which seems to cover this entire area, possibly produced by constantly shifting streams. This explanation of the origin seems more probable because of the great number of streams which seem to head from about the same source in the eastern cordillera, all of which carry gold even to their mouths. These streams are the Rio Chico, Ilog Munti, Sapang Palanao, Cornell or Santor, Mayon, Macabaclay, Pagsanjan, Calabasa, and Cabu, which flow into the Rio Grande.

Umirey River.—For notes on this field we are indebted to Judge Frank B. Ingersoll, who has been prominent in dredging circles for many years in the Philippines.

This is a region almost entirely unexplored during the Spanish régime. It has only been within the last ten or twelve years that it has been invaded by the American prospector. Unlike most of the gold-bearing districts of the Philippine Islands, the native inhabitants in this region know practically nothing about even the most primitive kind of mining. In most localities of the Archipelago where gold is found the natives know its value and how to win it from the rock or the alluvial dirt. Many of them, particularly the women, are very skillful panners. Along the Umirey and its tributaries there are never seen either wooden *pabirics*—so well known elsewhere—or any other gold-saving devices.

The people are very primitive in their habits. Up to the last few years they had no fixed habitations and depended for food on fishing, hunting, and trapping. Of very recent years a few of them, under the tutelage of the American prospector, have settled down, built houses, and are cultivating a few crops.

The people are called Damagats (?). Most of them are tall and powerfully built, being capable of "packing" tremendous loads over the mountains. They are reputed to be the descendants of Spanish residents of a penal colony who mated with diminutive Negritos, from which alliance come their "kinky" hair and dark complexion.

Up to the advent of the American prospector about 1911, most of these people had never seen money and the "cargadores" (packers) were paid in red cloth, beads, small mirrors, salt, etc. This occurred in a district not much over 30 miles from Manila in an air line.

So far as it is known for gold possibilities the district is located in the two provinces of Rizal and Tayabas. The Angelo River, which is a branch of the Umirey, rises in the northeastern part of the Province of Rizal near Mount Angelo. This is in the sierra which divides the Pacific slope from the rest of the Island of Luzon. The Angelo is a branch of the Umirey, which latter empties into the Pacific Ocean at Dingalan Bay about 80 miles to the north of the port of Mauban.

The Angelo and the upper part of the Umirey run through extremely rough country and the current is very swift in most places. Here and there level stretches are encountered where there are flats suitable for dredging. This condition obtains for about 35 miles. Over much of the distance there is little but exposed and barren bed rock. At one place the Umirey River disappears from view and runs underground for a distance of about three miles. Shortly before reaching the comparatively low lands through which the Umirey runs for about 18 miles before reaching the sea, the river descends through a succession of cataracts. Here the country is so rough that it is with great difficulty that an ascent can be made on foot and the cost of a road would be prohibitive.

For a number of years, the Luzon Gold Company, a Philippine corporation, has had large placer holdings along the Angelo and the upper reaches of the Umirey. In places there are most excellent showings and as a rule the gold found in the streams is coarse. At one place there are large flats, physically well-suited for dredging, with an estimated goldbearing area of about 600 or 700 acres. At other places the ground is suitable for hydraulicking and still again

for ground sluicing. As yet there have been no discoveries of veins.

In 1912 a small sluicing plant was installed on the ground below the cataracts of Umirey River, but this was swept away by a freshet and the gold in the sluice boxes, estimated to be worth about 10,000 pesos, was lost.

The dredging ground mentioned has had considerable testing and its owners estimate very high values, but to bring in the necessary plant would require the building of a road through the mountains for a distance of about 48 kilometers from the town of Montalban, Rizal Province, which is about 32 kilometers distant by rail from Manila.

On the lower Umirey River, Messrs. Squires Brothers, of Manila, have a number of dredging claims. Several years ago, an Australian company, Umirey Gold, Ltd., built a dredge near the mouth of the river and, partly by flotation and partly by digging a channel, worked its way up the river for some 24 kilometers to the Squires Brothers's claims which had been taken under a working lease.

There has been a great deal of discussion regarding the adaptability of this dredge to the conditions encountered and the methods used in attempting to win gold. At all events the venture was unsuccessful, and the dredge was finally dismantled and moved to the Lianga district in Mindanao.

Cagayan de Misamis, etc.—Enrique Abella(1) published a lengthy account of this district as early as 1877. A translation of his Spanish report will be found in the Mineral Resources for 1909. In 1908 Ickis (335) made a survey of portions of the same country.

The principal workings of the people of Misamis were located along the Iponan and Cagayan, near Pigtao on the former and Manigue on the latter stream. The placers are of two general types; the high-level, or bench, placers of greater age, and those of the more-recent river bottom. Ickis was of the opinion that in spite of the values in gold which the Filipinos had recovered from these streams modern dredging or large-scale slucing in these localities would hardly pay; but over the divide, on the headwaters of the Pulangi to the southeast, he found extensive gravel beds which yielded such encouraging panning tests that he recommended further exploration with drills.

The gold in this region, like much of that in northeastern Mindanao, is clearly derived from quartz veinlets in schists. Accompanying these schists in this region are some old slates, which may be of Mesozoic age.

The following paragraphs are excerpts from a translation of Abella's description of these early workings, particulary of the bench placers:

Not all the gold is won from the sands of the river bottom, and they have recourse to them, as I have already indicated, only in the dry season, during which the bench placers within the limits of the hydrogeologic basin of Iponan River cannot be worked.

Situation.—From the village of San Simon, where the valley walls are higher and more confined by rounded hills, the river receives as one goes upstream a great number of tributaries which cross many alluvial and auriferous spots and also unimportant arroyos. For example, following the river upward, there is, on the left, the small valley of Pasayanan, with indications of scattered and ancient workings; then, on the right, the richest, that of Batinay, which moreover is of greater extent; then that of Dominalog with recent workings of a less-primitive character; and continuing, those of Babantohon, Pigsagan, Dumalogdog, and the famous Pigtao, the locality where the most recent Christian settlement, now withdrawn to Tagsulip, was established; and finally, Camingañan, Cayomangon, Saganahai, Tapbagbag, and Taculut, almost within the territory of the Moros.

Continuity.—The placers are not all situated on the same level as the waters of Iponan River, but at a certain altitude above them, not exceeding as a rule 20 meters, and in elevated parts of the lateral branches, though never very far from the principal river, demonstrating that the origin of the placers bears a definite relation to the ancient bed of the stream. This bed, formerly very much wider than the present one, has suffered with time from the effects of partial denudation which has eroded the once continuous capping of the alluvions, resulting in the present discontinuity and isolation of the localities.

General character of the placers (alluvions).—The general character of the alluvions is uniform. Essentially argillaceous throughout, it is in the upper part composed of a very sticky clay, reddish, and containing very small rounded pebbles, fragments of old slates of various classes, which become more numerous and larger as one goes deeper, the clay which envelops them being usually whiter, more sandy and not so compact, and containing pebbles (cantos) of eruptive rocks, others of magnetic iron or hematite, which the natives call *tonase*. The abundance and size of these pebbles are considered a sure indication of the richness of the placer. The gold is not confined exclusively to the portion in which the pebbles are found, since in the uppermost layer of the alluvion gold dust begins to be encountered, although rather scattered; but, notwithstanding this dispersion of the gold, most of the metal, the greater richness, is always found near the bed rock. The depth of one of these placers never exceeds sev n meters in those places where it has its greatest area, nor does it become less than a meter in the smaller areas, this difference being due to the subsequent denudation to which I have alluded above. In those spots where this process has had little effect and where the alluvions are intact, the natives distinguish in them various horizons which really correspond to the changes of composition and appearance I have already pointed out, and distinction and classification of which reveal a very exact knowledge of the structure of placers, remarkable in a race so primitive and backward. This classification from above downward is as follows:

Payason.—Clay, more or less dark, which lies immediately below the vegetation.

Acaron.—Red clay, very sticky, with small pebbles, generally slaty and semidecomposed (batóng patay—dead rock, literally).

Dugcálon.—Yellow clay, more sandy, less sticky, with pebbles of quartz and eruptive rocks, some of great size, others smaller of hematite or magnetite (*tonasé*) with the maximum richness of gold.

Dapanás.—The bed rock is marl, limestone, or conglomerate.

However, these divisions are not all present in the placers, since there are spots, as I have indicated above, where the eroding action of the water has removed some of the upper layers, leaving parts of those below, and because of its richness the natives work the ground with profit in spite of the small thickness.

As for the distribution of values in the placers in the same horizon, that is to say, within the zone of richness, *dugcálon*, it is not uniform nor can it be, if one recalls the circumstances attending its formation.

Those places in which particularly rich values were encountered are called by the natives, the *Monteses* as well as the Visayas, *topadas*, a good Spanish word, and this seems to indicate that Spaniards, probably coming from Mexico, may have once worked these placers.

Method employed in the district for the recovery of the gold.—The method is in reality the same as that employed by the natives throughout the Islands for working the placers, and though quite simple it is very similar to that used even to this day in other countries, and reveals a certain knowledge of the rudimentary principles of mechanics which seems to corroborate the hypothesis of former Spanish work.

To summarize, this proceeding has four phases distinct as to order and object: (1) *Investigation* of the deposit by means of *tujubs*, not always necessary, as, for example, when by other indications or by known signs they know beforehand that the placer is rich in the part they expect to work; (2) *preparation* for the work by the construction of a canal, reservoir, and all the other work; (3) *concentration* of the alluvial ground or the exploitation proper of the deposit, by means of the work in the *banlasan;* and (4) *the cleaning up* (*depuración*) of the sands by hand washing with the *bilingan*, finally obtaining the gold free. Each one of these phases represents quite different amounts of work; the first, as I have just indicated, is sometimes dispensed with; the second, undoubtedly, is the most laborious of all; the third, it can almost be said, works of itself; and the fourth, though quite tedious, has to do with small amounts of material and constitutes only a very small fraction of the work.

In Iponan River Valley the following placers are the best known: Pasayanan, Batinan, Dominolog, Pigtao on the Iponan, and Bitog Calao on Cagayan River. Along Cutman and Bigaan Rivers there are similar placers. The average of several of these deposits would be, according to the figures of Abella, about 3 grams per cubic meter. The following paragraphs are from Eddingfield's notes (217) on the Cansuran district:

Cansuran River.—The Cansuran Mining district is located about 10 kilometers south of Surigao, Mindanao, near the center of the Peninsula of Surigao. The district extends from a little beyond

Mounts Canmajat and Binutong northeasterly to the Surigao River, comprising principally the area between Biga and Tungunaan Rivers which flow into the Surigao.

It is said that over thirty years ago an Englishman operated in the district for a short time. About the year 1885 a Spaniard, Ricardo Gonzales, obtained a concession by which he controlled all the water rights of the district. He did no mining himself, but granted water rights to the natives for 25 per cent. of the gold produced, with the privilege of buying at a very low figure all of the gold which they obtained. Since that time the natives have worked whenever sufficient water could be obtained for sluicing.

The country between Surigao and the point where the Cansuran Creek enters the Biga is a wide cultivated valley. A road is in use for 4 or 5 kilometers south of Surigao and is at present being extended; beyond this point, a trail, at places difficult for a horse, leads to the gold district. The Surigao River is too shallow in many places to permit the easy passage of large *bancas* beyond the point to which the road has been built.

The country between the Biga and the Tugunaan is very precipitous and hilly. The rivers and streams have cut deep channels through the country leaving steep slopes. The central portion northeast of Longong is comparatively flat, forming a plateau which slopes gradually toward the Surigao River. Southwest and west of Longong, however, prominent hills with steep sides make up the country.

The gold occurs as placer and is unusually coarse for the Philippine Islands; many nuggets have been found weighing over 30 grams each. The great majority of the gold as brought in by the native workmen would not pass a 30-mesh screen and a large amount would be caught on a 10-mesh screen. The grains are for the most part well rounded showing considerable movement, except on Tagbasingan and Canmajat Mountains where crystallized gold, often wire gold, is found which apparently has not been moved far. The workings on Canmajat are said to be in quartz and the gold to be panned from crushed rock taken from a vein which cuts across Canamajat, striking almost north and south. The average gold in the district runs about 790 fine in gold and 200 in silver.

The gold in the southwestern part of the property, that portion which is made up of high hills and ridges, is found in gravel beds from 3 to 10 meters thick. These beds cover the hills and ridges almost uniformly and have the appearance of being deposited by one or more old rivers. They are made up of coarse and fine gravels. Bowlders weighing several tons are common, and bowlders weighing from 10 to 100 kilograms each are very abundant. Most of these, probably 90 per cent., are andesite, others are schist, diorite, and red felsite. In the northwestern part along the Cansuran River some quartz pebbles were found, but the greatest part of the deposit contained no quartz pebbles of any size. The bed rock consists of shales more or less slaty in character and schists in which are numerous quartz stringers carrying free gold.

The Surigao Mining Company did some sluicing in this locality in 1911, and later, in 1914 and 1915, the Cansuran Placer Company began large-scale hydraulic operations with monitors, but the enterprise did not prove successful owing, it is said, to difficulties in handling the large bowlders and trees which had to be removed in order to reach the pay dirt.

Several engineers have made tests and estimates of the value of the gravels and dirt in the Cansuran region, the most conservative being that made by an engineer from the division of mines, Bureau of Science, whose average figure was 21 centavos (about 10 cents United States currency) per cubic meter (a little more than 1 cubic yard). Nothing has been done on this property since 1916.

Lianga.—Very little information is available at this writing with reference to the placer deposits on Hinatuan River near Lianga, east coast of Mindanao. Mr. Kane, perhaps the most experienced dredge master in the Philippines, a New Zealander, for many years identified with the industry in the Paracale district, Luzon, has tested it and is now (July, 1922), operating a modern dredge on the ground. Owing to difficulties of navigation on the east coast the dredge was taken overland from Agusan River in sections.*

Binabay River, Mindoro.—From time to time prospectors go to Mindoro, particularly to the Binabay River district (northern part) and sluice the gravels of that stream, but they always meet with difficulties, the chief of which are climate and health conditions. In 1916 flumes for bringing in water for sluicing were built, but no appreciable amount of gold has ever been reported.

Placer, Surigao.—Much has been written about this region, especially by Goodman and by Eddingfield, but the following summary by Pratt in 1914 gives the most important point in its history; its chief interest at present is historical, as very little of consequence is going on there.

Surigao Province has been a producer of gold for many years, but promises now to become more important in this respect through the operations of the recently organized Cansuran Placer Company. Attention has recently also been directed to Surigao's mineral resources by reason of the discovery by Mr. H. F. Cameron, engineer for the Department of Mindanao and Sulu, that a large area along the eastern coast of the province is covered with iron ore.

Gold mining in Surigao began in very remote times. The metal, detected first in the sands of the rivers and beaches, was traced almost at once to its original home in small quartz stringers and pockets in the andesite, which constitutes a large part of the land mass of the region. Although small, these quartz bodies appear to have been rich in gold at the surface, and at many places the ore has been taken out from open trenches and shallow holes over considerable distances.

One of the best known of the early prospectors in the Surigao gold region was a Frenchman referred to by the Filipinos as Don Maximillano. Apparently this man explored most of the known gold localities in Surigao early in the last century. He is said to have died at Surigao sixty-two years ago. It is stated that he worked first with the placer gold in the vicinity of the present holdings of the Cansuran Placer Company about 11 kilometers south of the town of Surigao. Later he prospected the gold-bearing quartz at Tinabingan, Placer, but ultimately he moved to the eastern margin of Lake Mainit, where he made his home and did most of his mining.

There is to-day little evidence of mining on the site of Don Maximillano's property at Mainit. Bricks are found in one locality at the edge of the foothills surrounding the lake, which the older residents believe to have been part of a furnace used by the Frenchman. Depressions which probably mark former shallow pits are found in the same neighborhood. A little gold is obtained by panning in an adjacent gully, and assays of a few pieces of ore encountered near one of the gold pits show fairly high gold values. There is no showing of ore in place, however, and it appears improbable that much mining was done here. The Frenchman is believed by the local people to have been rich, but he might easily have made enough from agriculture in this fertile region and from the sawmill, which he operated in clearing his land, to impress his simple neighbors.

A former mine which is famous in Surigao Province was located on a small island named Campiña, east of the Island of Masapelid in the jurisdiction of Placer. Gold was discovered on Campiña, the area of which is less than 1 hectare, about the year 1883, and mining was carried on assiduously for a period of two years, according to the president of the town of Placer. Mr. Maurice Goodman, a mining engineer, formerly in the Bureau of Science, visited Campiña and found rather extensive old workings, but although he took numerous samples, his assays showed only very low values in gold. It is probable that the miners followed the usual rich stringers in andesite and exhausted the small deposit. It is estimated by some of the old miners that Campiña yielded 30,000 pesos in gold.

Curuon, Mindanao.—Captain Leonard, a veteran of the Philippine military campaigns, has been working some placers by sluicing on the headwaters of Curuon River, about 75 kilometers northeast of Zamboanga, Mindanao, for some years on a small scale and with only moderate success. There is no question that gold is there, but it is not known that it exists in quantities sufficient to justify any large expenditure of capital. The gold is derived from auriferous schists in the backbone of the peninsula.

The following are the principal difficulties encountered in this branch of mining in the Philippines: "Spotty" nature of the ground, excessively large bowlders and vegetation to be handled, not enough water at one time and too much at another, typhoons, and high cost of installing the proper machinery and of skilled superintendence.

(*Continued on page 725.*)

*The results of the first clean up of this dredge have just reached Manila from this out of the way corner of the Philippine Islands and they are rather gratifying, though they indicate nothing remarkable in the value of the ground.

The Need for Testing Materials of Construction used in the Far East

By C. A. MIDDLETON SMITH, M.Sc., M.I.Mech. E., (Taikoo Professor of Engineering in the University of Hongkong)*

DURING the rains of the summer of 1925 in Hongkong, there were two disasters, involving loss of life, caused by the collapse of retaining walls. The first one occurred in the neighbourhood of the Happy Valley, which is an Eastern part of the city of Victoria. There was one death. Many tons of earth and rocks slid down from the hillside on to the recreation ground some two or three hundred feet below. The second disaster was worse. The loss of life was much greater. A retaining wall in about the centre of the city, built some 28 years previously, suddenly gave way. It caused the collapse of several houses just below it, and as many as 75 people lost their lives as a result of the accident. There were also many injured. The loss of property was not neglible.

In each case, there was the usual enquiry by means of a Coroner's inquest. Both juries had the advantage of evidence of experts.

It may be as well to explain for the benefit of those who have never visited Hongkong that practically every building on the Colony is on a prepared site. The nature of the ground when the island commenced its commercial career in 1841, especially in and around the city of Victoria, was such that speaking generally, there were no sites levelled by Nature. Of granite formation, the island rises up at a steep slope from sea level to a central ridge, the highest point of which is more than 1,700-ft. above the sea. During the development of Hongkong, there have been many reclamation schemes. At present, the whole of Morrison Hill is being thrown into the sea, and the result will be many acres of level ground, some reclaimed from the sea. Where Morrison hill, a conspicious land-mark in the Colony, stood formerly, there will be several acres of flat ground suitable for recreation purposes.

Buildings on the reclaimed land must have special foundations. As, in accordance with modern practice, and because of the high value of land in the city, many of the new buildings are eight or ten stories in height, great care must be taken to secure firm foundations. Modern systems of pile-driving are employed.

The Retaining Walls

It usually happens that any building erected on the hillside in Hongkong has a retaining wall, either in the front or behind it. Often, there is one in front and one behind. The ground is mostly decomposed granite with solid granite boulders of varying size embedded in the soil. When building, these boulders are split up, and the granite is used for making the retaining walls. Also when broken up into small pieces and mixed with sand and cement it is used for concrete.

There will never be any lack of granite suitable for these purposes on the island, however extensive the building operations may become.

Since the introduction of the reinforced concrete method of construction for buildings, a great deal of steel, as well as cement, has been used in building work in the Colony.

There is very little evidence of reinforced concrete retaining walls in Hongkong, probably because the much thicker walls built of granite blocks are cheaper to build.

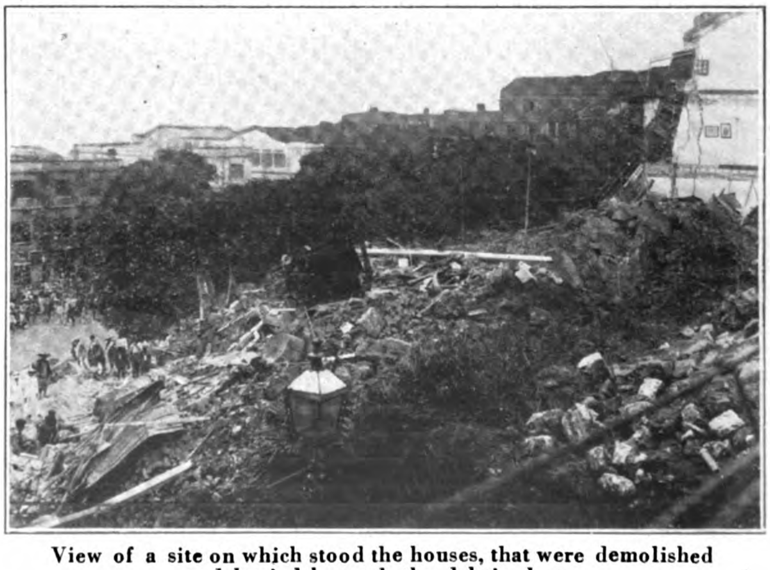
The retaining walls of the early days were made almost entirely of granite blocks. These were faced to be more or less rectangular and were of such a size that a man could lift one of them. They were placed one on top of the other and remained in position because of their weight and the thickness of the wall. It may be mentioned that, as the blocks did not fit absolutely close one alongside the other, there was usually a very good chance that any water which accumulated behind the wall, found an easy outlet through the small spaces between the blocks. In other words, the drainage of water was more or less provided for by the somewhat crude construction of the walls.

One drawback to that type of wall was that rats and other vermin found shelter between the stones. In the neighbourhood of dwelling houses, this was, after a time, considered a serious matter from a health point of view.

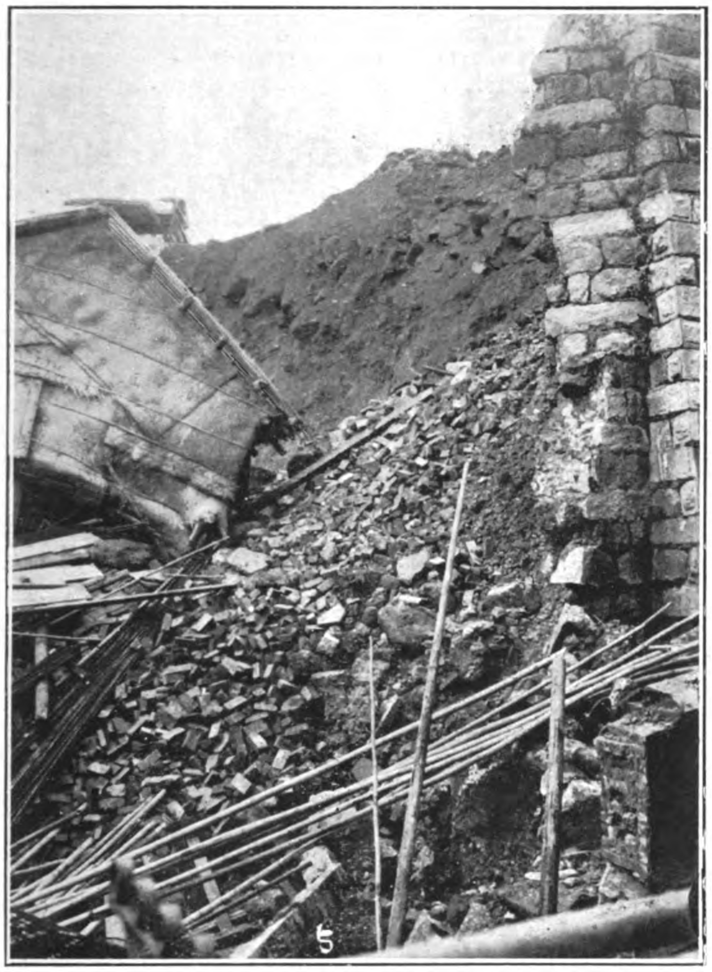
The discovery that rats were plague carriers and the knowledge that even small patches of stagnant water enable the malaria—carrying mosquito to breed made the Sanitary Department of the Colony view this type of wall with disfavour. There are, however, still to be seen examples of these old style retaining walls in the Colony, although, as far as the writer is aware, such walls are now never built.

*Author of "A Handbook on Testing Materials." London (Constable & Co., Ltd.)

Ambulance corps rescuing survivors and recovering the dead



View of a site on which stood the houses, that were demolished and buried beneath the debris shown



View of the side wall and fallen matshed

The Building Authority

In Hongkong, the local Government assumes a more or less general responsibility for the life and property of the inhabitants. The biggest spending Department of the Government is the Public Works Department, usually referred to as the P.W.D. The Head of the Department is called the Director of Public Works. He is a member of the Legislative Council and is a civil engineer by profession. He has a large staff of European and Asiatics responsible to him. The P.W.D. in Hongkong always seems to have had severe critics. Its work is much more before the general public than let us say, the work of the Crown Solicitor or the Government Auditors. People always complain when roads are being repaired or the water supply fails. It not unfrequently happens that nontechnical men, with no knowledge of the difficulties of engineering work, and no appreciation of the skill needed to surmount them, are the loudest critics.

The Public Works Department is split up into sub-divisions dealing with watersupply, roads, harbour improvements, reclamations, buildings, surveys, electrical matters, etc. Two separate divisions deal with buildings. One, called the Architectural Department, is concerned with the erection and maintenance of buildings used by the local government, of which there are, of course, a large number. The Military and Naval Authorities have their own officers for this class of work and their buildings do not come under the notice of this Architectural Department which is concerned only with quarters, public buildings etc., belonging to the local Government.

The other division of P.W.D. which has to do with buildings is called "the Building Authority." There is local ordinance which gives the Building Authority definite powers. It will be shown later that the general opinion in Hongkong is that this Building Ordinance requires bringing up-to-date.

The head of the division called the Building Authority is an Executive Engineer responsible to the Director of Public Works, who, in the end, is responsible to the local Government. The Executive Engineer, however, has very grave responsibilities to shoulder. Although he frequently reports to and consults with the Director of Public Works, it is obvious that the latter cannot possibly attend to the details of all the many divisions of his Department and also carry out his duties as a Legislator and general supervisor of his staff and initiator of new Engineering schemes for the improvement of the Colony.

Another Department of the Government, entirely separate from the Public Works Department, is also concerned with buildings in the Colony. That is called the Sanitary Department. All plans of new buildings are submitted by the Building Authority to the Sanitary Board for comments. Primarily, the Sanitary Board concerns itself with public health problems.

In the case of a citizen of the Colony wishing to build a new house, or planning to make any structural alteration of any description in any existing building, he must employ an authorised architect or civil engineer. The local Government publishes a list of these gentlemen. No one may practice as an architect or civil engineer in Hongkong unless his name is on the list. An advisory committee recommends names to the local Government.

The authorised architect makes plans and submits them for approval to the Building Authority. No work can be commenced until the later has passed the plans.

The inevitable tendency of the Building Authority is to play for safety. This tendency is reflected in the offices of the architects who save themselves the probability of having to amend plans if they make everything very safe. The Building Authority insists on definite regulations about the thickness of walls etc. If, on the one hand, the architects complain that these regulations make the cost of building very high, the obvious reply of the Building Authority is that Chinese contractors are not reliable and local conditions, such as the abnormal wind pressures of typhoons and the heavy rainfalls, make comparison with details of buildings in England useless.

The fact remains that the cost of building in Hongkong is very high indeed. Some of this is due to the cost of the preparation of the site, which seems to average about 20 per cent. of the total cost of the building. Some of it is due to the cost of materials. And although Chinese labour is said to be cheap, the methods employed, and possibly the effect of the climate, leads one to wonder whether, in the end, the cost of the labour is really very much less than that of labour for similar work in England. It is difficult

A matshed which fell about 50-ft. It was on the top level before the collapse of the wall

Scene Soon after the Disaster, looking up from the Blake Gardens

to compare local costs of building with those in England, because the practice in Hongkong is to build higher rooms and to provide fairly wide verandahs. Yet it costs about £5,000 to build any house at all on the Peak. The writer recalls one ordinary two storied house of about seven rooms that cost £12,000.

One noticeable feature of the present system is an almost complete absence of any regulations concerning the strength of the materials used in building construction. The Building Authority has a very limited number of inspectors whose duty it is to visit buildings during construction to see that the plans are adhered to strictly and to report on any materials used. From time to time, the Building Authority has prosecuted contractors for using mortar of a poor quality, but of late, this practice seems to have fallen off. Either the contractors do not transgress—which seems unlikely—or, what is more probable, the Building Authority has been insufficiently staffed.

Materials Sent to China

During the last thirteen years, the writer has been lecturing to engineering students in the University of Hongkong. The equipment includes a fairly complete outfit for testing the materials of construction. There are definite routine experiments for testing cement, bricks, steel, timber, etc., and as far as possible, the materials used are varied.

The basis of comparison for these tests it that of the British Standards specification. That is because these standards are usually accepted as reliable and safe by all Anglo-Saxon engineers. Also any materials used in the local shipyards or other places where certificates are demanded are made to comply with these specifications.

It may be stated at once that very little of the local steel purchased casually does comply with the requirements of the British Standards Specification. It is the opinion of the writer that nearly all of the steel that has been used for reinforced concrete construction in this part of the world has failed to meet the requirement insisted upon in England. A great deal of this steel comes from the Continent of Europe, and some from Britain and America. A well-known local engineer, who had great experience of testing steel in Britain and America, discussed this matter with the writer. On seeing the results of many tests on steel made in the University this engineer said " of course they are just dumping steel that would not be used in ordinary practice at home. It is a case of " send it out to China, they won't worry." It ought not to be allowed." As these sentiments exactly coincided with those of some of us who had thought the matter over carefully for some time, they are worth recording.

There are three tests to which samples of steel from every consignment used in reinforced concrete buildings should be subjected. They are (a) tensile tests (*b*) cold bending (*c*) bending after tempering.

The tensile tests should give the yield-point, the ultimate strength and the elongation. The yield-point is a most important figure as if once that is exceeded in actual practice the material is untrustworthy. There is, of course, in actual practice, always a factor of safety in the design of reinforced concrete buildings, but it must be always considered bad practice to use bad materials. It must be emphasised that the factor of safety is to allow for unexpected stresses, etc. It is not employed to cover up defects of material.

We may therefore say that any reinforced concrete structure in which the steel used is below the requirements of the British Standards Specification must be defective. On that basis, there must be a number of defective buildings in Hongkong.

It is not the intention to make a panic. No doubt the factor of safety will cover the defective material and the buildings, being liberally designed, will be stable for many years. What is insisted upon is that it is essential, for the protection of the public, that all steel used in reinforced concrete should be used only when there is a satisfactory certificate as to its physical properties.

The Question of Cement

Exactly the same statement applies to cement. There have been used in Hongkong cement of various brands. Some of the cement is made locally, some is imported from Formosa, Haiphong, Phillipine Islands, etc. The quality of this cement varies. It would be improper to give the names of the brands of cements which the writer considers most reliable. It is no guarantee that because in August 1925 a sample of the " Owana " brand gave a good result, the consignment delivered in October 1925 or 1926 is equally good. It is necessary to make tests on a sample from each consignment. That is done in Hongkong by a very limited number of architects or contractors.

It may be mentioned that, as Hongkong is in the tropics,

View showing part of Terrace of Houses, Three Houses similar to these shown were entirely Buried by Debris of Wall

and as the humidity of the atmosphere is very great, it is at least open to discussion as to whether the tests for cement as recommended by the British Standards Committee are really applicable. In that connection, the writer suggests that possibly the increase of strength required for the tensile tests made 28 days after mixing the briquettes, as compared with the results on tests made seven days after mixing, are perhaps not suitable. Any chemical action is affected by temperature. The general effect of making tests in an atmosphere of 88°F. instead of 64°F. would probably be for the chemical action to take place much more rapidly in the 88°F. temperature.

To express the idea in another way, we can almost assume that if the same cement is mixed in two different temperatures of 88°F. and 64°F., then the chemical action on the former that takes place in an interval of five days might be just about the same that takes place in the latter after seven days.

This is, of course, a problem that requires very full investigation before any definite opinion can be given. The subject is mentioned because it does seem unfair to reject a cement that fails, in the tropics, to conform exactly to the British Standards Specification for the increase of strength demanded for the tensile tests after 28 days. The opinion of the writer is that if a cement gives a fairly high, figure for the 7 days tests and a definite increase for the 28 days test, then it is reliable. The cement that should be rejected is that which shows no increase at all.

It is important to insist that mortar tests be made. Tensile tests on neat cement are not so informative as tests on mortar. The difficulty about the mortar tests is the sand. Standard sand is not available in China, but if great care is taken in the selection and washing of the sand, the mortar tests should be reliable.

The Use of Lime Mortar

A quotation from the report of the technical experts who investigated the collapse of the retaining wall which caused the loss of 75 lives in Hongkong may be permitted. " In rebuilding important retaining walls Portland Cement would no doubt be used in place of the lime and red earth used in old designs."

It has been the practice in Hongkong to use mortar made up of local red earth (which is really decomposed granite), and lime. That practice has been carried out, not only in the building of retaining walls, but in other building operations. It is one that should cease. It is hoped that one result of this disaster will be the revision of regulations regarding the composition of mortar.

No doubt if Portland cement were used always the building regulations could be revised. The real difficulty is that of supervision. As soon as the Inspector's back is turned, the cement will be omitted by the contractor, in nine cases out of ten. Heavy fines or other penalties may be imposed, but the average contractor will run risks. It is impossible to have a reliable inspector standing over every building job in the Colony. The number of such inspectors employed by the P.W.D. should be very much increased, however, and possibly the police or sanitary inspectors might have power to report where cement is being wilfully omitted in the mixing of mortar.

The Problem of Drainage

The collapse of the Po Hing Fong wall took place on July 17th at about 9.30 a.m. In June there was a total rainfall of 23.3 inches and in July, up to the date of the disaster, there was a total of 18.8 inches. On the morning of the 17th there was 9.5-in. of rainfall between 1.30 a.m. and 9.30 a.m. The collapse happened just at the end of that very heavy rainfall.

So far as one can gather from the newspaper reports the experts and the coroner were agreed that the rainfall had nothing to do with the collapse. It is not the intention of the writer to dispute with the experts, but the ordinary person will think it a coincidence that the wall failed just after this very heavy rainfall.

This was an old wall and the experts were satisfied that there was ample drainage facilities for any water that might soak into the filling behind it.

The modern practice is to have weepholes in the walls. To be effective these must be kept clear. It is most important that the surface above the walls should be covered with cement rendering and wide channels provided for the escape of water. It may be that in the case of Po Hing Fong there was ample drainage, but it is essential that precautions should be taken so that the minimum possible quantity of water should sink into the ground behind the wall.

The rough and ready method of design that is accepted by the local P.W.D. seems to be that the width of the wall at the base must be one-third the height.

In this particular case, there were three retaining walls forming the northern support of the site above the walls. Two of the walls were built in 1860 and one in 1897.

The Engineer in charge of the building operations on the site above the walls evidently had his doubts about the safety of the walls. Being a Government servant he reported the matter to the Director of Public Works who promptly visited the site. In returning their verdict, the jury expressed the opinion that " an error of judgment was made in deciding not to rebuild or strengthen the No. 1 retaining wall."

The writer has no wish to in any way defend the P.W.D. officials, but, as an engineer, he sympathises with them in the many difficulties which they encounter from a general public indefatigable in its criticism. One of the great causes of complaint is the expense of Public Works. It is always easy for any official to play for absolute safety by spending money. The faithful public servant is the man who, without undue risk for human life, tries to be economical. In this particular case, two of the walls had stood up for 65 years and the third had remained intact for nearly 30 years. It would have been a very costly business to rebuild the walls. It was, perhaps, totally abnormal conditions that caused the collapse It is always easy to be wise after the event, but even if there was an error of judgment there was no negligence on the part of the Director of Public Works.

Reference has been made to the collapse of a wall near the Happy Valley in June. One death resulted and there might easily have been many more. The facts of this case seem to be much more clear than those of the July disaster. In June, the rainfall was also heavy and the root cause of the failure of the wall was the accumulation of water behind it.

An expert witness, Mr. Boothby, Chief Engineer of the Canton-Kowloon Railway, said that the cement mortar used was of " a very inferior quality ; the aggregate appears to be soil found in the vicinity " The proportions were one in six. There were no records of any tests concerning the strength of the mortar, nor does that appear to be the common practice in the Colony.

In this case, the architect in charge of the work was very severely censured.

The Lessons of Tragedy

The old adage that " it is no use crying over spilt milk " still holds good, but it is very useful to have these public enquiries into the causes of any disaster that causes loss of life. There can be no doubt that the probability of any repetition is lessened. If it can be proved that human life is endangered because materials have not been tested, or supervision has been insufficient, we may be sure that the Government will insist upon reforms.

All engineering work is nowadays a matter of theories contantly tested by experiments. We make advances largely because of accumulated experience. There is very little sympathy for the Engineer who is negligent or careless. The consequences of such carelessness are usually much more appalling in Engineering than in other kinds of work. Thus, carelessness by an acccountant may result in money losses. Carelessness by a doctor is not easily discovered and usually involves one life only. Carelessness on the part of an engineer may result in the loss of hundreds of lives and the carelessness cannot be covered up.

It is impossible to guarantee that any one of us is incapable of making an error of judgment. We can, however, make certain that the materials used in engineering work are reliable. That can only be done by insisting that certain definite tests are made on the materials used by engineers. We can play for safety in that way at least.

Additional Note re Retaining Wall at Po Hing Fong

Since the above was written, the question of the inspection of retaining walls has been brought before the Legislative Council of the Colony of Hongkong, and the Colonial Secretary, on behalf

(*Continued on page 726.*)

Tientsin Fire Brigade Testing its Pumps

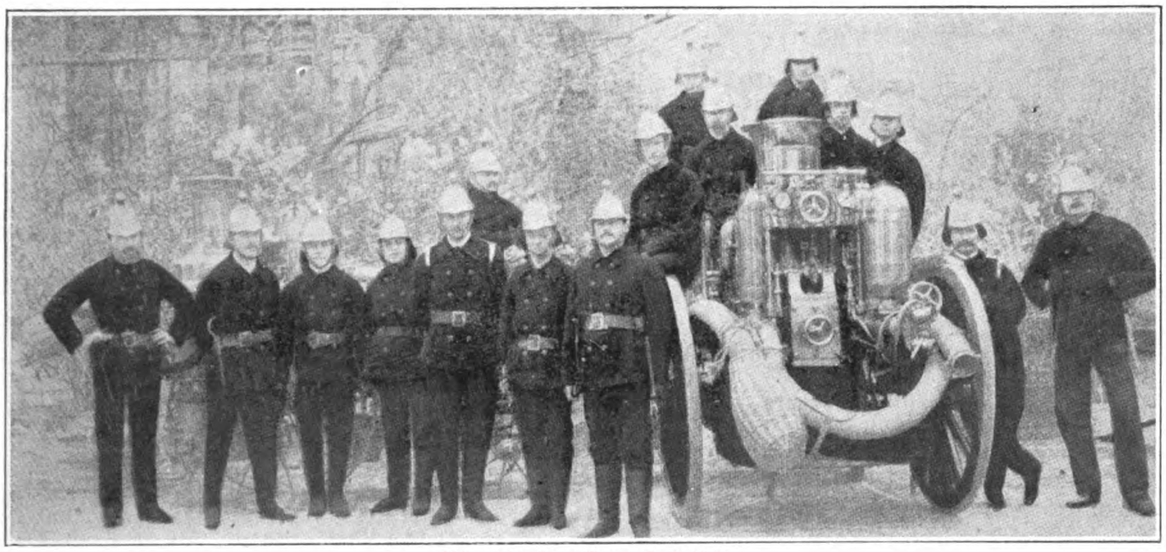
Fire Fighting Machinery in China

THE various fire brigades in China, particularly in the Treaty Ports, are developing modern organizations and are using modern equipment. Shanghai's fire brigade is a particularly effective organization which has to face the most difficult problems of fire fighting because of the character of the city. The crowded areas of brick and wooden houses, the industrial factory and the crowded theater require constant attention in a city where law is not easily enforced because of the peculiarities arising out of the system of government under which foreigners and Chinese live in that city.

One of the latest fire fighting devices to be employed in Shanghai is the fire floats, a description of which follows :

The contract was placed with Messrs. Dixon Bros. & Hutchinson Ltd., who were responsible for the machinery and the design of the craft, the hull being built for them by Messrs. Day, Summers & Co., Ld., Southampton. Owing to the awkward size and type of the vessel—too large for shipment complete and two small and unsuitable to make the voyage out on her own keel, it was necessary to send her out in plates and angles, with the machinery crated. The hull was built up (all the members being only bolted together

Merryweather's Motor Fire Engine "Hatfield," "D" Chassis-30 B.H.P., Swatow



Tientsin Fire Brigade, 1906

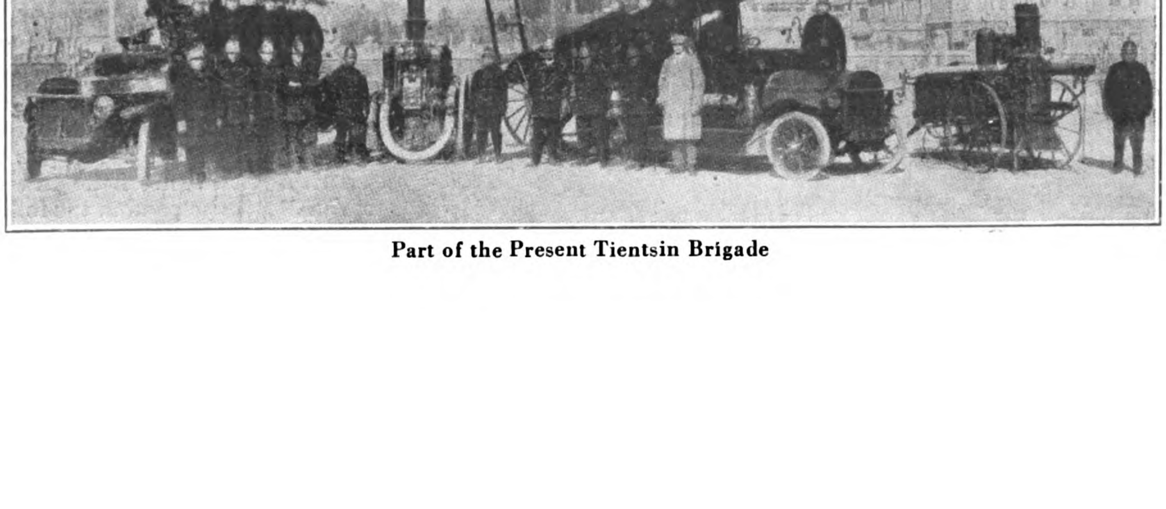
with temporary bolts) and taken down again after suitably painting and marking all the various plates and angles to agree with the working plans and wood model also supplied, to enable the native labour to re-erect it at Shanghai. The machinery was erected and coupled up to the pumps, etc., and tested in Messrs. Dixon Bros. & Hutchinson's shops and never entered the hull at all. This will have to be installed at Shanghai from the drawings and information supplied.

The boat has a straight stem and raised forward deck, with a good flare at the bows. The stern is a type of " slipper " or could be described as a modified " cruiser," having a very sharp turn in profile and very flat on the run. The machinery space occupies some 25-ft. A steel casing is arranged over the engine-room, the forward end being rounded and on top of which are mounted the distribution boxes. Forward of the engine casing is the steering cockpit, protected by the raised forward deck. Here is located the hand-steering gear of the Archer's selfholding pedestal type, whilst to port and starboard are paraffin tanks, with a combined capacity of some 200 gallons. Entrance is given to the forecastle beneath the raised deck, by a double door and sliding companion hatch on the starboard side. Two low teak skylights are fitted over the engine-room, on top of the engine casing, and opening circular lights in the casing sides. A stout towing hook is arranged amidships and tow rails and guards provided over the after-engine room skylight. Good bollards are fitted forward and samson posts aft in addition to two bollards. No mast is provided, so that the navigation head-light is carried on an iron stanchion. The rudder is of the balanced type, being a single steel plate carried in wrought-iron arms and coupled to a 2-in. diameter stock, on which is mounted a tiller arranged to take the wires from the steering gear.

A few excerpts from the specification as regards the hull may be of interest. Of Siemens Martin mild steel, the frames are of $1\frac{3}{4}$-ins. by $1\frac{3}{4}$-ins. by $\frac{3}{16}$-in. angle, spaced 20-in. apart and in one length from keel to gunwale, heel pieces being fitted amidships. The floors are of $\frac{1}{8}$-in. plate, fitted on every frame and extra deep in way of the machinery. Reverse bars are fitted across the tops, these being heavier in the engine-room than elsewhere. A centre keelson is fitted, formed of continuous double angles on top of the floors and an intercostal plate between the floors, lugged to the keel and floors. Similar-type side keelsons are fitted, one each side of the centre line. The side stringers are of single continuous angle, $1\frac{1}{2}$-in.

Two watertight steel bulkheads enclose the engine-room, and are of $\frac{1}{8}$-in. plate, stiffened by angles. The other bulkheads are of wood, whilst the coamings around the cockpit and after-hatch are of steel. The shell plating is $\frac{1}{8}$-in. thick, the seams and butts being lapped. The engine seating consists of a steel plate fitted on top of the floors, to take the holding-down bolts of the engines and pumps, which are mounted on a stout channel girder in one length, to avoid, so far as possible, errors in lining up. Teak pads are to be fitted between the girders and the plates on the floors. Twin engines drive the propellers through reverse gears and also each engine drives a fire pump through a Hele-Shaw clutch and chain. The two fire pumps are mounted on the centre line of the vessel, forward of the main engines. The engines are of Messrs. Dixon Bros. Hutchinson's standard type, operating on paraffin and petrol and starting on petrol. They are supplied right and left handed for twin-screw installation. Each engine has six cylinders with a bore of 6-in. and stroke of $6\frac{1}{2}$-in.; 105 b.h.p. is developed at 900 r.p.m. on petrol and 90 b.h.p. on paraffin at the same number of revolutions. The engines installed are being arranged to run to 1,000 r.p.m., at which 120 h.p. is obtained. Dual controls are provided to the engines, enabling them to be controlled either from the engine-room or from the steering cockpit. Forward of each main engine is the Hele-Shaw clutch and a length of shaft forward to the self-contained silent chain drive, mounted in welded steel casings with ball bearings. A plummer block is fitted immediately forward of the Hele-Shaw clutch. The after pump is driven by the port engine and the forward pump by the starboard engine. Both pumps are of the Rees Roturbo type. They are of the multi-stage design, each capable of handling 700 gallons per minute against a total head equal to 120-lb. per sq. in. or 1,000 gallons per minute against 80-lb. per sq. in. Provision is made for a fitting on deck, connected to the suction side of each pump, for salvage work. Special small self-contained pumps with clutches are fitted on the main engines to prime the main pumps. Each pump suction is provided with a 6-in. bore sluice valve, and a strainer box interposed between the seacock and each pump. The usual fuel filters are provided, together with an oil cooler each side of the engine-room. Petrol is carried in two tanks—one securely fitted at each side of the after-cockpit—with a capacity of 75 gallons each, so that sufficient pertrol can be carried to operate the engines on this fuel for long periods when desired. An electric lighting set is located to port, supplied by Messrs. Dixon Bros. & Hutchinson. It has an output of $1\frac{1}{2}$ kilowatts, the dynamo being driven by a single-cylinder motor with a bore of $3\frac{1}{2}$-in. and stroke of $3\frac{1}{2}$-in. This set exhausts through a silencer and out at the vessel's side. It is anticipated that the speed will be 12 knots with both main engines in operation. The length is 57-ft. overall, whilst the extreme breadth is 12-ft. and the draught about 2-ft. 7-in.

In Tientsin, the fire brigades are still partly voluntary. The British Municipal Fire Brigade is under Police control, modified to some extent by an arrangement whereby local British Volunteers serve in the capacity of minor officers. The senior Police Inspector is Foreman. The strength of the Brigade is 29,



Part of the Present Tientsin Brigade

composed of six foreign officers and 23 Chinese firemen. Gear consists of one motor engine, one motor tender, one steam engine and about two miles of hose. The engines are of the latest pattern appliances, the motor capable of directing four streams at a nozzle pressure of about 250 pounds. Alarm can be given either by telephone or by pushing electric alarm buttons placed in many parts of the Concession.

The Fire Brigade, of the French Municipal Police is under Police control, with supervision by local French Volunteers. The strength is 34 Chinese firemen and engineers and two French officers. Equipment consists of four motor reel trucks, two Delahaye motor engines, one large escape, one electric and one steam pump and 6,000 yards of hose. Alarm is given by telephone and electric push buttons.

The Fire Brigade of the Italian Municipal Police is also under police control, without any special personnel. Equipment is one motor pump, capable of pumping 700 litres of water in one minute and a Fiat water cart, which can be immediately adapted to fire fighting, and 1,000 metres of hose. Alarm is raised by police whistles, sufficiently effective owing to the small size of the Concession.

With regard to the motor fire engines in use by the British Municipal Council in Tientsin, the fire engine and motor pumps were made by Messrs. Dennis Motors Ltd. and the ladders by Morris Ajax.

The Swatow Police Fire Brigade recently improved its equipment by purchasing a Merryweather Motor Fire Engine, which is of the " Merryweather " latest type and is fitted with all the latest improvements, including a telescopic scaling ladder to extend to a height of 35 feet. The pump will deliver 250 gallons of water a minute up to a pressure of 115 lbs. per square inch.

An interesting incident occurred within 36 hours of its arrival in Swatow and whilst it was being assembled a fire broke in the northern part of the city and spread rapidly, involving ten or twelve houses. The authorities being unable to cope with the fire with their existing apparatus, the " Merryweather " Engine was rushed to the site, put to work through 800 feet of hose, and was able to extinguish the fire in a very short time, thus saving some thirty or forty houses from destruction. This incident is of special note as the engine had not been tested since leaving the makers' works.

The Ujikawa Electric Company

A Great Hydro Electric Enterprise in Japan

THE Ujikawa Electric Company which was established on October 25, 1900 is capitalized at Yen 85,000,000 and produced an aggregate of 249,546 h.p. which supplies 314,925 lamps. The business of the company is in 8 prefectures, 5 large cities and 183 villages.

The Ujikawa Electric Company was formerly promoted to utilize the water of Lake Biwa, the largest lake in Japan, for generating power to be supplied to the cities of Kyoto and Osaka and their suburbs. Lake Biwa, which is widely known for its natural beauty, is situated in the centre of the Omi province and is 13½ miles wide and 40 miles long, covering an area of about 2,421 sq. miles. The waters of every river in Omi Province flow into this lake, which thus has a total volume of water of as much as 1,000,000,000,000 cubic ft. at ordinary times, its volume of water of the whole surface, being aggregating some 780,000,000 cubic ft. to one inch depth. Under such condition, even after a drought, little change is made in the volume of water. Moreover, upon completion of a dam by the Home Office in 1904 at Nango on the river Seta, the lake was practically treated as a reservoir, an ideal condition for a hydraulic power plant.

The company supplies hydraulic power which is generated by the power houses located at the River Uji as well as in the Yamato district. With the ideal " reservoir " of Lake Biwa, every power house of this company situated at the river Uji is capable of operating the year around, quite free from fear of shortage of the volume of water. As to the power houses located in the province of Yamato, in which is situated a dense forest district, providing that part of Japan with more rainfall than any other part. In addition, because of the topographical condition of Yamato, a " high head," one of the essentials for hydraulic power plant can be obtained there.

The business territory of this company covers Kyoto, Osaka, Kobe and their suburbs which comprise the industrial centers of Japan, having a large number of bulk consumers. As the distance between the power houses and these cities is very short, the cost for laying transmission lines is eventually small.

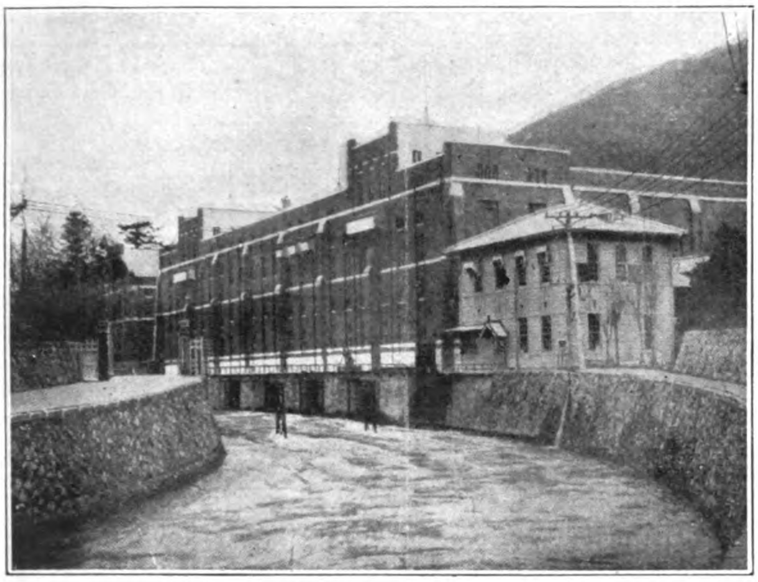
After its inception, the company erected a power house at Uji Machi in the Kyoto Prefecture, capable of generating 29,000 k.w. and utilizing one part of water (2,000 cubic ft., per second) of Lake Biwa and to supply power to the two cities, Osaka and Kyoto. The construction work of this power house, which was sanctioned in December, 1907, commenced early in the following year and was completed by July, 1913, commencing operations on August 1 of the same year.

Excepting for electric light and tramways, power consumed for general industrial purposes was little in those days. Therefore, the company encouraged the use of electric power among the industrial circles, with the result that the demand for power so remarkably increased that with the power generated at a single power house, a shortage of supply was at once felt. To meet the increased demand the company, therefore, arranged to enlarge the generating capacity at the Uji Power House and had generators of a large type installed there to replace the old ones, thus increasing its generating capacity to 32,000 k.w. by August, 1922.

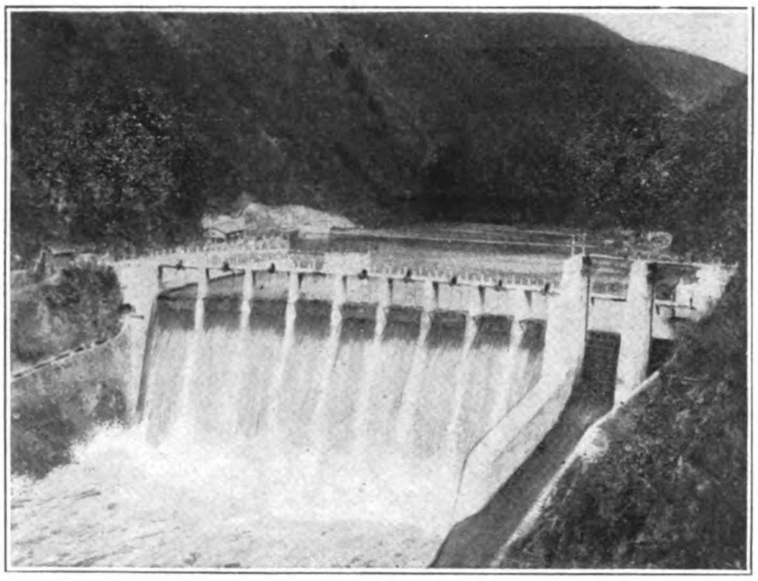
During the European War, industry in Japan increased and the demand for power likewise increased, with the result that a steam power station, the Fukuzaki Power House was built at the side of the River Shirinashi, near Osaka. The construction of this power house commenced in February 1918 and was completed in April, 1920. Its generating capacity was originally 30,000 k.w., which was later increased to 40,000 k.w. and the equipment for which was completed in April, 1923. In addition to this, the construction of Shidzukawa Power House located about 12 *cho* up stream of Uji Power House, with a capacity of 28,000 k.w. was commenced during September, 1920 and completed in March, 1924.

The Omine Power House which will be capable of generating 16,000 k.w. and is now under construction, is so located to be able to utilize a dam built at the intake of Shidzukawa Power House.

This company was originally established with a capital of Yen 12,500,000 but with the expansion of its business, the capital was doubled to Yen 25,000,000 in May, 1916. In September, 1921, after amalgamating with the Omi Hydro-electric Power Company, which had been supplying power and light to the whole north-eastern section along Lake Biwa, the capital was again increased to Yen 31,400,000, and in the following month, the Yamato Electric Company that had been supplying power and light to the extensive



Uji Power House



One of the principal dams

district in the Prefecture of Nara was merged with this company, with the result that the capital had to be increased to Yen 37,650,000. In May, 1922, this company amalgamated with Kumano Electric Company and consequently, the capital was again increased to Yen 38,700,000. Again by merging the Taisho Hydro-electric Company which aimed at supplying power to the whole city of Kobe, the capital came up to Yen 41,366,650 in October in the same year. Finally, in November, 1922, the capital was increased to the neighborhood of Yen 85,000,000.

The business territory of this company now covers 8 prefectures, 5 cities and 183 towns and villages including the three largest cities, Kyoto, Osaka and Kobe to all of which power is supplied by this company. Besides supplying power from its own generating plants, this company is now meeting with increasing demand of power from other electric power companies.

Equipment for the Generating Plants

The following table shows the total generating power with its equipment for generating power plants which include plants, now in operation, and under construction as well as not yet set to work :

	Now in Operation K.W.	Under Construction K.W.	Not Yet Set to Work K.W.	Total K.W.
By Hydro ...	71,697	31,570	23,957	127,224
By Steam ...	40,000	—	40,000	80,000
Total ...	111,697	31,570	63,957	207,224

Hydraulic Power Plant

Name of Power House	*Name of River*	*Generating Power* K.W.	*Remarks*
Uji	Ujikawa	32,000	Now in operation
Shidzukawa	,,	28,000	,,
Ohira	Ujikawa	5,400	Not Yet set to work
Omine	,,	16,000	Under Construction
Tawaragawa	Tawaragawa (Kyoto)	460	Not yet set to work
Kiwada	Aichigawa (Shiga)	2,204	(1,469—in operation 735—not yet set to work
Kayao	,,	640	In operation
Aidani	,,	747	,,
Anegawa	Anegawa (Shiga)	615	,,
Ibuki	,,	3,171	Not yet set to work
Koidzumi	,,	450	,,
Takatokigawa	Takatokigawa (Shiga)	1,039	Under construction
Tadehata	Kanzakigawa (Shiga)	2,052	Not set to work
Sako	Takaharagawa (Nara)	500	In operation
Kashio	Yoshinogawa (Nara)	2,365	,,
Yoshino	,,	1,661	,,
Tenkawa	Horagawa (Nara)	640	,,
Shirakawa	Shirakawa Mata Gawa (Nara)	2,414	,,

Name of Power House	*Name of River*	*Generating Power* K.W.	*Remarks*
Suriko	Kitayamagawa (Nara)	5,610	Under construction
Nagatono	Amanokawa (Nara)	8,921	,,
Zenki	Zenkigawa (Nara)	2,176	Not set to work
Totsugawa	Totsugawa (Nara)	8,315	,,
Takataki	Onogawa(Nara)	442	,,
Ikenogo	Ikenogogawa (Nara)	756	,,
Takimoto	Takimotogawa (Wakayama)	240	In operation
Takata	Takatagawa (Wakayama)	136	,,
Nachi	Nachigawa (Wakayama,	120	,,
Osato	Ainoyagawa (Mie)	100	,,
Funata	Yutanigawa (Mie)	50	,,
	Total	127,224 K.W.	

In addition to these, the Company filed an application for the water rights for 39,869 k.w. plants.

Steam Generating Power Plant

Name of Power House	*Location*	*Generating Power* K.W.	*Remarks*
Fukuzaki	Kitafukuzaki-Machi, Osaka	40,000	In operation
Kitsugawa	Funamachi, Osaka	40,000	Not yet set to work
	Total	80,000	

Hydraulic Power Plants now in operation

The following are the principal power houses at the River Ujikawa.

UJIKAWA POWER HOUSE.—Location : Ujigo, Ujimachi, Kyoto-fu. Location of intake : Nango, Ishiyama-Mura Shiga-Ken. Length of Canal : 6,131 *ken* ; Column of Water Used : 2,200 *ken* : Head : 205 *shaku* ; Generating Power : 32,000 kilowatt ; Turbine : six sets, 8,100 h.p. each ; Generator : six sets, 7,000 kilowatt ampere ; Transformer : 21 sets, 1,800 kilowatt ampere ; When Construction started : December, 1908 ; When Completed : July, 1913.

SHIDZUKAWA POWER HOUSE.—Location : Makioyama, Kyoto-fu (some 12 *cho* up-stream of Uji Power House) : Location of Intake : At the right side of the river Ujikawa (about 50 *cho* up-stream of the Nji Bridge.) ; Length of Power Canal : 1,0009 *ken* ; Dam, length 216 *shaku*, height 101 *shaku*, breadth of the top 28 *shaku* ; Length of water-filling section : 1 *ri* 26 *cho* ; Area of the above section : about 38 square *cho* ; Maximum depth : 86 *shaku* ; Volume of filling water : 129,000,000 cubic ft. ; Water tank : area, 530 *tsubo* depth, 24 *shaku* ; Water Pressure Pipe : six, each with 11 *shaku*, inner diameter and 102 *ken* length ; Head : 150 *shaku* ; Volume of Water Used : 2,800 ; Generating Power : 28,000 k.w. ; Turbine: six, each 17,000 h.p.; Generator: six, each 14,000 kilowatt-ampere ; Transformer : 12, each 3,000 ; When started : September, 1920 ; When completed : March, 1924.

In the Omi District.

KIWADA POWER HOUSE.—Location : Kiwada, Higashi-Ogura-mura-Aichigun, Shiga-Ken : Location of Intake : At the above place : Length of Power Canal : about 2,000 *ken* ; Volume of Water Used : 105 ; Head : 321 *shaku* ; Generating Power : 2,204 kilowatt, 1,469 k.w. completed and 735 k.w. not set to work ; Turbine : 2, 1, 100 h.p. ; Generator : two, each 750 kilowatt-ampere, 1, 720 kilowatt ampere ; When completed : April, 1922, the work was partially completed.

KAYAO POWER HOUSE.—Location : Kayao, Yamagamimura, Kanzakigun, Shiga-Ken : Location of Intake : Tadebata in the above district : Length of Power Canal : 1,575 *ken* ; Volume of Water Used : 80 ; Effective Head : 137 *shaku* ; Generating Power : 640 k.w. ; Turbine : one set, 900 h.p. ; Generators : one set, 800 kilowatt ampere.

AIDANI POWER HOUSE.—Location : Aidani, Yamagamimura, Kanzakigun, Shiga-Ken. Location of Intake : Same in the above district ; Length of Power Canal : 290 *ken* ; Volume of Water Used : 100 ; Effective Head : 116 *shaku* ; Generating Power 747 kilowatt ; Turbine : one set, 1250 h.p. ; Generator : one set, 750 kilowatt-ampere.

ANEGAWA POWER HOUSE.—Location : Kami-Itanami, Higashi-Kusanomura, Shiga-Ken ; Location of Intake : Magayaji in the above district ; Length of Power Canal : 2,873 *ken* ; Volume of Water Used : 35 ; Effective Head : 320 *shaku* ; Generating Power : 615 kilowatt ; Turbine : one set, 1,100 h.p. ; Generator : one set, 720 kilowatt-ampere.

In the Yamato District.

SAKO POWER HOUSE.—Location : Sako, Kawakamimura, Yoshinogun, Nara-Ken ; Location of Intake : Takahara in the above district ; Length of Power Canal : 1,045 *ken* ; Volume of Water Used : 13 ; Effective Head : 727 ; Generating Power : 500 k.w. ; Turbine : two sets, each 600 h.p. ; Generator : two sets, each 400 k.v.a.

KASHIO POWER HOUSE.—Location : Kashio, Nakashomura, Yoshinogun, Naraken ; Location of Intake : Otaki, Kawakami-Mura, Nara-Ken ; Length of Power Canal : 1,580 *ken* ; Volume of Water Used : 220 ; Effective Head : 176 ; Generating Power : 2,365 k.w. ; Turbine : three sets, each 1,800 h.p. ; Generator : three sets, each 1,250 k.v.a.

YOSHINO POWER HOUSE.—Location : Minmi-Narai, Nakasho-Mura, Yoshino-Gun, Nara-Ken ; Location of Intake : Kashio, in the above district ; Length of Power Canal : 2,514 *ken* ; Volume of Water Used : 350 ; Effective Head : 78 *shaku* ; Generating Power : 1,661 k.w.; Turbine : three sets, each 1,100 h.p.; Generator : three sets, each, 1,000 k.v.a.

TENKAWA POWER HOUSE.—Location : Nakagoe, Tenkawa-Mura, Yoshino-Gun, Nara-Ken ; Location of Intake : Horagawa in the above district ; Length of Power Canal : 584 *ken* ; Volume of Water Used : 18 *ken* ; Effective Head : 548 *shaku* ; Generating Power : 640 k.w. ; Turbine : one set, 1,000 h.p. ; Generator : one set, 800 k.v.a. ; When completed : July, 1915.

SHIRAKAWA POWER HOUSE.—Location : Shirakawa, Kami-kitayama-Mura, Yoshino-Gun, Nara-Ken ; Location of Intake : Kawai in the above district ; Length of Power Canal : 2,206 *ken* ; Volume of Water Used : 60 ; Effective Head : 602 *shaku* ; Generating Power : 2,414 h.p. ; Turbine, two sets, 2,200 h.p. ; Generator : two sets, each 1,900 k.v.a. ; When completed : June, 1921.

In the Kumano District.

TAKIMOTO POWER HOUSE.—Location : Takimoto, Oguchi-Mura, Higashi Mura-Gun, Wakayama-Ken ; Location of Intake : In the same place, as above ; Length of Power Canal : 1,455 *ken* ; Volume of Water Used : 6 *ken* ; Effective head : 687 *shaku* ; Generating Power : 240 k.w. ; Turbine : one set, 375 h.p. ; Generator : one set, 300 k.v.a. ; When completed : December, 1921.

TAKATA POWER HOUSE.—Location : Takata, Higashi-Muro-Gun, Wakayama-Ken ; Location of Intake : In the same place as above ; Length of Power Canal : 753 *ken* ; Volume of Water Used : 4 ; Effective Head : 560 *shaku* ; Generating Power : 136 k.w. ; Turbine : one set, 200 h.p. ; Generator : one set, 170 k.v.a. ; When completed : September, 1919.

NACHI POWER HOUSE.—Location : Nachi-Mura, Higashi-muro-Gun, Wakayama-Ken ; Location of Intake : In the same place as above ; Length of Power Canal : 1,045 *ken* ; Volume of Water Used : 105 ; Effective Head : 290 *shaku* ; Generating power : 120 k.w. ; Turbine : one set, 250 h.p. ; Generator : one set, 150 k.v.a. ; When completed : February, 1913.

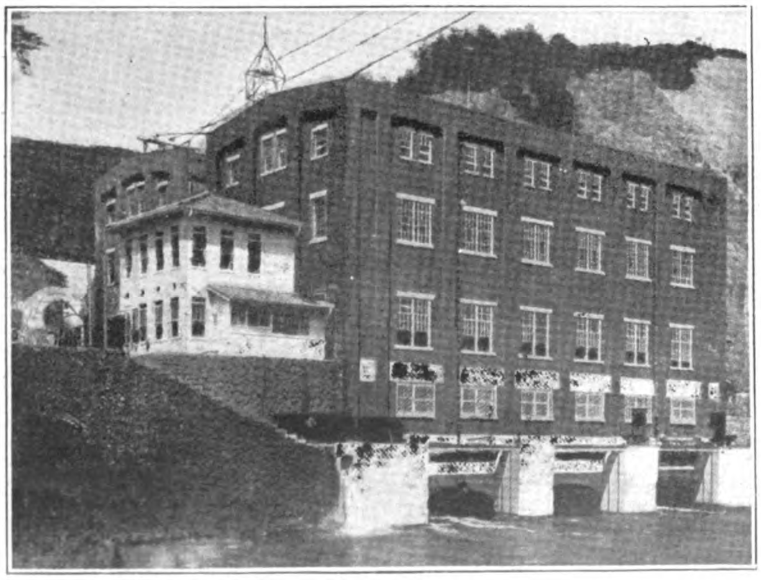
In addition there are two more hydraulic power houses with aggregating capacity of 150 k.w.

Steam Generating Power now in operation

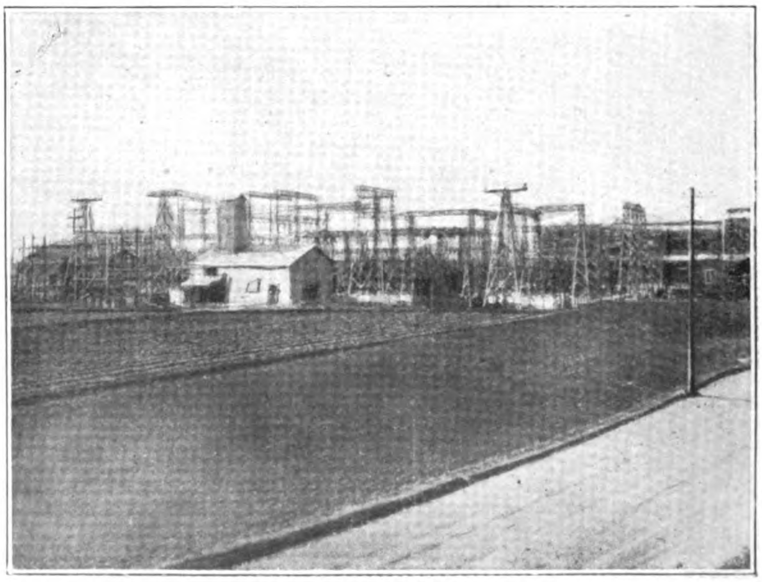
FUKUZAKI POWER HOUSE.—Location : On the right bank of the river Shirinashi, Fukuzaki-Machi, Minato-Ku, Osaka : The area of the ground : 7,350 *tsubo* ; The building area : 865 *tsubo* ; Structure of the power house : Two storeyed re-inforced concrete building ; Boiler : 14 sets, each with heating area of 7,097 square ft. ; Steam pressure : 250 pounds ; Super heating degree : 225 degree Fahrenheit ; Stokers : 13 sets of underfeed stoker and one set of coal-combustion appliance ; Screening machine : 14 sets each with the area of 4,915 square ft. ; Chimney : 5, all reinforced concrete ; Steam Turbine : four sets each with 17,500 h.p. ; Condenser : four sets each with 16,000 square ft. ; Generator : four sets each with 12,500 k.v.a. ; Coal-discharging equipment : 350 ton vessel can be moored at the right bank of the river Shirinashi ; When completed : February, 1923.

Outline of the Extension Works.

Hydro-electric Power Plant (at the River Uji) (1) Ohira Power House, the construction work in the third stage (under application). Projected Location : Sotobatake, Ishiyama-Mura, Shiga-Ken ; Projected Location of Intake : Nango, in the same district as above ; Length of Power Canal : 2,200 *ken* ; Volume of Water Used : 1,800 ; Effective Head : 48 *shaku* ; Generating Power : 5,400 k.w. ; Turbine : three sets each 4,000 h.p. ; Generator : three sets, each 3,500 k.v.a.



Shidzukawa Power House



Nagasone Sub-station

OMINE POWER HOUSE, (under construction).—Projected Location: Right under the dam of the construction work in the second stage; Projected Location of Intake: Up-streams of the dam; Length of Power Canal: 71 *ken*; Volume of Water Used: 3,500; Effective head: 70 *shaku*; Generating Power: 16,000 k.w.; Turbine: two sets each with 12,500 h.p.; Generator: two sets, each with 10,000 k.v.a.

Besides these, the Company has one more plant with a capacity of 460 k.w. on the course of the River Tawara. It was already sanctioned to start construction.

In the Omi District.

(1) IBUKI POWER HOUSE (sanction pending).—Location: Ibuki, Sakata-Gun, Shiga-Ken; Location of Intake: Magariya, Higashi-Kusano-Mura, Asai-Gun, Shiga-Ken; Length of Power Canal: 5,459 *ken*; Volume of water used: 90 *ken*; Effective Head: 527 *shaku*; Generating Power: 3,171 k.w.

(2) KOIDZUMI POWER HOUSE (sanction pending).—Location: Kubokaido, Sakata-Gun, Shiga-Ken; Location of Intake: Koidzumi in the above district; Length of Power Canal: 745 *ken*; Volume of Water Used: 76; Effective Head: 91 *shaku*; Generating Power: 450 k.w.

(3) TAKATOKIGAWA POWER HOUSE (under construction).—Location: Kawai, Takatoki-Mura, Ika-Gun, Shiga-Ken; Location of Intake: Omi in the same district as above; Length of Power Canal: 1,396 *ken*; Volume of Water Used: 200; Effective Head: 81 *shaku*; Generating Power: 1,039 k.w.

(4) TADEHATA POWER HOUSE (sanction pending).—Location: Tadehata, Kanzaki-Gun, Shiga-Ken; Location of Intake: Tobao in the same district; Length of Power Canal: 2,573 *ken*; Volume of Water Used: 60; Effective Head: 542 *shaku*; Generating Power: 2,052 k.w.

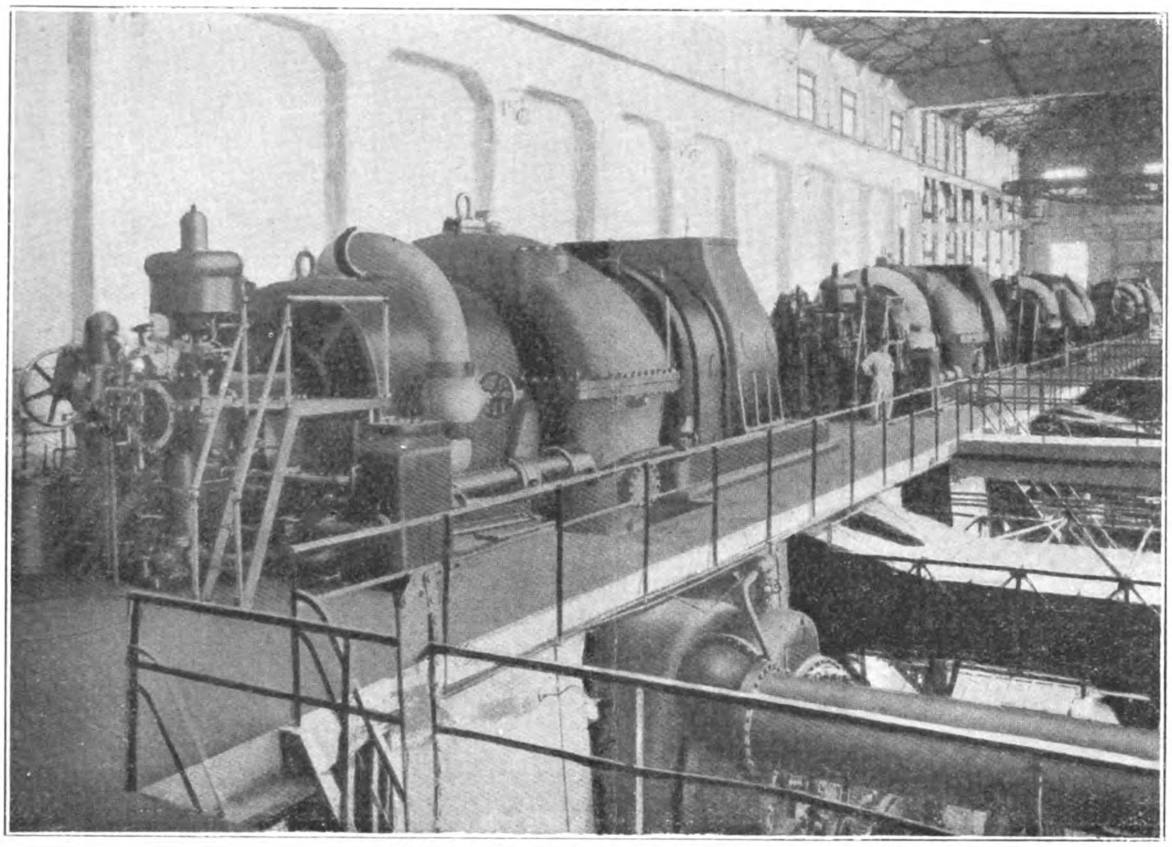
In addition to these, this concern has filed applications for two more plants with total capacity of 611 k.w.

In the Yamato District.

SURIKO POWER HOUSE (under construction).—Location: Kuwabara, Shimokita-Yama-Mura, Yoshino-Gun, Nara-Ken; Location of Intake: Ikehara, in the same district: Length of Power Canal: 1,650 *ken*; Volume of Water Used: 550; Effective Head: 187 *shaku*; Generating Power: 5,610 k.w.

NAGATONO POWER HOUSE (under construction).—Location: Nagatono, Totsugawa-Mura, Yoshino-Gun, Nara-Ken; Location of Intake: Wada and Shinohara of Yoshino-Gun, Nara-Ken; Length of Power Canal: 5,287 *ken*; Volume of Water Used: 235; Effective Head: 623 *shaku*; Generating Power: 8,921 k.w.

In addition to these, this company has 10 more projected plants with aggregated capacity of 35,225 k.w. The sanction for the construction is now pending.



Fukuzaki Power House Turbine Room

The concern has filed an application for four more plants with total capacity of 1,719 kilowatt.

Steam Generating Power Plant.

Kitsugawa Steam Generating Power Plant (under application): Projected location: Funamachi, Minato-Ku, Osaka: Capacity: 40,000 kilowatt Generator: 25,000 k.v.a. (two sets).

The aggregated generating capacity of the plants of this concern including both those already in operation as well as those under construction amounts to 207,000 kilowatt of which 80,000 kilowatt is of the steam generating power.

The quantity of power this company purchases from other concerns.

Though the total capacity is obtainable as much as over 200,000 kilowatt, it is not sufficient to meet with the increasing demands of power, light and heat in the Kansai District. To meet with the requirement, therefore, the company are now being supplied with power from the following sources: Ibikawa Electric Company: 5,000 kilowatt; Nihon Electric Company: 40,000 kilowatt; Daido Electric Company: 17,600 kilowatt; Imadzu Electric Company: 10,000 kilowatt.

The equipments for transmission, supply and sub-station.

The Territory of Head Office: One part of the hydraulic power generated at the Uji Power House is to be supplied to Kyoto Electric Light Company through Kyoto transformer sub-station, some nine miles distant, by means of a transmission cable of 12,000 volt. and the remainder, after being transformed up to 55,000 volt. is supplied to Nae sub-station in the north-east of the city of Osaka through Neyagawa switching station. The length of the power cable between the section reaches to 21½ miles. At the Nae sub-station, the voltage of power is transformed down to 11,000 volt., this being supplied to the Osaka Electricity Bureau and every station of this company located in the eastern section of Osaka by means of the underground cable.

The power generated at Shidzukawa power house is also transformed up to 55,000 volt and is transmitted to Neyagawa Switching Station by means of power cable having the length of 14.8 miles. Here, combined with the power from Uji power house, one part being transmitted to the Nae sub-station, while the remainder, through a power cable, 17½ miles in length goes to the Nagasone sub-station located in the eastern section of Sakai where the voltage is transformed down to 22,000 volt. Thus, the power is transmitted to every sub-station in the southern section of Sakai as well as Osaka.

Neyagawa Switching Station is connected with Kanazakigawa sub-station by means of 8½ miles power cable with 55,000 volt.

Kanzakigawa Sub-station would receive the supply of power with 55,000 voltage from Osaka sub-station of the Nihon Electric Company and after transforming the power down to 22,000 volt,

it is supplied to every sub-station in the western and northern section of Osaka.

The power supplied from the Daido Electric Power Company is received at Neyagawa Switching Station as well as at Abiko sub-station at Onomachi, Sumiyoshi-Ku, Osaka wherefrom the power is sent to every sub-station at Sakai and the Southern section of Osaka.

The power which is supplied from the Ibikawa Electric Company has the voltage of 77,000 which are received at Mikuni transformer sub-station located in the neighborhood of Kanzakigawa sub-station.

Power is transmitted from Shinjo sub-station which belongs to this company's Yamato Branch to Kobe sub-station by means of power cable 45 miles in length 77,000 voltage. After transforming down to 11,000 volt, the power is supplied to the Kobe Municipal Electricity Department.

The equipment above-mentioned are for the hydraulic power plant, and those for the steam generating power plants are one from Fukuzaki power house and other from Imadzu Electric Power Company. The power generated at the former power house is transmitted to every sub-station at the western and southern section of Osaka means of underground cable with 11,000 voltage. From the Imadzu Electric Power Company, power is received at Tachibana sub-station located in the Northwestern section of Amagasaki whence power is transmitted to its neighboring sub-station.

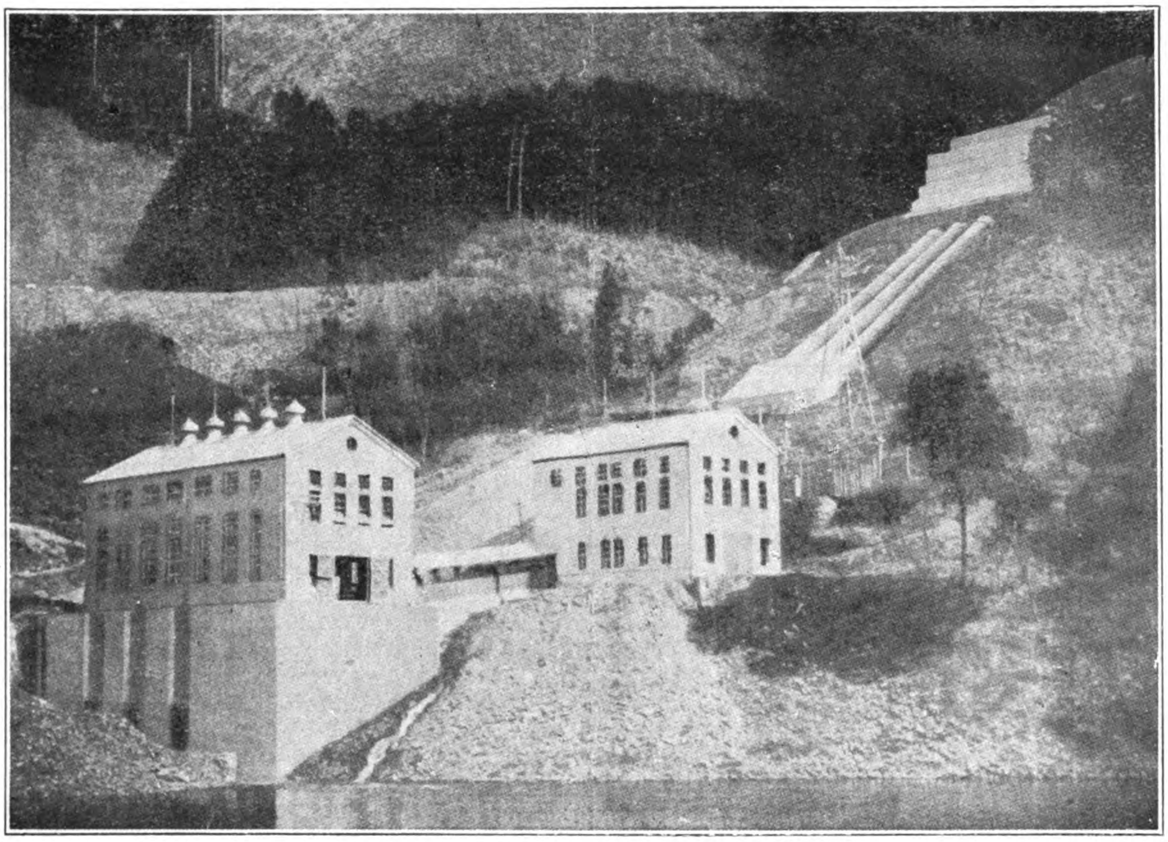
At the end of March, 1925, the total length of the lines for power supply was 2,524 miles of which some 39 miles were for the underground cable line, the remainder being the overhead line.

The Omi Branch : The voltage of power generated at the power house belonging to the Omi Branch is 3,500 volt, and increasing the voltage up to 20,000 volt, the power is transmitted to 10 sub-stations and one transformer-tower respectively. The connection among them is made by means of the transmission line with 20,000 volt.

The sub-station would generally supply power with 3,500 volt. reduced from the original voltage of 20,000. For the power of lamps, 50 or 100 volt. one is to be supplied, while for motors, 200 volt. power is supplied.

With the increasing demand of power in recent years, the present equipment for the power plant of the Branch seems to be incapable to meet with its requirement. At the outskirts of Hikonemachi, therefore, the Shohoji transformer sub-station was erected. One part of power with 77,000 voltage transmitted from Ibikawa Electric Company to Osaka is to be received here, and reducing it down to 20,000 volt, the power is supplied to various sub-stations.

One part of the sub-station located at Notogawa and Hachimanmachi is equipped to be capable to receive power totalling 600 kilowatt with the voltage of 14,000 from the Kyoto Electric Light Company.



Kashio Power House of the Yamato Branch

The Yamato Branch: Of the Hydraulic Power plants belonging to Yamato Branch, the three power houses, Shirakawa, Sako and Tenkawa are capable to generate power 3,500 volt each. After transforming the voltage up to 16,500 or 44,000 volt, the power is transmitted to every sub-station within the territory of the branch. Again transforming the power down to 3,500 voltage, it is to be supplied for both purposes, light and power. For the former, power with 100 volt, is used and the latter, 200 voltage.

One part of power with 44,000 volt generated at Shirakawa power house is transmitted to Suriko sub-station some 8 miles distant. Here transforming down to 22,000 volt, the power is transmitted to the two sub-stations at Kimoto and Shingu in Kumamoto some 27 miles off.

At the two Power Houses, Yoshino and Kashio, power with 3,300 volt is generated, and the power, after being increased in the voltage as 33,000 volt. is transmitted to Shinjo sub-station about 15 miles distant where it is raised again to 77,000 volt and transmitted to Kobe sub-station by means of transmission line, 45 miles in length.

Kumano District Office.

The voltage of power generated at every power house in this district is 3,500 volt. each and the power is directly supplied from each power house. The voltage of the transmission line which connects among Takimoto power house, Nachi power house, Katsura sub-station (now under construction) and Shingu sub-station is 11,000 volt.

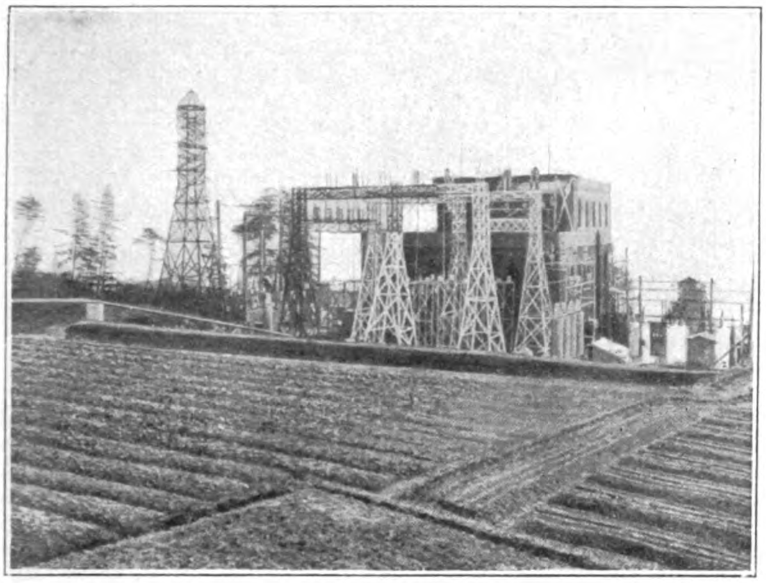
The both sub-stations, Kimoto and Shingu are to receive power from Yamato branch, and when supplying, the power is reduced from 22,000 to 3,500 volt. At Shingu sub-station, the power is raised in voltage up to 11,000 volt. and transmitted to the sections of Katsura-Machi.

Shingu sub-station has besides an equipment to receive 500 kilowatt steam generated power with the voltage of 3,500 from Shingu Electric Power Company.

The voltage of power supplied in the district of Kumano Branch is 100 for light purpose and 200 for motor.

The current supplied from Head Office, branch offices and district is all of 60 cycle.

The following shows the transmission and supply lines of this company (end of March, 1925). Territory of Head Office : Total length of overhead transmission line 952.8 miles : Total length of overhead supply-line, 2,484, 7 miles ; Total length of underground transmission line 217.8 ; Total length underground transmission line : 39.4 miles ; Omi Branch : Total length of overhead transmission line : 273.4 miles ; Total length of overhead supply-line : 3,760.4 miles ; Yamato Branch : Total length of overhead transmission line : 468.9 milss ; Total length of overhead supply-line : 1,596.7 miles ; Kumano District Office : Total length of overhead transmission line : 212.8 miles ; Total length of overhead supply-line : 490.3 miles.



Kobe Sub-station

The following table shows this Company's sub-stations now in operation. (March, 1925).

Head Office :

Name	*Description*	*Capacity*	*Location*
Noe	Receving	31,800 k.v.a.	Noe-machi, Osaka
Kyoto	do.	5,000 kilowatt	Higashi-kujo, Kyoto
Tachibana	Receiving and S'pling	18,000 k.v.a.	Amagasaki, Hyogoken
Nagasone	Receiving	14,200 k.v.a.	Kanaokamura, Osaka
Kanzakigawa	do.	54,000 k.v.a.	Mikunimotomachi, Osaka
Kobe	Receiving and S'pling	51,000 k.v.a.	Nishinada, Hyogoken
Urae	do.	30,000 k.v.a.	Urae, Osaka

In addition, there are 20 more sub-station saggregating 133,800 k.v.a. Besides with 12 switching stations.

Omi Branch :

Name	*Description*	*Capacity*	*Location*
Shohoji	Receiving	3,600 k.v.a.	Senbonmura, Shiga-ken
Hikone	Supplying	2,598 k.v.a.	Hikonemachi Shiga-ken
Nagahama	do.	1,500 k.v.a.	Rokushomura, Shiga-ken

In addition, there are eight more sub-stations including one transformer tower with total capacity of 4,950 k.v.a.

Yamato Branch :

Name	*Description*	*Capacity*	*Location*
Shinjo	Receiving	4,500 k.v.a.	Shinjo, Nara-ken
Gosho	Receiving and S'pling	5,700 k.v.a.	Goshomachi,, Nara-ken
Suriko (temporary)	Receiving	3,300 k.v.a.	Shimokitayama, Nara-ken

In addition, there are in this territory eight more sub-stations including one transformer-tower with total capacity of 1,915 k.v.a.

Kumono District Office :

Name	*Description*	*Capacity*	*Location*
Shingu	Receiving and Supplying	2,760 k.v.a.	Shingumachi Wakayama-ken
Kimoto	do.	360 k.v.a.	Arii, Mie-ken

The following shows the number of sub-stations now under construction; seven with aggregating capacity of 47,500 k.v.a. in the territory of Head Office; one with the capacity of 750 k.v.a. in the territory of Yamato Branch; two with total capacity of 900 k.v.a. in the territory of Kumano district office.

General Business Condition

The following table shows the yearly results since the operation of this company was started in August, 1913.

Head Office :

Year	*Amount of H. P.*	*No. of Consumers*
March 1914	40,276	1,476
,, 1915	54,613	2,151
,, 1916	63,859	3,011
,, 1917	77,183	3,794
March 1918	87,160	4,784
,, 1919	105,147	5,693
,, 1920	111,389	5,879
,, 1921	127,593	6,627
,, 1922	144,851	8,318
,, 1923	164,196	9,753
,, 1924	200,550	10,993
,, 1925	240,297	12,444

Omi Branch :

Year	*No. of Lamps*	*No. of Consumers*	*No. of H.P.*	*No. of Consumers*
May, 1921 ..	141,313	84,498	2,073	571
March 1922 ..	150,024	86,334	3,227	650
,, 1923 ..	168,141	89,396	3,888	988
,, 1924 ..	178,884	91,795	4,616	1,105
,, 1925 ..	186,249	92,857	5,798	1,415

Yamato Branch :

Year	*No. of lamps*	*No. of Consumers*	*No. of. H.P.*	*No. of Consumers*
March 1922 ..	51,020	24,419	2,474	243
,, 1923 ..	62,518	28,082	4,997	305
,, 1924 ..	78,865	31,999	9,995	366
,, 1925 ..	87,342	33,159	10,274	421

Kumano District Office :

Year	*No. of Lamps*	*No. of Consumers*	*No. of H.P.*	*No. of Consumers*
May, 1922 ..	34,505	17,174	624	55
March 1923 ..	36,699	17,582	865	70
,, 1924 ..	41,571	19,041	1,445	109
,, 1925 ..	43,453	19,896	1,605	148

Head Office :

The total amount of power which are directly sold within the territory of Head Office is 240,297 h.p. with 12,444 consumers. During the past six months, the amount of power has increased by 12,582 h.p. with 795 consumers.

Power for motor supplied-5,798 h.p. with 1,415 consumers.

During the past six months, the amount has increased by 293 h.p. with 196 consumers.

Yamato Branch

Number of lamps-97,342 with 33,157 houses.

During the past six months, it has increased by 4,727 with 354 houses.

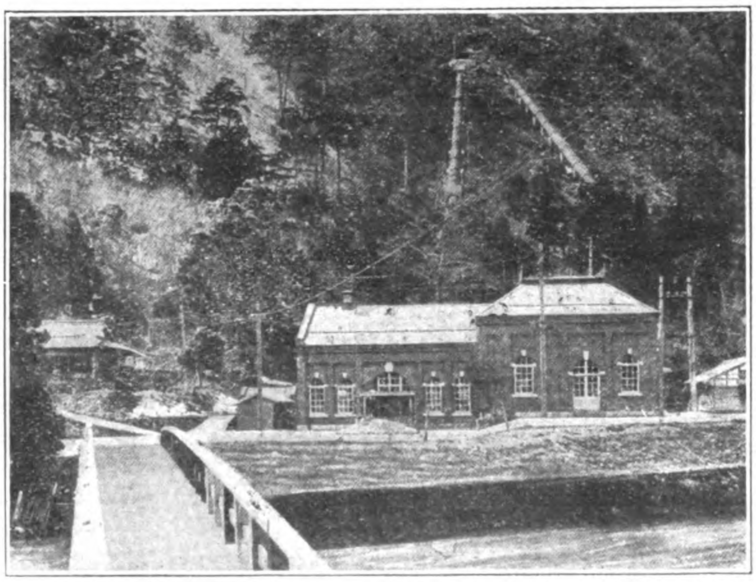
Power for motor supplied-10,274 h.p. with 421 consumers.

During the past six months, it has increased by 72 h.p. with 30 consumers.

Kumano District Office

Number of lamps—43,453 with 19,896 houses.

During the past six months, it has increased by 1,369 with 348 houses.



Ananekawa Power House (belongs to Omi Branch)

Power for motor supplied—1,605 h.p. with 148 consumers.

During the past six months, it has increased by 138 h.p. with 27 consumers.

The following is the table showing where power, consumed number of motors installed and total h.p. (September 1924):

Where Power Consumed	*No. of Motors Installed*	*Total h.p.*
Electrical Enterprise each has its own plant (7)		76,500
Iron Works	2,72	20,957
Cotton Spinning Mills	298	14,5€0
Saw-mills	517	9,215
Paper-mill	88	7,600
Copper-Works	59	5,903
Cement Factory	46	4,753
Cable Works	191	4,053
Dye Houses	371	3,955
Ice Manufactory	129	3,916
Water Works	17	3,172
Steel Mills	106	3,319
Shipbuilding yards	137	2,997
Rubber Manufactory	175	2,886
Glass Factory	483	2,649
Fertilizer Manufactory	118	2,618
Locomotive Makers	38	2,449
Public Works	176	2,121
Rice Mill	1,794	1,900
Pumping and Public bath house	339	1,846
Wire Manufactory	103	1,838
Foundry	282	1,810
Gilder	175	1,757
Celluloid Factory	134	1,688
Hemp-dressing	29	1,644
Wooden Works	411	1,550
Tannery	133	1,526

Far East Shipping Companies In A Bad Way

From Our London Correspondent

THE reports of two of the shipping companies trading with the Far East—the Java-China-Japan Line and the Indo-China Steam Navigation Company—which have just been issued, disclose a very unsatisfactory state of affairs.

The directors of the Java-China-Japan Line in their report of last years workings say that the civil war in China has brought great uncertainty both in commercial and political aspect, but that notwithstanding the many adverse factors the volume of trade expanded, although prices were unsatisfactory. Freights in the Far East could not be raised above the level of working expenses, trade with Japan being depressed by the financial difficulties in that country imports of the Netherlands East Indies improved, but the volume of return cargo is still small compared with the exports of sugar from Java to China and Japan.

The relation between the prices of bunker coal and oil has altered so materially in favor of coal that the use of oil by the company's steamers has had to be reduced, although the same possesses technical advantages and oil can be secured by the ships at Balik Papan in close vicinity to the wells.

The Java-Pacific line has not yet been resumed. The steamer *Tjibesar* has been commissioned, and the steamer *Tjiseroce* has been launched and will probably be ready in October of the current year. The agreement arrived at with the builders for the completion of this vessel meant a financial sacrifice to the company, which has been written down from the miscellaneous reserve. Gross profits on trading amount to 1,031,107 gls. which, being insufficient to cover expenses and depreciation has been augmented by adding 164,910 gls. from miscellaneous reserve and 807,653 gls. from depreciation reserve, the latter transaction having become necessary on account of the attitude of the East India authorities in respect of fixing the book value of tonnage in the preceding year, when this value had to be increased and the difference transferred to a depreciation reserve, which will be booked off gradually.

The Indo-China Steam Navigation Company has been hit very heavily by the shipping depression. So unsatisfactory, indeed, has been the result of the year's working that no dividend is to be paid either on the Deferred Ordinary or the 6 per cent. Preferred Ordinary shares of the company. The latter received its dividend for 1923, when, after transfers from contingency and investment fluctuation accounts, a credit balance was established of £16,000. For 1924 the credit balance on revenue account was only £945. The loss on the working of the ships was £104,400, and with the allowances of £105,400 for depreciation and general charges the adverse balance is raised to over £221,000. To meet this the contingency and investment reserves are drawn upon to the extent of £208,700, and with the addition of interest receipts and the small credit balance brought in the deficit is extinguished and the small sum referred to is established as a credit. There are, of course, special reasons for the poor results reported. Not only was trade depressed and the freight market unfavorable, but the company had to face the added difficulties arising from the trouble in China. No better outcome of the past year's operations could have been expected.

Passing of the "China"

WITH only a feet of scrap iron showing above the water, there is now passing out of existence, by the way of the ship-breaker, the old s.s. *China*, a vessel that for close on 36 years was one of the most popular on the Pacific. Over in Kowloon Bay the work of breaking up is being carried out, and the romantic career of a famous ship is fast closing. Built as long ago as 1889 by Messrs. Fairfield & Co., Ltd., of Glasgow, the *China* was one of the great liners of her day. Of over 5,000 tons gross registry, the vessel had three decks and a promenade deck, was 440-ft. in length, 48.1-ft. wide and 32.8-ft. deep. Her appointments and fittings were the latest then known in marine furnishings and she was turned out from the Clyde yard for the Pacific Mail Steamship Company with much pride. An interesting circumstance in connection with her early days was that, although owned by an American firm with head offices in New York, the vessel was placed under the Hawaiian flag. At that particular time, the laws of the United States were that no foreign-built ship could be placed under American registry without the payment of heavy fees, and so the owners of the *China* registered her at Hawaii, which was then independent but which was agitating to be taken over by America. When the islands were later taken over by the United States' Government, the vessel automatically became one of American registry and thus was saved the payment of the heavy fees which would have been necessary a few years earlier. The Pacific Mail Steamship Company operated the vessel, together with others, for some years and it was during those early days that the *China* enjoyed such popularity. The vessel was later sold to the China Mail Steamship Company, which had also bought the *Nile*, and was regularly on the Pacific run until the liquidation of the owners, some two years ago. Owing to bad times generally, the China Mail Steamship Company was unable to meet its obligations and the *China* was forcibly detained in harbour at Hongkong under an order made by the Supreme Court on the application of a number of creditors. The *Nile* was detained in San Francisco. At one time it seemed likely that the *China* would be acquired by a Chinese syndicate, but it was found that to refit the ship and to instal the new boilers which would be required would be too expensive an undertaking. Thus it has come about that the vessel lay in Kowloon Bay for many months, awaiting the settling up of the affairs of the owning Company. A short while ago she was sold to Chinese for breaking up, the *Nile* meanwhile having been disposed of in San Francisco for a similar purpose.

Round the World for Twopence per Mile

Description of A Wonder Ship—Cunarder "Carinthia"

FROM OUR LONDON CORRESPONDENT

THE last of the fourteen new vessels to join the fleet of the Cunard Line, the *Carinthia*, built by Vickers, Ltd., is a master piece of the shipbuilders' and decorators' combined arts. She sailed at the end of August on her maiden voyage. Nearly six months will elapse before she returns, and by then it is contemplated that she will have covered 30,000 miles, visiting Australia, New Zealand, America, and many other parts of the world. Incidentally, a mathematical calculation by a member of the Cunard staff shows, that the cost of such an experience works out at approximately 2d. per mile, or £2 per day.

Built at the Barrow Yard of Messrs. Vickers, Ltd., as a sister ship to the *Franconia*, the *Carinthia* is also specially designed for world cruises.

The *Carinthia* is the third liner of the company's present fleet to be built by Messrs. Vickers, Ltd., and the second liner of that name to figure in the Cunard fleet. All the latest developments are embodied in the *Carinthia*. Her passenger accommodation extends over seven decks, and all the first class public rooms excepting the restaurant, are on "A" deck.

She is designed to burn oil fuel and her dimensions are as follows :—

Length 624-ft., breadth 74-ft., depth 45-ft., tonnage 20,000. Accommodation for passengers, first class 331, second class 473, third class 810.

Though the general arrangements of the magnificent accommodation have been constructed on the same lines as the *Franconia*, there are many outstanding features as far as the decorations and furnishing of the *Carinthia* are concerned. Perhaps the most notable is that of the introduction of the Spanish school of art, which is to be found in the smoking room.

While much has been done in domestic architecture, it has been left to the Cunard Company to introduce Spanish forms of decoration in their entirety into an ocean going liner.

The scheme adopted in the *Carinthia's* smoking room is based on certain elements in the house of the great Spanish painter El Greco, who lived at Toledo in the fifteenth century. It is particularly appropriate that one of the great attractions of this apartment is an actual copy of El Greco's fine portrait of King Ferdinand, who, it will be recalled established the present Spanish dynasty.

Other masterpieces of the Spanish school of painting are represented by copies of the famous jeune mendiant by Murillo, Velasquez's Philip IV, Ribera's satirical study of a philosopher, together with several pieces of fine Spanish embroideries.

The windows surrounding the lower portion of the room have been very carefully studied. A typical Spanish lead light design has been employed, but a number of pieces of stained glass have been acquired and embodied in the work. The room itself is of two heights, and the arrangement has allowed the maximum space for the great central portion.

It is considerably greater than that of any other vessel of its class, and the advantage is sustained by employing four great stone mullioned oriels. The fireplace recess is formed by a typical arch, 12-ft. high over an intrados of intaglio tiles. The side walls of the central portion are treated with great wrought iron grilles, and between the grille windows hang long embroidered banners.

At the after end the shape of the room has been ingeniously screened off by small recesses on each side of a semi-circular bay window. The ceiling is typical of the period, and comprises an elaborate system of framed beams with geometrical patterns entirely in wood. The floor is of a type that has never been employed outside Spanish palaces. Instead of being ceramic, ruboleum has been introduced. A number of modern Spanish etchings adorn the walls.

The lounge is in striking contrast to the smoking room. It is typically English, the decoration and furnishing representing the delightful period when William of Orange produced a composite style of British and Dutch forms. Walnut furniture, cross banded veneer and marquetry, old red lacquer black and gold furniture, rich velvet and tapestries present a pleasing 17th century atmosphere.

The Adam Restaurant.—The early manner of the Brothers Adam has often been greatly admired on account of its simplicity ; even more so than their later decorative style which was largely influenced by the Louis Seize period and the works of Ciprianni and Pergolesi.

The charm of the *Carinthia's* restaurant strikes a new note, the object of the designers having been to introduce as simple an effect as possible within the limited dimensions. The ideal expresses itself in the ventral portion which runs through the two decks. It is illuminated by two finely carved and gilded Adams torchers, throwing indirect lighting to the ceiling. The forward end of this central portion is of apsidal form, decorated with a reproduction of Le Brun's cartoon for the gobelin tapestry of the Chateau de Chambord The original cartoon is in the Louvre.

The aspe is coffered and the tone of the painting is the key of the color scheme of the whole apartment. This has been carried out in French grey, with slight pink blush, and tones with the Norwegian rose marble columns and the rose and écru marble ruboleum floor. At the after end there is a semi-elliptical treble arrangement of round-headed arches, giving skill and dignity to the treatment.

To avoid the danger of bareless and lack of interest of which this style is sometimes accused, the three arches have bronzed glazed screens. This arrangement forms a spacious foyer at the foot of the main staircase, where comfortable settees have been introduced. The delicate silver lamp standards on the small dining tables have shades of vellum painted with silhouettes and classical subjects.

The sports arena occupies some 5,000 square feet and extends through two decks. Spaciousness is its keynote, with a handsome teak staircase leading to a balcony overlooking the swimming bath. At each side of the bath and with separate entrances are the rackets court and gymnasium. Facing the balcony is a fine bronze copy of the Discobolus. The lighting system of the swimming bath is entirely indirect. It is base on triumphal columns similar to to those erected by the Romans when bronze ship's prows were applied, and these prows have been made suitable for the form of lighting which has been introduced. There are, of course, the usual dressing cubicles, shower baths and electric baths for massage treatment.

The card room has been specially studied for the convenience of players, and the color scheme is a restful green consistent with the Cippalino marble columns. Over the fireplace has been placed a copy of a composition by Hubert Roberts, while at the forward end another composition by the same artist is flanked by four Hogarth engravings from the set "Marriage a la mode." There is also a fine display of Spode wear.

The drawing room closely resembles the decoration of the card room, the whole color scheme being blue and gold. There are comfortable settees and chairs for reading and convenient writting accommodation. The cabinets in this room display Wedgwood ware.

Eighteenth century treilliage treatment has been adopted in the design of the two garden lounges. An improved type of window

gives these lounges the effect of a large verandah overlooking the sea. The decks have been specially treated for dancing.

The numerous staterooms have been fitted with beautiful mahogany bedsteads, large wardrobes, dressing tables, night tables, book cases, easy chairs and settees. There are also a number of suites comprising sitting room, bedroom and bath room, in addition to a large number of cabins de luxe.

Equal attention has been paid to the comfort of the second class passengers. They have the use of dining saloon, smoking room, lounge and verandah cafe.

The dining saloon has been executed in a vigorous Georgian style adapted to modern tastes so far as the color schemes are concerned. The marble columns of sang de boeuf strike a strong note of color against the vellum background. A very fine Georgian design of curtain gives a color note to the moulding and other painted details. A single torchere in the centre of the room lights up the whole central portion, while at each table are similar lamps to those in the Adam restaurant. A musician's gallery has been ingeniously introduced into the dome of the room.

The second class lounge can be described as a dainty Adam room. The rather severe walls have been relieved by mezzotints of the period and form a background to the graceful eighteenth century mahogany furniture.

The verandah cafe, with its leaded light windows and array of wicker furniture, overlooks the stern of the vessel and provides an uninterrupted view of the ocean highway.

The atmosphere of an old English Inn, with its oak panelled ceilings and walls, has been introduced into the smoking room.

An unusual amount of space has been devoted to third class accommodation. There are two large dining saloons which, with the other public rooms, have been decorated with simple oak panelling and white friezes. The walls of these rooms are adorned with a number of interesting pictures. The commodious cabins are fitted with berths for two, four, or six persons. There is also a library and ample space for promenading, games, and recreation.

The propelling machinery is fitted in one engine room, and consists of two sets of steam turbines of the latest Parsons' marine type, and driving twin screws through double reduction helical gearing. The complete turbine installation is capable of developing a collective shaft horse power of 12,500, with revolutions of propeller shafts about 90 per minute.

The total power of astern work is about 70 per cent. of the ahead power. Each set of turbines consists of one high pressure turbine driving through a flexible coupling one pinion, and a low pressure turbine driving through a flexible coupling the other pinion of the first reduction gearing, and through the second reduction pinions to the gear wheel mounted on the main shaft.

Astern turbines are incorporated in the casings of the low pressure ahead turbines. Adjusting blocks of the Michell type are fitted to the turbines and the bearings of the turbines and gearing are arranged to work under forced lubrication.

One condenser of the underhung type is fitted for each set of turbines, and bolted direct to the exhaust branch of the low pressure turbine. The main shafting is of ingot steel, and is finished bright all over. Each line has a main thrust block of the Michell type fitted next to the gearing to take up the propeller thrust. The propellers are of the built type with four manganese bronze blades to each, bosses are of cast steel, and cast iron cones are fitted over propeller nuts.

The steam generating installation consists of three double-ended and three single-ended boilers arranged in one boiler room, and suitable for a working pressure of 220 lbs. per square inch. The boilers are of the multitubular return tube type, working under forced draught.

The mean diameter of all the boilers in 17-ft. 6-in. and the mean length of the double ended boilers is 22-ft. 6-in., and of the single ended boilers 11-ft. 6-in.

Each double ended boiler has eight furnaces with eight separate combustion chambers, the single ended boilers have four furnaces with four separate combustion chambers. The combined heating surface for all boilers is about 29,160 square feet.

The boilers are arranged to burn oil on the Wallsend-Howden pressure system. The installation is arranged on the duplex system and consists of four complete sets of pumping and heating plant, two large and two small, two of the set acting as standby.

For the forced draught system, there are two pairs of Howden's single inlet fans electrically driven, one motor arranged to drive two fans. All boilers are connected to a single large oval funnel.

The machinery and boilers have been constructed to the requirements of the Board of Trade, Lloyd's, and American survey.

A very full equipment of auxiliary machinery is fitted, comprising two circular pumps of the turbo-driven centrifugal type, one turbo-driven and two direct-acting feed pumps, extractor pumps, air ejectors, and other fittings in connection with Weir's closed feed system, and also the necessary outfit of forced lubrication, sanitary, fresh water, and other service pumps together with complete evaporating and distilling plant and auxiliary condenser and pumps.

The electrical installation produces another fine example of the very modern improvements which have been effected throughout in the construction of the vessel.

All the more important purposes to which electricity has been put on board ship are found, such as elevators for passengers, hoists for boats, baggage, stores, motors driving refrigerating and ice-making machinery, boiler-room fans, ship's and engine-room ventilating fans, galley and pastry machinery.

Electricity is further utilized for internal communications, such as telephones and bells; for navigational purposes, such as sounding machines and submarine signalling apparatus; for communication with the outer world by wireless telegraphy.

The *Carin'hia* is equipped with two steam turbo-driven geared generators, each of 375 kilowatts capacity.

Developments in previous units of the Cunard fleet, and now in the *Carin'hia*, have been in the direction of extending the use of electric power to the operations of the deck machinery, the capstans, windlass, cargo winches and steering gear being all electrically operated. Further use of electric power has been found in the laundry, in the prevention of corrosion in boilers, and in the rejuvenation of the human frame by electric sun baths.

The life saving appliances have had all the attention bestowed upon them that this important subject demands. The number of lifeboats supplied is more than sufficient to carry every individual aboard and are worked by means of Wellin's patent quadrant davits, thus insuring quick handling of the boats. The ship is also fitted with an istallation of wireless telegraphy and two motor lifeboats.

Above the bulkhead deck the ship is divided by fire-screen bulkheads as a precaution against fire. In the event of fire in any portion of the ship the outbreak can be localized by closing the fireproof doors and then dealt with by means of the efficient supply of fire hydrants, hose, and chemical fire extinguishers installed.

The ventilation of the ship throughout is maintained by natural means supplemented where necessary, in the passenger accommodation by a mechanical installation. For this the directional valve system is employed, whereby a supply of fresh air, heated if desired, is supplied to any compartment or cabin, with means of regulating it at will, by the passengers. In addition, passages, cabins, corridors, and public rooms are fitted with radiators and small electric pedestal fans.

The compasses employed on the *Carinthia*, following what has become a custom in the Cunard line, are of the Sperry Gyro type, while Messrs. Kelvin, Bottomley and Baird have supplied the pneumercator tank guages in use on board.

The kitchens, pantries, and bakeries of the *Carinthia*, are the most up-to-date in any vessel of equal size. No pains have been spared to make the plant the most efficient possible. The kitchens are large and well ventilated, and the flues from the ranges are carried down through the deck below, thus giving the radiation of unnecessary heat into the atmosphere. All ranges, both for passengers and crew, and the bakers' ovens are fired by oil, using the same fuel as the ship's boilers.

Among the items of apparatus fitted are steam jacketted stockpots of the tilting pattern, charcoal grills, steam ovens, kitchen hot presses, and the following machines electrically driven:—Potato peelers, meat mincing machines, ice-cream machines, dough mixers and dish washers.

In the pantry are fitted hot presses and carving tables, with steaming shelves over, all of the most up-to-date design. The coffee apparatus is similar to that employed in the very best hotels. There are electric toasters and griddle plates.

The whole outfit has been thought out with the object of serving luxurious meals equal to anything obtained in the finest hotels in the world.

Kunishima Waterworks, Osaka

MANY towns and country districts in Japan possess waterworks equipped on modern lines, and one worthy of particular mention is the Kunishima Waterworks, of the Municipality of Osaka. The original scheme was to provide pumping sets delivering 450-500 cub. ft. or 600-700 cub. ft. per min. against a manometric head of 200-ft., but after further consideration of all matters, it was finally decided to install sets delivering 600 cub. ft. per min. against a manometric head of 180-ft.

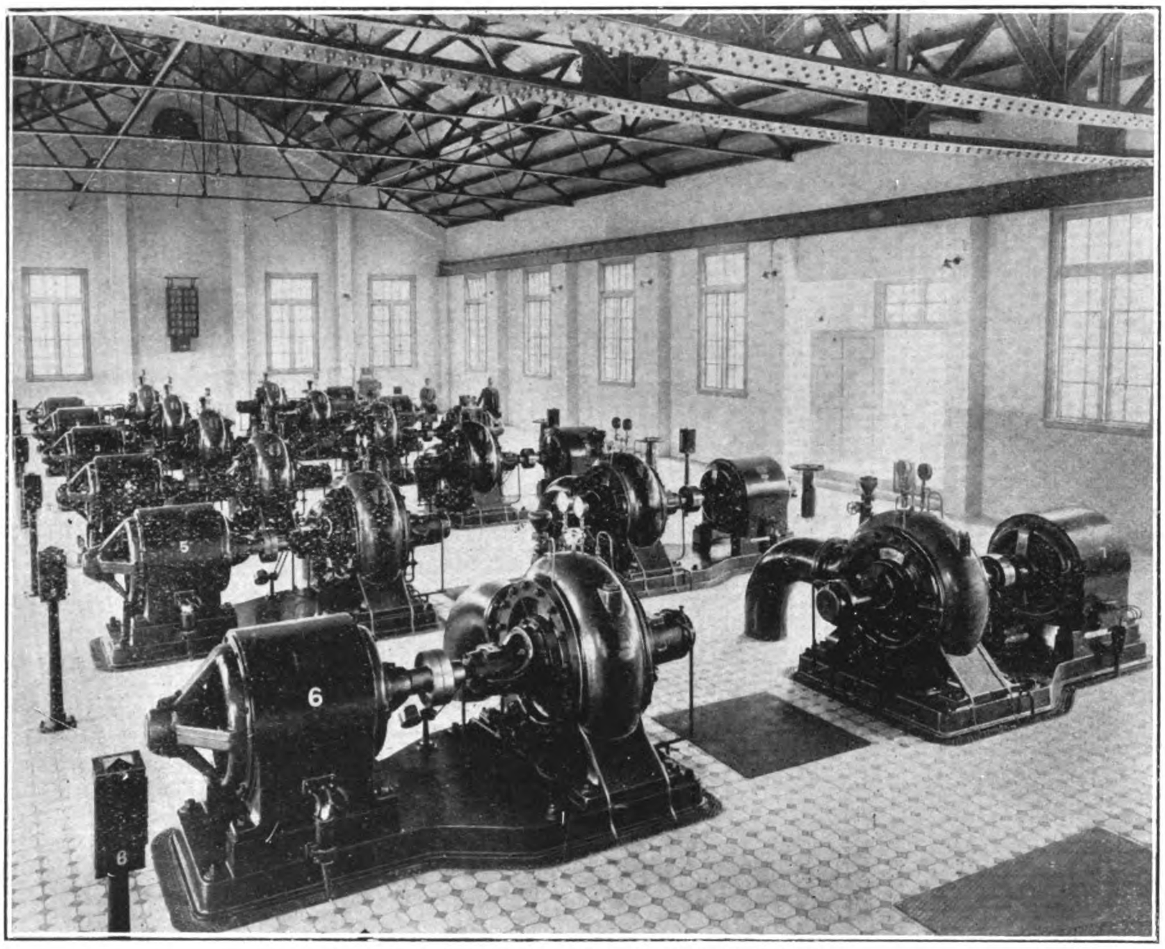
The following is an extract from the specification issued to the firms invited to tender for the work:—

"The pumping machines required are, in all, twelve in number, each machine consisting of a a centrifugal pump direct coupled to a three-phase induction motor of high efficiency. Each pump should be capable of lifting filtered fresh water at a steady and continuous rate of at least 600 cubic ft. per min. against a total manometric head of 180-ft. The water level in the suction well is expected to fluctuate from 4-ft. to 14-ft. below the floor level. Every pump should be capable of sucking up water from the suction well, through the strainer, foot valve and suction piping, against any suction head within this range. If oil be used for lubrication of the stuffing boxes or glands in the walls, or covers of the casing through which the shaft passes, some means should be provided for preventing it from entering the inside of the casing. The masses of the revolving parts should be perfectly balanced, so that there is no vibration or noise when the pump is running at any speed attained. The casing should be so designed and made, that the inside is easily accessible and the impeller and guide ring can easily be taken out whenever required. Every part of the pump should be designed and made with such strength and stiffness, that the machine can run continuously with safety, even when the load is 20 per cent. more than the normal."

The particulars given in the specification called for 12 Sulzer pumps, each delivering 600-cub. ft. per min. against a manometric head of 180-ft. and running at 1,170 revs. per min. to correspond to the periodicity of the three-phase supply which is 60 cycles.

The interior of the completed pumping station is shown above. The pumps are of the single-stage high-lift centrifugal type with guide rings and constructed to a special design.

The twelve pumps were submitted to specified tests, in batches of four, these tests being carried out at Winterthur before despatch.



OSAKA MUNICIPAL WATERWORKS, JAPAN
12 Centrifugal Pumps, delivering 45,500 galls. per min., against a head of 180 ft.

The testing arrangements conformed to the usual practice as laid down and approved for official tests.

The manometric head was ascertained by actual measurement of the suction head from the water level in the suction well to the middle of the delivery pressure gauge, and by measuring the pressure head by means of a control pressure gauge. The quantity of water delivered was measured by a Venturi meter and the head adjusted by throttling for which purpose a gate valve was employed. The pumps were belt-driven by a 500-h.p. three-phase motor, the characteristic curve for which was obtained by a a mechanical brake and electrical measurements. The power absorbed by the shafting and belting was ascertained by uncoupling each pump. Table 1 shows the test results of the first four pumps running at 1170 revs. per min.

All four pumps easily attained the guaranteed efficiency of 80 per cent. and in some cases exceeded it by 1 or 2 per cent. The quantity of water delivered by the pumps and the heads against which they could work also proved to be somewhat greater than what had been anticipated from the calculations and tests made with pumps already built on similar lines.

The official trials at Osaka after the pumps were installed, were carried out under the supervision of Professors of the Osaka. Technical College appointed at the request of the Municipality.

All twelve pumps were tested on site and the results of some of these tests are given in Table 2. When these results are compared with those obtained at Winterthur, it will be seen that they confirm that the efficiency of the pumps exceeds 80 per cent.

Table 1.

	Guaranteed	Tests					
Delivery, cub. ft. p. min.	600	594	755	596	600	615	716
Suction Head, ft. mano		10.5	10.5	10.2	10.2	10.2	10.5
Delivery Head, ft. mano		186.3	170.8	186.0	189.3	196.8	177.8
Total Head, ft.	180	196.8	181.3	196.2	199.5	207.0	188.2
Revs. per min	1170	1178	1162	1160	1168	1167	1165
H.P. at motor shaft		289	339	289	299	304	339
H.P. lost in shafting and belting ...		16	16	16	16	16	16
H. P. absorbed by pump	260	273	323	273	283	288	323
Theoret. H.P. of pump in water raised		255	264	225	230	245	259.5
Efficiency of the pump % ...	80	82.5	81.7	82.5	81.3	80.6	80.3

(*Continued on page 720*)

Proposed Train-Ferry Schemes for Nanking-Pukow and Wuchang-Hankow

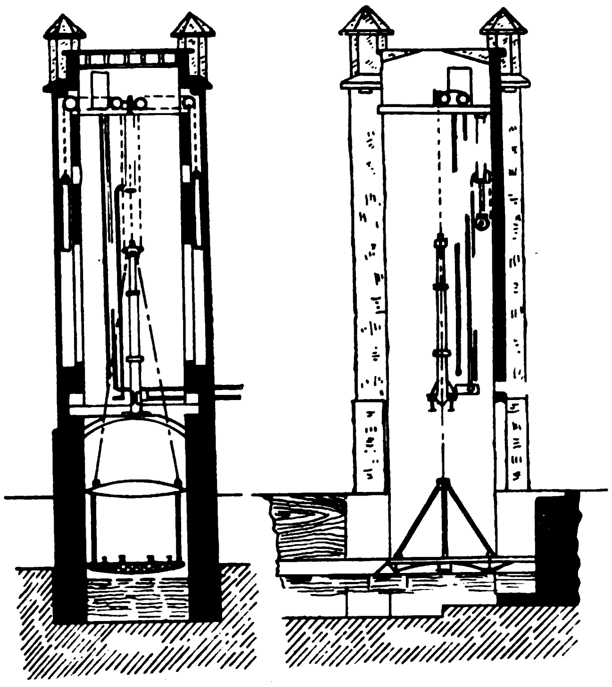
By *P. H. Chen.*

IT is well known to the traveling public that the most inconvenient part of the journey between Shanghai and Peking is to take the ferry boat between Nanking and Pukow. All the passengers have to get off at Nanking, look after their baggage, and wait for the ferry. On fine days, such accommodation is already unpleasant enough, but on inclement days, which are not uncommon in that section of the country, the conditions are indeed intolerable. Moreover, in order to arrange the train schedule for crossing the Yangtze River in daylight, trains must pass the bandit-infested districts in Shantung at midnight, and this, to a certain extent, was also responsible for the unfortunate Lincheng incident.

Not only passengers have experienced inconveniences and hardships, but the goods traffic has also suffered from poor economy and poor efficiency. At one end of the ferry, all the goods must be unloaded from the trains, loaded on the small boats, unloaded again from the boats and reloaded on the trains at the other end. The handling charges for a 40-ton carload across the Yangtze River have been as high as thirty dollars. Again, in rough weather, small boats have to stop operation, and consequently many cars which otherwise could be used to good advantage have to lie idle. And furthermore, on account of the lack of adequate accommodation, south bound trains from Lunghai Railway are restricted to only one train a day.

That there is a need for improvement of the trans-river service between Nanking and Pukow has been a long past conclusion. One reason why the attention has been neglected is that there have been some people who strongly oppose having the service improved, simply because they have a pet wish to see Pukow developed into a great center of commerce, one to take the place of Shanghai, or one at least equal to Shanghai. It is a matter of fact that, when compared with Shanghai, Pukow would be a better port, as it is very much farther inland while at the same time it has an adequate depth of water to accommodate the biggest ocean liner. Now these people maintain that the improvement of the transportation service between Nanking and Pukow would hinder such a development as desired. But they seem to ignore the fact that the possibility they see is still something in the future while the inconveniences and hardships are actual daily occurences. Fortunately there is a growing number of other people, who while not unaware of the possibility of Pukow as a commercial center, still see the urgency of the need of improving the service.

During the past years, many schemes for solving the problem were proposed by different engineers. Some advocated that a bridge should be built while others offered plans for a tunnel. But such proposals did not seem to have come from those who had actually investigated the site in detail. The present channel is 3,800 feet wide and 154 feet deep at low water. And further, it is by no means a fixed channel; it may possibly be shifted to Pucheng in the future. With unusual depth of water, swift current, and wide, shifting channel, it is beyond one's comprehension to have a bridge built at this site at moderate cost, and for the same reason it is also out of the question to build a tunnel with long approaches.



TRAIN-FERRY WITH A VERTICAL DEVICE ON SHORE.

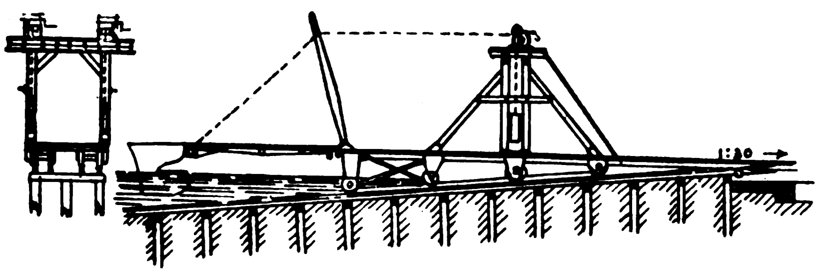
More recently other engineers have proposed the use of train-ferries, of which three different designs have been brought to notice, They are: 1. Train-ferry with a lifting deck; 2. Train-ferry with a vertical lifting device on shore; and 3. Train-ferry with a fixed incline on shore and a triangular movable gangway.

1. The train-ferry with a lifting deck is used in Europe and America only at places where the differences of water levels are small. The deck can be raised or lowered to suit the different levels and usually wire ropes are used for loading and unloading. This type of train-ferry has been very strongly recommended for Nanking and Pukow and details have already been worked out by some British firms, with an estimate of costs as follows:

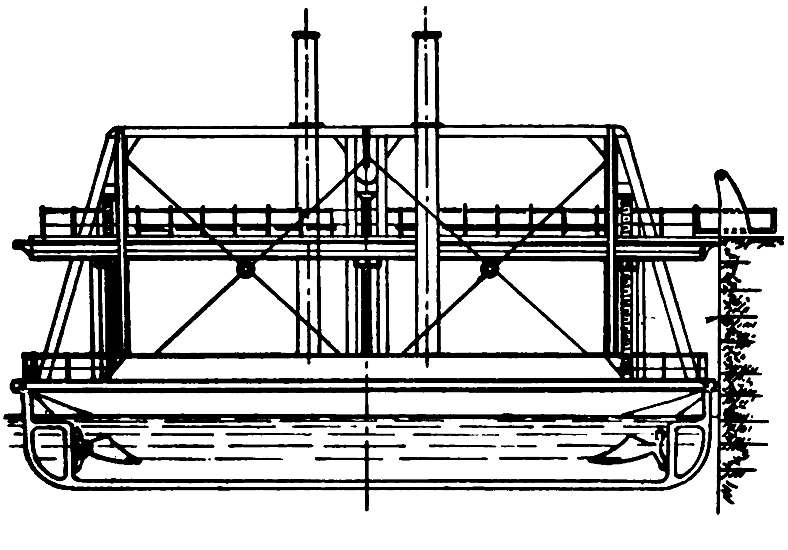
Piling and decking for wharves and jetties, approaches, moorings, earth work, etc.	$1,500,000
Train-ferries	4,100,000
Total	$5,600,000
Land to be acquired ..	1,250,000
Grand total	$6,850,000

In the first place this design is too costly and in the second place it is not practicable. In case of a heavy storm, it is exceedingly dangerous to have trains crossing the river some forty feet above the water level. Even in fine weather, it would have a great deal of psychological effect, on passengers riding at a dizzy height. If the deck is to be lowered and raised each time it is used, it will require too much time and expense. Moreover, such a ferry gets out of order easily and therefore needs too much care.

2. The train-ferry with the vertical lift on shore is common in Europe. The train has to be lowered every time to the level of the ferry and raised up again after crossing the river. Such a scheme requires too much mechanical operation. Nor does it seem economical to install powerful machines with a power house which is used only a few hours a day. Besides, they are easily out of order and the maintenance expense will be consequently very high.



A TRIANGULAR MOVABLE GANGWAY



TRAIN-FERRY WITH A LIFTING DECK

3. The train-ferry with a fixed incline and a triangular gangway is also being used in Europe and America. The gangway moves along the incline to suit the ferry. But one trouble with this scheme is that a part of the incline is under water all the time, so that in case there is something the matter with the structure, it is very difficult to repair. And further, the mooring place changes with the water level, and it is rather expensive to build a wharf of the right kind.

The schemes and designs mentioned above have been carefully studied and all have been found wanting so far as it concerns their being applicable to the crossing of the Yangtze River between Nanking and Pukow, and therefore in their place the writer wishes to propose in the following paragraphs a new train-ferry scheme, which is at once simple in construction, easy to operate, and cheap to build and maintain.

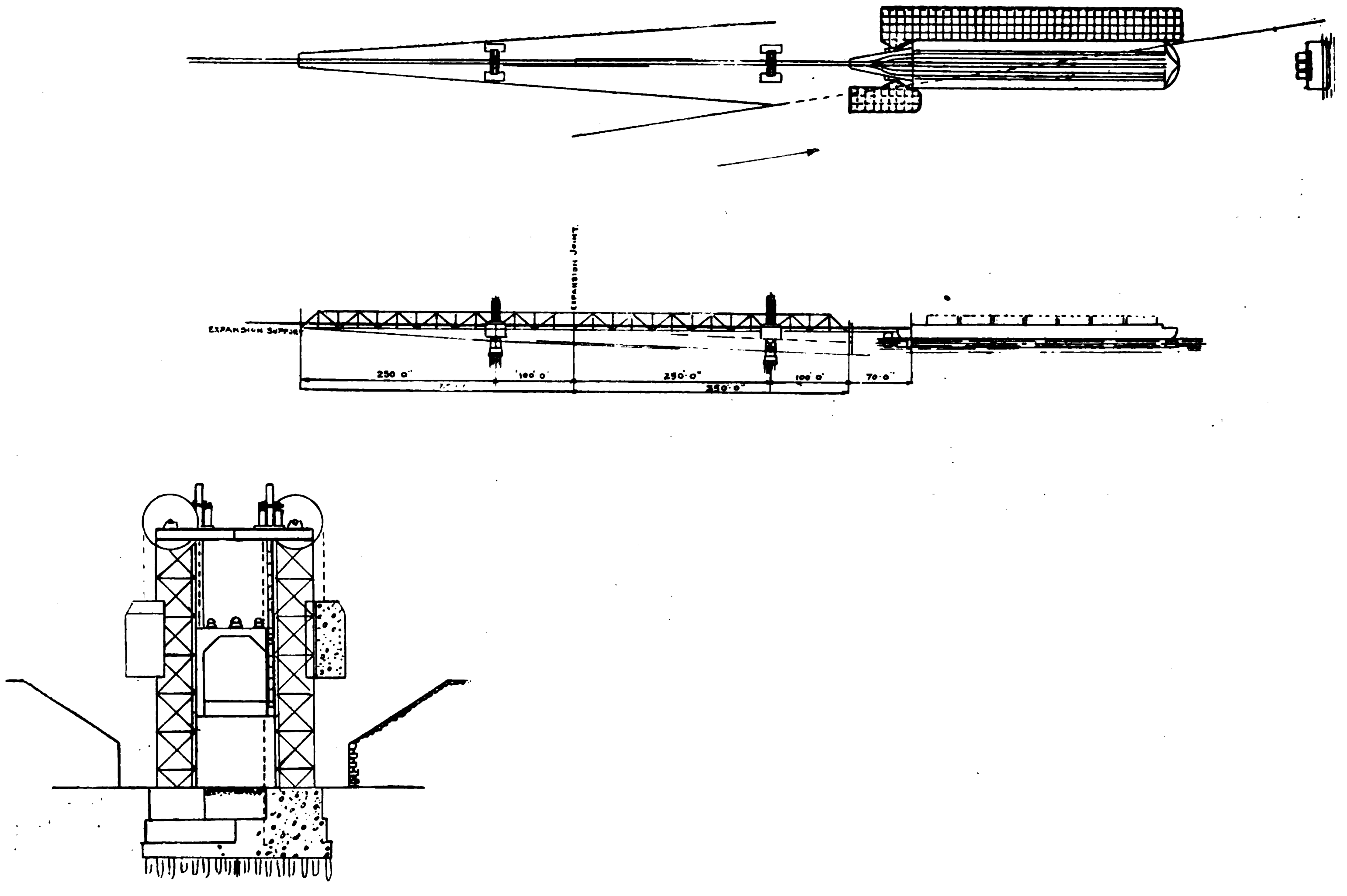
The new scheme is a train-ferry with a movable incline. The details are explained as follows:

1. *Ferry boat.* An ordinary ferry boat with three or four tracks on deck may be used. There is no special equipment on the ferry; it may be operated either by its own power or by a tug boat. The construction is therefore very simple.

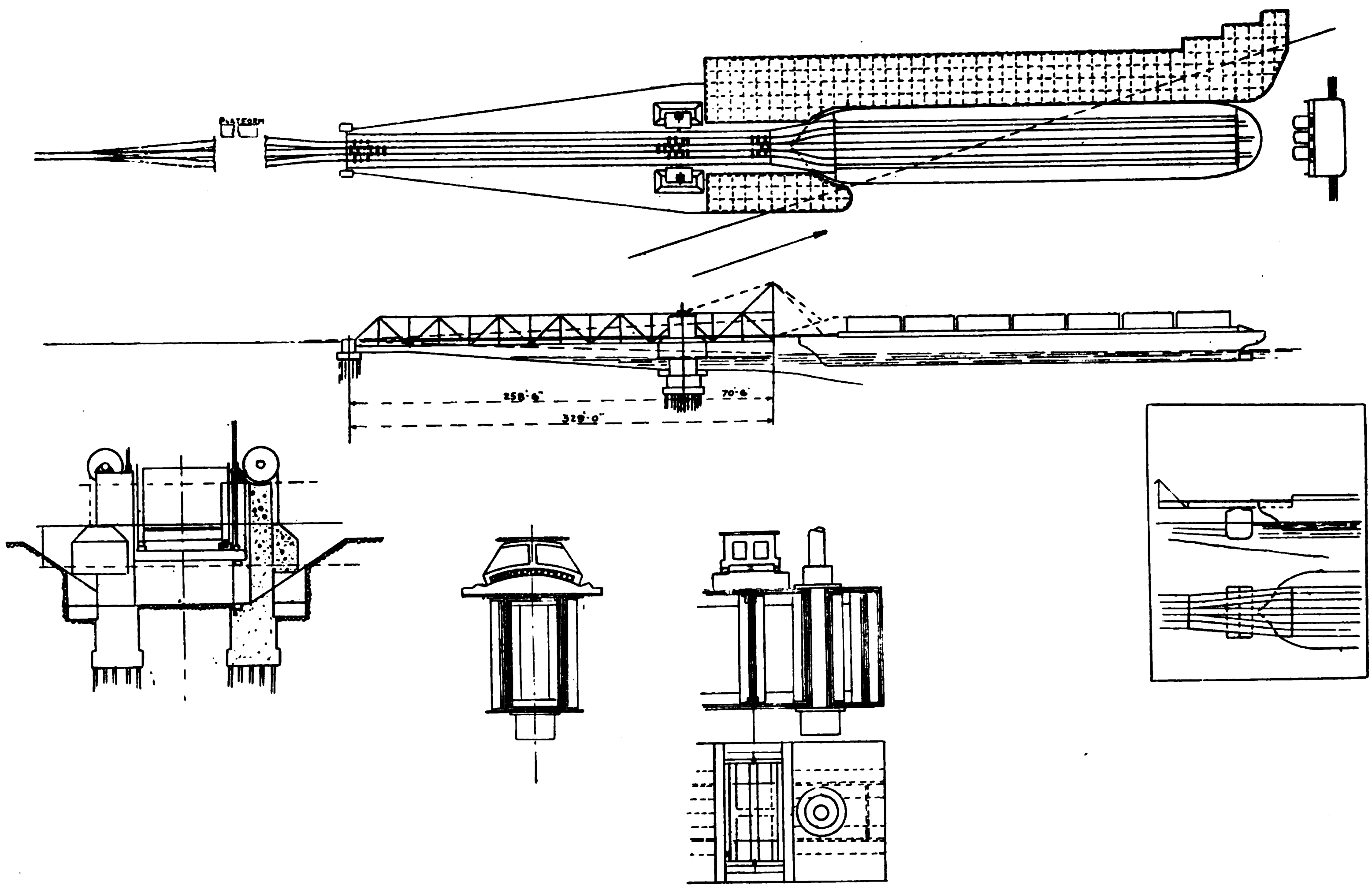
2. *Movable incline.* This is made in the form of a steel bridge, one end of which is hinged and the other end can be lifted by means of big screws resting on piers. The dead load is counter-balanced by counter-weights, the same as vertical lifting bridges. If there is no change in water level, it will remain in position. It is provided with a floating gangway, which by means of its change of slope, will take care of slight variations. This bridge can be raised or lowered either by an electric motor or by hand power, as the dead load is already counter-balanced.

3. *Loading and unloading trains* is done by a shunting locomotive with racks. The weight of the locomotive should not exceed the weight of the heaviest freight car, so that the locomotive can go on the ferry whenever necessary. Rack locomotives are the same as ordinary shunting engines, except with gears to work on racks. In this way, the tractive force on the incline does not depend upon the friction on rails, which renders the locomotive very safe on high grades. On level tracks, however, they will take the place of ordinary shunting engines.

4. *Grade.* With rack locomotives, a 4 per cent. grade will be safe for the incline. This is more so, as the deepest grade occurs only once a year within only a short period. To change to a lighter



PLAN OF TRAIN-FERRY BETWEEN HANKOW & WUCHANG



PLAN OF TRAIN-FERRY BETWEEN HSIAKWAN & PUKOW

grade will slightly increase the construction cost. Such details can be decided upon when the scheme is adopted.

5. *The wharf* is to be at an angle with shore line so as to reduce construction work in the river, and with the further advantage that it will not have the danger of scouring and possible damage by boats. There will be occasional dredgings to maintain a sufficient depth of water for the train-ferry.

6. *The location of the wharf* should be in front of the present station. Back shunting on both stations should be avoided by using curved platforms. On the Hsiakwan side, the train should enter the Nanking station at a curved platform and then directly go to the wharf without back shunting. The writer has personally visited these places and found such could be done without incurring excessive expenses.

7. *Train.* The track on shore is to be at the level of the highest water level. No part of the track will then be under water at any stage. The track on the ferry is twelve feet above the water level. The movable incline will be able to rise twelve feet and descend thirteen feet, which is equal to the maximum difference of high and low water levels.

8. *Estimate.* The train-ferry will cost approximately $600,000 each ; the movable inclines, about $650,000 ; the wharves, about $700,000 ; and miscellaneous expenses, $200,000. The total cost is about $2,750,000, exclusive of land required.

To have a train-ferry service for Wuchang-Hankow is even more difficult than to have one for Nanking-Pukow, because at Wuchang-Hankow the difference between the high and low water levels is nearly fifty feet. Although it is not impossible to build a bridge across the Yangtze River at this locality, yet the train-ferry is cheaper and for years to come will be able to handle economically the traffic of the present growth.

The proposed design for a train-ferry between Wuchang-Hankow is somewhat different from the one that is for Nanking-Pukow and the differences are as follows :

1. There will be only one track on the movable incline instead of three, and one special three-way switch on the floating gangway. The reason for this modification is to reduce the weight of the bridge which has to be rather long.

2. In order to compute stresses more definitely the towers are to be made of steel which may be encased in concrete to prevent rusting.

3. The expansion support is not on the tower. The bridge is definitely fixed horizontally at this point. The towers are designed to take the thrust.

4. The raising or lowering of the bridge is similar to the vertical lift bridges, that is, by the pulling of ropes, instead of turning the big screws.

5. The live load is taken by the built-up member of the structure with a number of pin holes every three feet apart. The bridge will be hinged for every three feet of difference in elevation. For finer adjustments, however, the hinge on the overhead girder is resting on an oil cushion, similar to a water jack. The oil runs in while the hing is raised and is automatically cut off when the hinge is lowered. In this way, the bridge can be adjusted to any elevation of a slight degree.

6. The incline will be 700 feet long to be divided into two sections, or if preferred, it may be 1,000 feet long and divided into three sections, each of which can be easily raised or lowered. If the difference in water levels is about ten feet, only the section next to the river is to be raised or lowered, and the other sections are to be moved only for greater differences in water levels, say twenty feet and above.

The Sibalom River Irrigation System

Antique Province, Philippines

From the Chief Irrigation Engineer's Report, June, 1924

THE project takes water from the south bank of the Tipuluan River and conveys same through a short main canal and a tunnel 128 metres long to the lands to be irrigated. The area of the irrigable district is 3,500 hectares located in the municipalities of Sibalom and San Jose of Antique Province in Panay Island. The land to be served by the proposed system is all under cultivation and is shown on the accompanying map.

San Jose, one of the two towns to be benefited, is the capital of the province and an automobile road connects it with the town of Sibalom. Small steamers provide a weekly service between San Jose and Iloilo, the third largest port in the Philippines. A road to connect these towns is well under way and will greatly improve market facilities when completed.

The entire area under the project is devoted to growing one crop of rice a year, but it is actually producing a very low yield.

The Sibalom Irrigation Project

The need for irrigation in this district has been recognized for many years as indicated by numerous resolutions received from time to time from the interested municipal councils and the Provincial Board of Antique. Crop failures or partial failures have been frequently reported during the past twenty years. Rainfall hydrographs of this district show that the rainfall is not adequately distributed to mature a normal rice crop.

A very small area is used for growing dry season crops of corn, tobacco and vegetables. The production of palay should be increased to 50 or 60 cavanes per hectare, which is fully 50 per cent. more than the present average yield. The proposed system will also provide sufficient water for a second crop of rice on the entire area under the projects.

The land has good natural drainage and placing it under irri-

gation will not necessitate the construction of artificial drains. The construction of a dyke bordering the main canal will prevent the inundation of the land by the Sibalom River and the loss of crops due to floods.

Gaging stations have been maintained on both the Tipuluan and Sibalom rivers covering a period of about 3 years and the records show that there is an adequate water supply for growing two rice crops a year on the land included under the proposed system. There are no existing water rights to interfere with the success of the project.

Irrigation Plan

The system, as planned, consists of a permanent headgate structure to draw water from the natural level of the river except during extreme low water when a temporary brush dam may be used to raise the water. Should changes occur in the river channel making it difficult to divert water without a dam during the rainy season, a low weir with falling shutters may be constructed at a comparatively small cost to regulate the flow in the main canal. The canal system includes 3.2 kilometres of main canal and approximately 50 kilometres of lateral canals. On the river side of the main canal, north of the town of Sibalom and also above the tunnel a dyke approximately 2 kilometres long and 2 metres high has been constructed, as indicated on the map of the project, to prevent the river from flooding the town of Sibalom and the land included under the system.

The construction of this project without a diversion weir involves no engineering difficulties and in case it should be necessary later on to build a weir, the diversion site selected is the best available site for the construction of a permanent weir. The construction of the canal system involves approximately 150,000 cubic metres of earthwork and the building of the usual canal structures to regulate the flow of water in the system and to provide drainage and road crossings.

The estimated cost of construction without a diversion weir is as follows :

Headworks	P. 28,000.00
Earthwork	125,000.00
Canal Structures.. ..	110,000.00
Right of way	1.000,000
	P.273,000.00
Engineering, 9% ..	24,570.00
Total	P.297,570.00
Say	300,000.00

The construction of the diversion weir is estimated to cost about P.250,000.00.

On the assumption that the system will be constructed without a weir to irrigate 3,500 hectares of land, the estimated cost per hectare is P.85.70. The equal annual installments to be paid in 20 years on the basis of the above cost of P.85.70 per hectare will be P.10.73 per hectare which consists of the following items : Construction charge, P.4.285 ; interest charge, P.3.73 ; estimated operation and maintenance charge, P.2.50 ; and insurance which is 2 per cent. of the preceding items, P.0.21.

The following reasons were advanced in recommending the construction of the project to the Secretary of Commerce and Communications of the Philippine Cabinet ; (1) The rice crop will be insured on the largest tract of available rice land in Antique Province ; (2) the land is all under cultivation and a sufficient water supply is available for growing two crops a year ; (3) the crops produced will find a ready market in Iloilo and Occidental Provinces ; (4) the production of rice will be increased in one of the most populous districts of Antique Province ; (5) the recent crop losses caused by droughts and floods will be prevented ; and (6) the cost of construction is low.

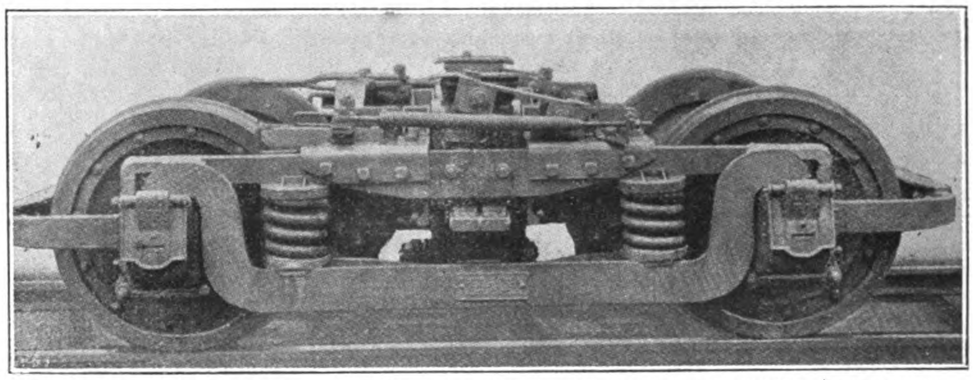
Construction work was started when the contract for the excavation of the entire canal system was awarded early this year to Mr. A. G. Yankey, a local contractor. The construction of canal structures was awarded to Mr. S. Nagauye, a Japanese contractor. Construction work is scheduled to be completed before the beginning of the rice growing season of 1925.

Kunishima Waterworks, Osaka

(*Continued from page 715.*)

Table 2.

	Guaranteed	Test No. 1	2	3	4	5	6	7	8	9
Load, approx ...		1/2	3/4	7/8	4/4	9/8	4/4	5/4	4/4	0
Delivery, cub. ft. per min ...	600	240.4	465.9	532.1	610.3	681.3	613.7	769.1	612	0
Delivery Head, ft. mano		192	192	188.7	185.5	177.6	185	163	177.5	172.5
Suction Head, ft. mano		7.9	7.9	8.1	8.4	8.9	9.1	9.6	14.8	14.7
Total Head, ft. mano	180	199.9	199.9	196.8	193.9	196.5	194.1	172.6	192.3	187.2
Revs. per min ...	1170	1200	1185	1180	1175	1170	1175	1175	1180	1190
Motor input in K.W.		128	186	202	222	241.2	224.8	262.4	223.2	90
Net power in K.W.		67.9	131.7	148	167.3	179.6	168.4	187.6	165.4	
Combined efficiency ... per cent.	74.5	53.04	70.79	73.27	75.34	74.32	74.9	71.5	74.1	

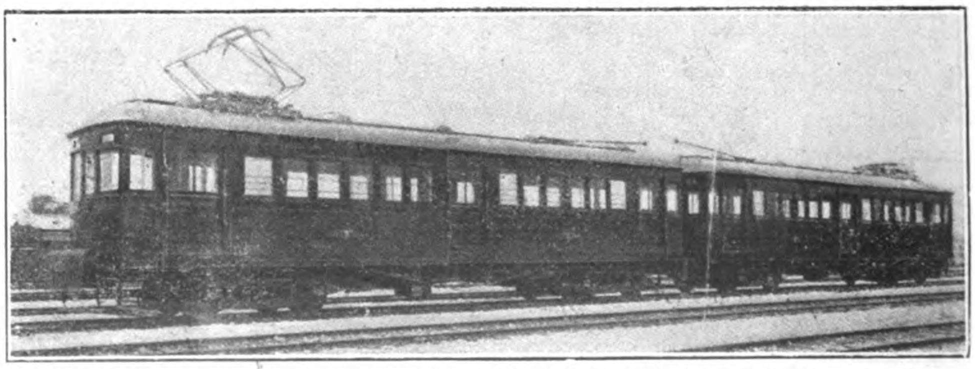


Brill Equipment for Japan.—Typical high-speed interurban Brill No. 27-MCB2 Truck furnished to the Hanshin Express Electric Railway, one of the leading interurban systems of Japan. Equipped with 33-in. diameter steel tired wheels, 4¼ by 8-in. MCB journals, and having 6-ft. 6-in. wheel base

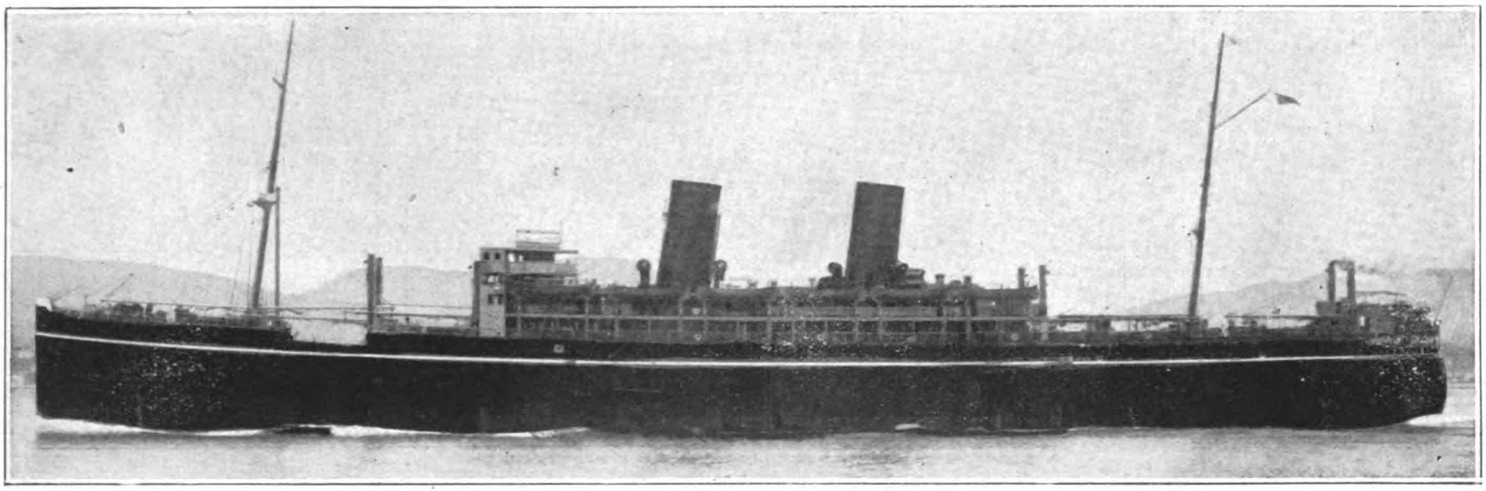
Brill Equipment for Japan

ANOTHER illustration of the world-wide activity of Brill Equipment in the field of transportation is to be found in a shipment made a few months ago to the Hanshin Express Electric Railway, Japan. It consisted of twenty No. 27-MCB2 Trucks, 6-ft. 6-in. wheel base, equipped with 33-in. steel wheels and 4¼ by 8-in. M.C.B. journals, and ten carsets of platform hand brakes and body brake riging.

The Hanshin Express Electric Railway is one of the leading interurban railway systems in Japan. It already had in its service numerous other Brill Trucks, and this recent shipment is an indication that their service has measured up to the high standard for which Brill Trucks are known.



Brill Equipment for Japan.—Brill 27-MCB Trucks in service on lines of Hanshin Express Electric Railway



New P. & O. liner *Chitral* on its recent trials

New P. & O. Liner—"Chitral"

BUILT and engined by Messrs. Alexander Stephen & Sons, Ltd., Linthouse, Glasgow, the *Chitral* was completed and delivered to the Peninsular and Oriental Steam Navigation Company on June 12, and is scheduled to make her maiden trip to Australia on July 3. This will enable the company to maintain an uninterrupted fortnightly service as she will run in conjunction with nine other vessels.

The principal dimensions of the *Chitral* are :—

Length overall	574 feet
Length b.p.	524 feet 7 inches
Breadth, moulded	70 feet
Depth, moulded to shelter deck	46 feet
Draft	30 feet 3 inches
Displacement	22,400 tons
Deadweight	11,000 tons
Gross tonnage	15,248 tons
Speed at sea	16 knots
Indicated horse power	11,000

The vessel has nine watertight bulkheads and six main cargo holds, with a total capacity of 600,000 cubic feet. Holds Nos. 2, 3, and 4, immediately adjacent to the machinery spaces have a capacity of about 300,000 cubic feet, and are insulated for the carriage of meat and fruit, the meat being refrigerated by the usual cold brine grids, and the fruit cooled by a system of motor fans and air trunks. In addition to the refrigerated cargo spaces the ships provision rooms are also insulated and refrigerated. The refrigerating plant is supplied by J. and E. Hall Ltd., Dartford, and the insulation has been carried out by Livingston & Co., Ltd. Glasgow.

The extensive mail and parcels rooms are arranged for sorting the mail bags during the voyage, as the vessel will deliver and receive mails at all her ports of call.

The cargo-handling appliances are designed on the union purchase system to deliver cargo simultaneously on both sides of the ship. Each hatch is, therefore, fitted with four winches, there being twenty-two 3-ton and four 5-ton Laurence Scott electric winches. The derricks are of tubular steel, and a 40-ton derrick has been fitted and tested under load at the foremast to take the occasional heavy cargo in No. 2 hold.

The number of passengers has been strictly limited—203 first and 103 second saloon passengers—in order to provide the greatest possible number of single berth state rooms. The remaining rooms have two berths, and some 18 rooms have folding upper berths for use when desired, these being the only upper berths in the passenger accommodation.

Every cabin has a porthole and an electric heater, and the furniture includes dressing table and drawers, wardrobe and wash-basin for each passenger, besides numerous hooks, hangers, and other gadgets.

There are de luxe and special suites with separate bath-rooms for 24 passengers, these rooms being specially decorated with hardwood or enamelled panelling. Baths are provided on an ample scale, and the ladies lavatories are fitted with electric irons and other appliances.

The first class lounge, music room and smoking room are situated amidships on the bridge deck. The lounge is in the 18th century style, and panelled in beautifully finished French walnut, with a fireplace of carved marble as the central feature of the room. The plaster ceiling is also noteworthy. The carpets are Persian in fawn and green, and the varied tapestry coverings to the walnut furniture give a very rich but subdued effect.

The music room is panelled in the Adam style. The walls are finished in green and ivory, with the delicate enrichments scrumbled. The raised roof rises to a height of 16 feet, with a circular cupola in wrought iron. The enriched plaster ceilings are particularly successful, the whole room giving a feeling of height and dignity. The floor, which is intended for dancing, is inlaid with oak parquetry. The furniture is a rich mahogany, and the coverings in green silk damasks are in harmony with the walls.

The smoking room is panelled in a bleached British oak and treated after the manner of the Gothic craftsmen of the 15th century. The varied carvings in this room are full of interest, and with the fine stone chimney piece and the ingle nook make this room peculiarly quaint and pleasing. There is a very fine laylight in the half timbered dome with leaded glass panels showing the armorial bearings of the ports of call of the ship. The furniture is oak and the coverings antique hide with occasional pieces covered in tapestry. The aft end of the smoking room opens into a verandah simply trested with plaster panels and fitted with Dryad cane furniture.

The first class dining room is on the upper deck and extends the full width of the ship. The treatment here is based on the style of about 1750, the color scheme being of buff and blue. The rich blue Scagliola columns are very attractive. The mahogany furniture consists of restaurant tables for two or more passengers with the chairs covered in blue to harmonize with the curtains and coloring.

The first class entrance on the bridge deck is noteworthy. The design is of the 18th century somewhat similar to the lounge The walls are finished in cool ivory with the carvings scrumbled, and an unique feature is the introduction of an old fashioned

grandfather clock, placed in an alcove at the after end. The first staircase is mahogany with a fine wrought iron balustrade.

The second dining saloon is further aft on the same deck, and is of a simple Georgian design with ivory walls, the enrichments being scrumbled. The furniture here is dark oak. The second music room and smoking room are situated at the after end of the shelter deck. The smoking room is a simple and cosy room, panelled in a rich brown oak, Scotch in treatment. There is a red rubber floor here laid in the form of a brick floor. The music room is panelled in the English Empire style and finished in two shades of grey. The color tones are rose and grey. The furniture is Sheraton and in mahogany. The whole of the public rooms were designed by the builders. The work was carried out by Waring & Gillow, Ltd., London, under the untiring supervision of the Hon. Elsie Mackay, daughter of Lord Inchcape, chairman of the P. & O. company.

The most noteworthy of the auxiliary details of the ship is the punkah louvre system of ventilation by the Thermotank Company. Fresh air is supplied to both passenger and crew quarters, with exhaust systems from all galleys, pantries, lavatories, etc. The supply trunks are so arranged that not only every room but every berth receives a separate supply of fresh air through the punkah louvres, which may be directed wherever each passenger may desire. The air is delivered from motor fans on the boat deck, the inlets being covered with mosquito proof netting.

Among other fittings may be mentioned the open air swimming bath and the laundry, fitted with a complete installation of motor-driven washers, ironers, driers, etc., also the oil fired cooking apparatus by J. Phillips & Co., Glasgow, and the milk machine to supply impeccable fresh milk and ice cream at any time and in any climate.

The safety appliances include twelve sets of MacLachlan gravity davits which enable one man to handle without effort any of the eleven 29 feet lifeboats or the 30 feet motor lifeboat; a wireless installation and a wireless direction finder by the Radio Communication Co., Ltd.; a motor driven electric generator on the boat deck to give current in emergency for lighting the ship and working the lifeboats, the lift from the engine room and the large emergency pump; Stone-Lloyd watertight doors below the water line and fireproof divisions and doors on the accommodation.

The propelling machinery consists of two sets of balanced quadruple expansion engines having cylinders $29\frac{1}{2}$ inches, $42\frac{1}{4}$ inches, and $60\frac{3}{4}$ inches, and 67 inches diameter with a stroke of 54 inches, and are capable of developing 11,800 i.h.p. for a speed of 16 knots on service. Steam is supplied by four single-ended and three double-ended cylindrical boilers working at a pressure of 215 lbs., and burning oil fuel on the "Clyde" system, of which the builders are the sole licensees, with Howden's forced draught. The main propelling machinery and the auxiliary machinery throughout are of the highest class, and have been fitted with all the latest improvements in design.

The dynamos, by Shanks & Co., are five in number, to give current to the numerous electric fittings, winches, and fans throughout the ship. The windlass and four warping capstans forward and aft are driven by steam, as is the steering gear, the steam tiller type by Brown Bros., Edinburgh. Twelve sets of the MacLachlan automatic patent gravity davits are being supplied. Eleven sets handle the 29 feet lifeboats, while the twelfth handles the 30 feet motor life boat.

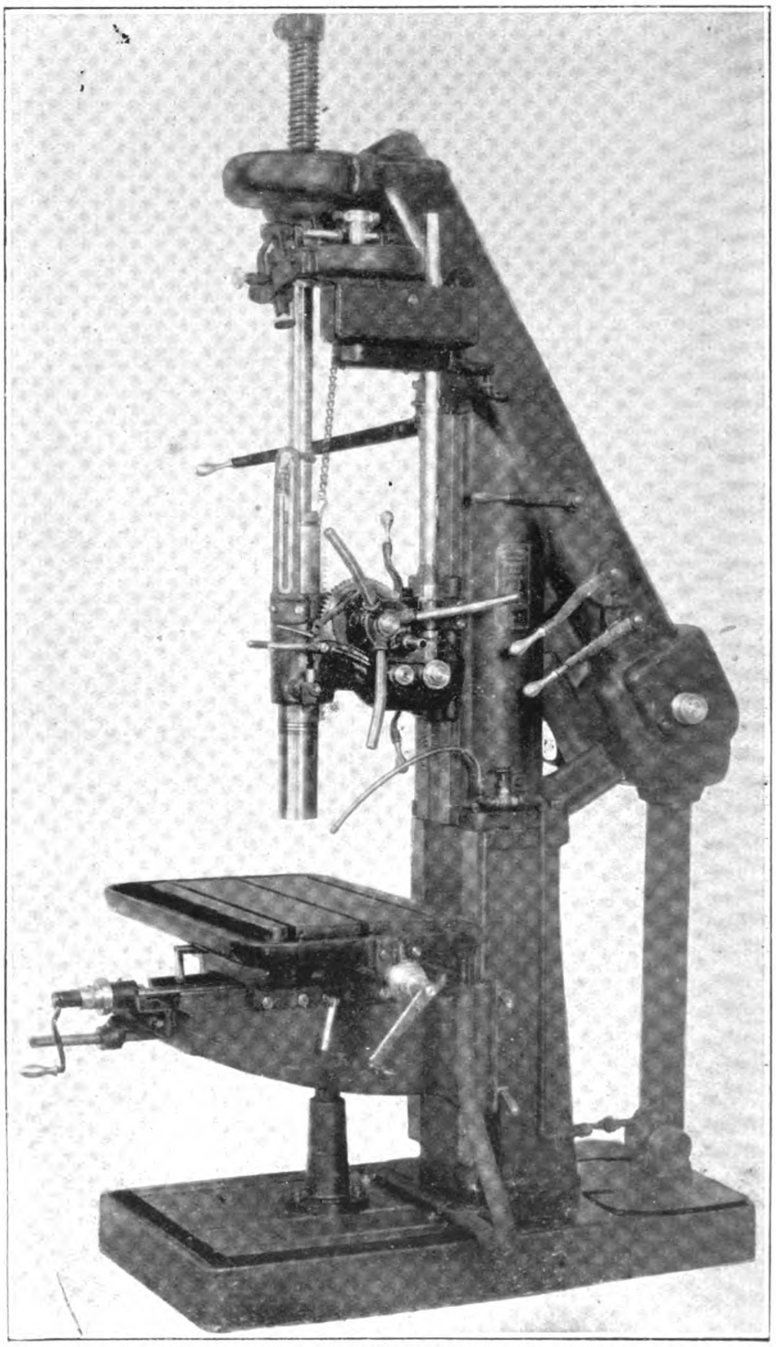
Self Oiled All Geared Sliding Head Drill and Tapper

WHAT is described as the very latest unit of "Self Oiled All Ball Bearing All Geared Drill" is here shown with compound table and special oil base having pumps on either side with oil well at the rear for the cutting coolant.

The pump shown, however, has nothing to do with the "Self Oiled System." The geared pump which takes care of the Self Oiling System is in the oil reservoir where the drive shaft is indicated at the foot of the backbone, and on which shaft will be seen pulley for driving the coolant pump.

This machine embodies all of the advantageous features of the All Geared construction, besides having a Sliding Head. It has thirteen radial ball bearings in addition to the spindle thrust bearing. The Self Oiling System automatically oils all bearings continuously. Friction is thus reduced, until with one finger, all shafts and spindles may be easily rotated.

There are available eight changes of geared speeds and eight changes of spur geared feeds, all under instant control from the front of the machine. The worm and worm gear with resulting wear are eliminated.



Self Oiled all Geared Sliding Head Drill and Tapper

Observe Star Wheel Handle which operates thru Internal Gear in ratio of four to one. A great improvement over ordinary lever.

Dovetail method of attaching rack to sleeve is used. In this construction, key takes thrust. No screws are used.

All Gears are fully enclosed, meeting requirements of modern safety laws.

This super-production drill handles high speed twist drills up to 2-in. at suitable speeds and feeds. Bores an 8-in. hole in cast iron.

The drill is furnished with back gears, spur geared feeds and automatic stop complete.

Construction Cribs near the 168th Mile, East Coast Railway, Pahang Section

Construction Work on the F.M.S. Railways

THE total expenditure during 1924 on construction work and surveys of new lines in the Federated Malay States, Straits Settlements and Johore amounted to $3,918,237 as compared with $6,788,784 for the year 1923.

East Coast Railway : Kelantan Section.

This railway starts from Tumpat and proceeds southwards towards Kuala Lipis in Pahang, the distance from Tumpat to the Pahang-Kelantan boundary being 140¼ miles.

The line from Tumpat to Tanah Merah (32 miles) was opened for traffic on July 1, 1915, and from Tanah Merah to Krai (20 miles 55 chains) on July 21, 1924.

The official opening of the "Guillemard Bridge" over the Kelantan River took place on July 19, 1924. This bridge which is the largest in the Peninsula and is situated about 35 miles from Tumpat was commenced in 1920. It is 2,166 feet long over all being composed of five clear spans of 250 feet and five spans of 150 feet. The height from the river bed to the under side of girders is 55 feet.

The quantity of concrete and brickwork in abutments and piers is about 20,000 cubic yards and the total weight of steel work in the girders is 2,776 tons.

Floods in January-March-November caused a certain amount of damage and delay. The rainfall for the year at Tanah Merah was 112.1 inches.

Earthwork between Tanah Merah and Kuala Pergau excavated during the year was 569,753 cubic yards of earth and 118,247 cubic yards of rock for main line ; 21,823 cubic yards of earth and 2,258 cubic yards of rock in stream diversions ; 93,685 cubic yards in stations yards and 85,200 cubic yards were filled in at Tebbing Tinggi Bund.

Platelaying reached the 63rd mile from Tumpat southwards.

In addition to the Kelantan Bridge the following large bridges were completed during the year. Sungei Bedal Bridge, one span of 100 feet ; Sungei Nal Bridge, two spans of 100 feet and two of 250 feet ; Sungei Durian Bridge, one span of 150 feet ; Sungei Krai Bridge, two spans of 100 feet each. The main bridges now under construction are the Lebir Bridge, two spans of 250 feet and three of 100 feet each ; Pahi Bridge one span of 150 feet and two of 100 feet ; Sungei Chanih Bridge, one span of 100 feet and Sungei Pria Bridge, one span of 150 feet.

Stations and the necessary quarters were opened at Sungei Kusial, Temangan, Sungei Nal and Krai.

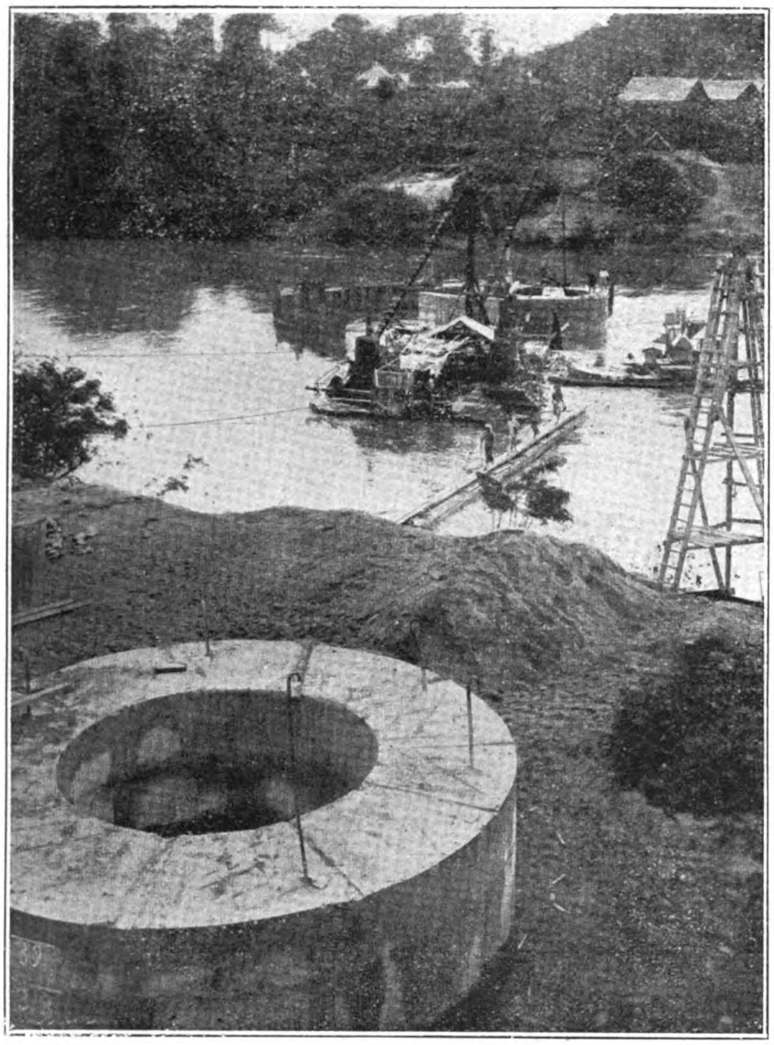
The headings of tunnels Nos. 1 and 2 at mile 69¼ were driven through and good progress made towards lining. A decauville track was laid from Manek Urai (63 miles) to the entrance of the tunnel.

The expenditure during the year amounted to $1,388,697.

East Coast Railway : Pahang Section.

The work beyond Chigar Perah, 163½ miles from Gemas, was recommenced in December, 1923.

Good progress was made on earthwork and jungle felling, some 247.97 acres of jungle being felled ; 361,325 cubic yards of earth and 116,164 cubic yards of rock being excavated on main line ; 27,341 cubic yards in stream diversions of which 4,472 cubic yards were rock ; 13,266 cubic yards of earthwork were done in station yards,



Well Sinking for Bridge over Lebir River, 63rd Mile, East Railway, Kelantan Section

temporary yards and sidings and 1,687 cubic yards removed on account of slips.

Platelaying was completed to 170 miles and $5\frac{1}{4}$ miles of track were lifted and packed.

Locomotive water supply tanks and pump house at Chigar Perah were in course of erection.

Work on the tunnel at 171st mile has been started.

All bridges from Chigar Perah, $165\frac{1}{2}$ mile to 171st mile, have been completed.

The expenditure during the year amounted to $476,614.

NEW ENGINE, CARRIAGE SHED AND GOODS YARD, IPOH.

The work of metalling the Kuala Kangsar Road Deviation was almost completed at the end of the year and a considerable amount of excavation and filling was done in the new goods yard.

The expenditure during the year amounted to $49,136.

KUALA KUBU DEVIATION.

This work, which was in progress at the end of 1923, was completed in July, and handed over to Open Lines on August 1, 1924.

Seventy-three thousand four hundred and eighty-four cubic yards of main line earthwork, one bridge of 150 feet span over the Selangor River and two (one of 40 feet and one of 60 feet span) over the Rasa River, together with station buildings, goods shed platform and loading dock and approach roads to the station and goods shed at Kuala Kubu Road were completed during the period.

The expenditure during the year amounted to $15,114.

PORT SWETTENHAM DOUBLING.

Construction work on the new bridge near the existing Connaught Bridge was started during May.

Plans have been completed and indents for steelwork and caissons sent to the Crown Agents.

Boring was carried out at six different places at the site of the new bridge, the average depth of the bores being 80 feet.

The expenditure during the year amounted to $55,811.

DOUBLING LINE, BATU JUNCTION TO KUALA LUMPUR AND SUNGEI BESI.

The doubling work, which was suspended between Batu Junction and Kuala Lumpur in 1920 and between the Abattoirs and Sungei Besi in 1923, was reopened in January.

The double line was opened to traffic between the Abattoirs and Salak South Junction on August 1, and the new down main line between Salak South Junction and Sungei Besi was finished on November 19, the old main line between these points being regraded.

Steady progress was made on the Kuala Lumpur and Batu Junction Section, the heading through the tunnel being completed on November 1. Swettenham Road Bridge was completed and work was started on the Residency Road and Club Road Bridges.

The total amount of earthwork executed during the year was 80,397 cubic yards and 4,076 cubic yards of rock.

The expenditure during the year amounted to $294,573.

CARRIAGE AND ENGINE SHEDS AND GOODS YARD, SEREQBAN.

The filling up of the locomotive and carriage yard sites was practically finished.

Contracts were let for the completion of the engine and carriage sheds.

All roads and fences in connection with this work have been handed over to Open Lines.

Pipe drains were put in hand; also sidings to the engine yard and are nearing completion.

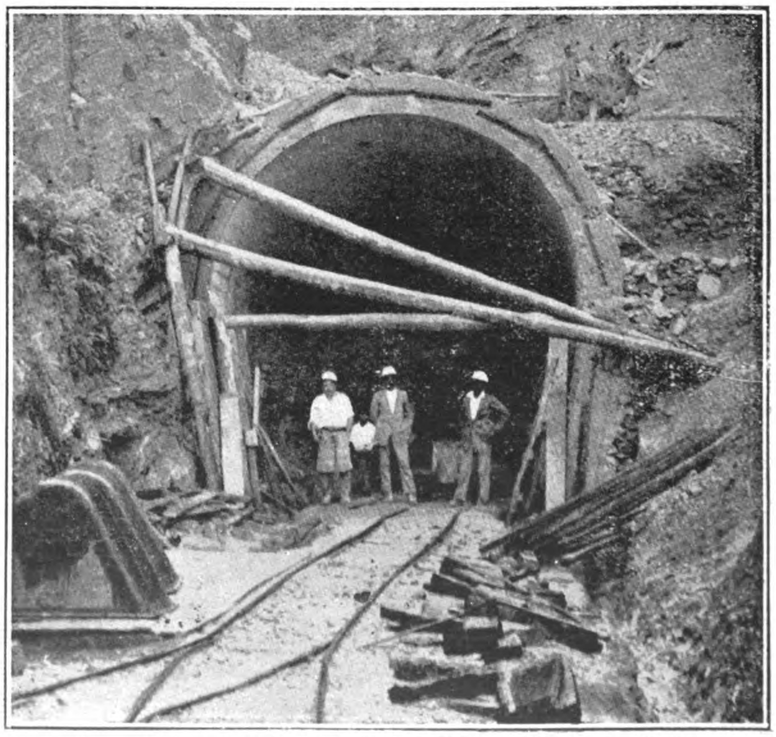
The engine turntable was erected.

The expenditure during the year amounted to $77,678.

CAUSEWAY ACROSS THE STRAITS OF JOHORE.

The Johore State Railway, leased to the Federated Malay States Railway System, was opened to traffic in the year 1909, and coincident with this opening a ferry service between Johore Bahru and Woodlands for purposes of carrying goods across the Straits was brought into use. Ferry boats carrying six goods wagons at a time for transhipment were also started.

It had been anticipated by the first General Manager of Railways, Mr. C. E. Spooner, C.M.G., that the time would not be far distant when the volume of traffic across the Straits would become so great that some means other than ferry boats would be required and it was his suggestion in 1904 that the Straits between Johore Bahru and Singapore Island should be bridged. After consideration of this and other schemes for a period of some years, Mr. W. Eyre Kenny, then Acting Colonial Engineer, Singapore, made the suggestion that a rubble causeway should be substituted for a



Tunnel at 69th Mile, East Coast Railway, Kelantan Section

Bridge over the Nal River, 48th Mile, East Coast Railway, Kelantan Section

bridge. After examination of all the suggestions, Messrs. Coode, Fitzmaurice, Wilson and Mitchell, Consulting Engineers, Westminster, were asked to prepare plans and estimates for the construction of a causeway.

These plans finally shewed a causeway, 60 feet wide on the top—carrying two tracks of railway and a 26 feet roadway—with a total length of 3,465 feet—the greatest depth crossing the Straits being 77 feet—and the average depth of water being 47 feet at low tide. Provision has been made at the Johore end of the causeway for the passing of small local craft by the provision of a lock, 510 feet long from end to end—which lock is provided with a double set of gates spaced 170 feet apart with a width inside the gates of 45 feet and outside 32 feet. This lock has been crossed by a Schiller roller bridge with three girders.

The total width of this bridge is 57 feet, carrying two lines of railway and a clear roadway of 24-ft. 6-in.—the lift bridge 570 tons in weight and the tide gates being operated electrically.

One million six hundred and forty-one thousand seven hundred and twelve cubic yards of granite were used in the construction of the causeway, the total cost of which was $12\frac{1}{4}$ millions approximately.

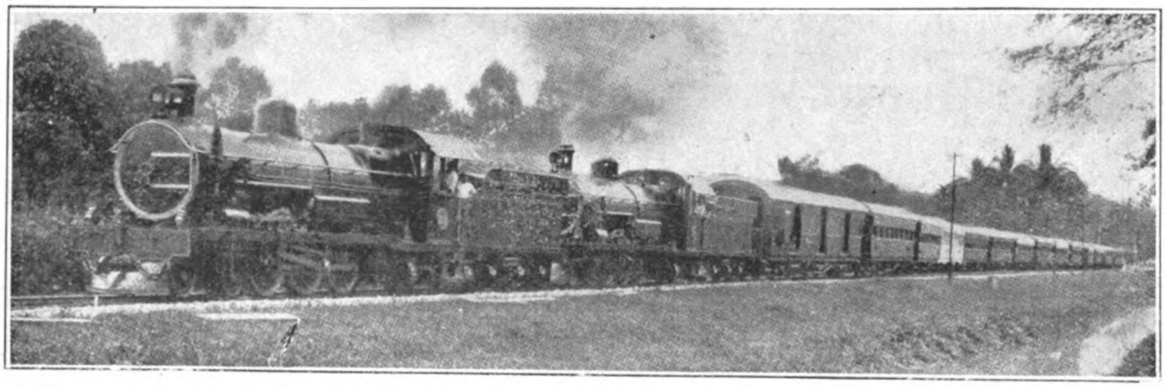
The roller bridge selected for the crossing of the lock is the only one of its type in this part of the world and it is believed that the causeway itself is the first work of this magnitude anywhere adopted.

The ceremonial opening was performed by His Excellency the Governor and High Commissioner in the presence of Their Highnesses the Sultan of Johore and the Rulers of the Federated Malay States, and the Chief Secretary to Government, Federated Malay States, on June 28, 1924, and the causeway has been in continual use from that date.

The result has greatly facilitated the working of railway transport; it has also tended very materially to increase motor transport as between Singapore and the mainland, and although the original idea for the construction of this causeway was enunciated by railway authorities for the purpose of facilitating its own transport and increasing its revenue, yet it cannot be wholly said that this has actually resulted, for the receipts between Johore Bahru and Singapore previously taken by the railway have been reduced by some $5,000 a month, as a result.

Mr. P. A. Anthony, C.M.G., was General Manager and Chief Engineer of the Railways during the designing and constructing of the causeway and Messrs. Topham, Jones and Railton, London, were the contractors.

The expenditure during the year amounted to $1,015,830.



Royal Special Conveying H.M. The King of Siam from Singapore on 29th September, 1924, Drawn by F.M.S.R. Locomotives

Gold Mining in the Philippines

(Continued from page 699.)

Miscellaneous Districts

There are numerous localities where both lode and placer gold have been found in small quantities and where larger gold production might be looked for, but they cannot be handled under present conditions. These localities have all been referred to in various issues of Mineral Resources of the Philippine Islands.

Some of the more promising areas for prospecting, in my estimation, are the following: The mineral belt from Baguio north to the Pacific Ocean, lying a little to the east of Baguio and Bontoc and following very nearly the crest of the Cordillera Central (this belt is 10 to 15 kilometers wide and is largely due to granitic intrusions); the cordillera of Camarines Norte south of Paracale; the main cordillera of Panay on the boundary of Antique Province; the eastern cordillera of Mindanao (Diuata Mountains).

It is more than likely that some good gold prospects may yet be located in Palawan, Mindoro, the Zamboanga Peninsula, and the eastern cordillers of Luzon, but I am not so sanguine about these regions as I am of those mentioned in previous pages.

The conditions affecting the welfare of this branch of mining in the Philippines are very much the same as those which have been discussed in connection with the industry in general. The most important needs at present seem to be capital, cheap power, more widespread interest, and a better price for gold; that is, lower cost of supplies, etc.

Production.—Figures showing the gold production for 1920 are given in Table 25.

The Need for Testing Materials of Construction used in the Far East

(Continued from page 703)

of the Government, included the following remarks in his statement.:—

A systematic inspection of old retaining walls has been commenced. All the walls in the Taiping Shan District, together with many others situated on the lower and middle levels, have been already carefully surveyed ; measurements and all other relevent data have been collected and conveniently tabulated for future reference and comparison. In several instances walls have been plumbed at intervals and diagramatic profiles plotted for further investigation. A similar inspection of walls in other districts of the city is at present in progress, and reports will be prepared as the necessary data are collected. Some of the walls already inspected are of very poor construction—considerably more so than the wall South of In Mi Lane, which collapsed in July*—and in certain instances the Public Works Department has already communicated with the owners—under powers bestowed by the Public Health and Buildings Ordinance—in reference to work which should be undertaken. No inspection, however careful, can of course provide against accident arising from disintegration below the foundations due to undetected subterranean water. After the completion of the systematic inspection now in hand, arrangements will be made for a quarterly return to be kept, giving particulars of any changes that may occur."

No doubt the general public in Hongkong will feel re-assured by this statement.

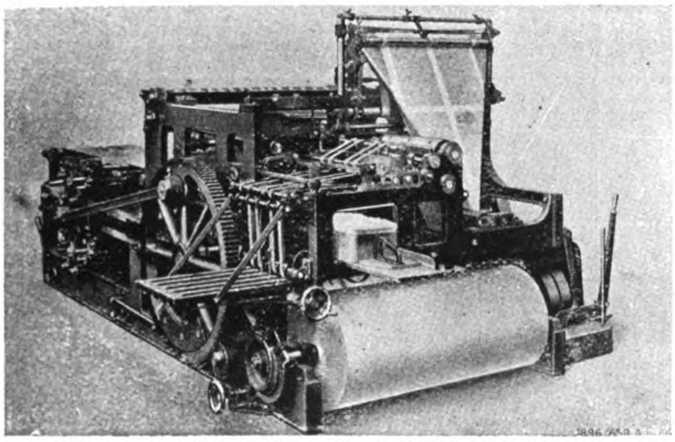
*Sometimes referred to as Po Hing Fong.

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 **Employees abt. 2,000**



Duplex Press with one Paper Roll, Delivery Side

SPECIALITIES:

Portland Cement Works
Brick and Tile Making Plants
Chocolate and Cocoa-Factories
Breweries and Malteries
Powder and Celluloid-Presses
Crushing and Breaking Machinery
Silico-Calcareous Brick Works
Paste-Goods Factories
Briquetting Plants
Rice-Mills
Roller Mills for Soap and Paint Manufacture
"Duplex" Newspaper Printing Presses
Conveying Plants of every kind

For particulars apply to the
Far Eastern Office: BUHLER BROTHERS
P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE
4 AVENUE EDWARD VII

蘇爾壽穿空式唧筒適於深井中吸取流質之用

蘇爾壽工程事務所 上海愛多亞路四號

本公司常備目錄供給各界 垂詢工程事務亦曷誠酬答

Suitable for raising water, oil, brine from deep boreholes and wells.

These pumps are constructed for Boreholes from 4 to 36" and depths to 400-ft.

Delivery head above surface can be as high as required.

Suitable for any kind of drive.

Sulzer Centrifugal Borehole Pumps

are of simple design, proved reliability and low running costs

Other products of our factories

Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fan and Ventilators for all purposes, Fire Engines, Stationary and Marine Diesel Engines, Airless Injection Diesel Engines, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

WINTERTHUR. SWITZERLAND.

JAN 29 1926

THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

上海仁記路拾六號

遠東時報

MANCHURIA—THE DANGER SPOT OF ASIA

THE EXTRATERRITORIALITY COMMISSION

JAPANESE FINANCE AND TRADE

THE PORT OF TSINGTAO

IRON, COAL AND MINERAL OIL ON ASIATIC COAST OF PACIFIC OCEAN

MACHINERY MANUFACTURING INDUSTRY IN JAPAN

STATE RAILWAYS OF THE NETHERLANDS EAST INDIES

ECONOMIC DEVELOPMENT OF FRENCH INDO-CHINA

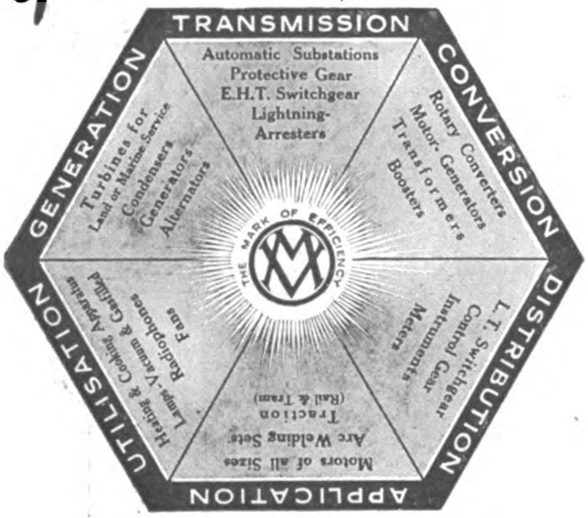
THE MANILA RAILROADS

IRON IN THE PHILIPPINES

Vol. XXI December, 1925 No. 12

SHANGHAI, PEKING, TOKYO AND MANILA

We cover every side of the Electrical Industry



Indian Offices:

Bombay: Metropolitan-Vickers Electrical Co., Ltd., Trafford House, Murzban Road, Fort, P.O. Box 323. *Tel.:—"Metrovick, Bombay."*

Calcutta: Metropolitan-Vickers Electrical Co., Ltd., Hongkong House, 9, Council House St. *Tel.:—"Metrovick, Calcutta."*

Delhi: Metropolitan-Vickers Electrical Co., Ltd., Alliance Bank Buildings, Chandni Chowk. *Tel.:—"Metrovick, Delhi."*

Madras: Metropolitan-Vickers Electrical Co., Ltd., 105 Armenian Street.

Agencies in China:

Arnhold & Co., Ltd. Shanghai. Tientsin. Hongkong. Peking. Hankow.

Write for lists dealing with the side in which *you* are interested.

"Metrovick"

ELECTRICAL PLANT AND

Cosmos

SUPPLY ACCESSORIES

cover effectively the whole Electrical field from large Power Installations to small Electric Lamps.

We have a vast experience in the design and manufacture of all kinds of Electrical apparatus.

OUR PRODUCTS MAINTAIN A GREAT REPUTATION.

METROPOLITAN Vickers ELECTRICAL CO. LTD
TRAFFORD PARK - - - - - - - MANCHESTER
ENGLAND 2046C

Reconstruction Number of The Far Eastern Review

PRESS REVIEWS

North-China Daily News:

An Echo of the Earthquake

The Reconstruction Number of the "Far Eastern Review," which has just come off the press, is one of the most remarkable publications ever issued in the Far East. Consisting of more than 400 large quarto pages, the magazine gives a fully illustrated and graphic account of the efforts of the Japanese Government and Japanese engineers to reconstruct Tokyo and Yokohama. Excellent reproductions of photographs depict the enormous damage done by the earthquake over a wide area and also the feats of reconstruction the Japanese have accomplished since. Although primarily of interest to engineers many others will feel that $5.00, at which price this special issue is sold, will be well invested in acquiring a copy. It is printed by *The North China Daily News* and is on sale at all booksellers.

Shipping and Engineering:

Mr. George Bronson Rea, Editor and Publisher of the *Far Eastern Review*, Shanghai, is heartily to be complimented on the Japanese Reconstruction Number of the Journal, which has just made its appearance, and which is probably the most valuable, interesting and praiseworthy issue of any periodical that has yet been printed in the Far East. Dedicated to the Japanese engineer, "whose monument will ever be the recreation of Tokyo and Yokohama after the terrible earthquake and fires had reduced those cities to veritable dust," this noteworthy issue of a monthly magazine which already stood in a class alone and apart, constitutes a printed and pictorial record of one of the mightiest industrial and engineering efforts in history—the reconstruction of Japan's capital and her largest port after one of the worst calamities in the records of mankind; and one cannot pay the *Far Eastern Review* a greater compliment than by saying that the Reconstruction Number is a worthy record and appreciation of the mighty effort its pages depict so well.

Hongkong Telegraph:

Japan's Reconstruction

It is now just two years since the greatest calamity that Japan had ever known in her history affected a large area of her most populous territory—destroying one of her large seaports and wrecking a great deal of her capital. There was terrible loss of life, and scenes of horror such as only a vast catastrophe can give rise to. The terrible effects of the great earthquake are still evident at both Yokohama and Tokyo, but a great amount of reconstruction work has been accomplished. In the comparatively short space of two years the Japanese engineers and their assistants have rebuilt much that had been destroyed, and it should not be long before practically all the broken achievements of the past are replaced. We are reminded of this achievement by the recent publication of a journal devoted to a description, graphically illustrated, of the feat that the reconstruction department has performed—and it is undoubtedly an accomplishment of which the Japanese nation can be justly proud.

FOUNDED, 1904

The Far Eastern Review

ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

A Monthly Review of Far Eastern Trade, Finance and Engineering, Dedicated to the Industrial Development and Advancement of Trade in Far Eastern Countries.

HEAD OFFICE: 16 JINKEE ROAD - - - - SHANGHAI, CHINA.

George Bronson Rea, *Editor and Publisher*

NEW YORK: Major Jack Hamilton, Special Representative, 50 Church Street.

GREAT BRITAIN: Walter Judd, Ltd., 81-87 Gresham Street, Bank, London, E.C.

MANILA OFFICE: Fleming, Percy Smith and Seth, Roxas Building, Escolta.

BERLIN: Rudolf Mosse, 46-49 Jerusalemer Strasse.

TOKYO: The Foreign Agencies Corporation, Mitsubishi Building No. 21, Marunouchi.

SUBSCRIPTION IN CHINA: $10.00 Mexican, U. S. & Philippines Gold $5.00, Elsewhere $12.00 Mexican per annum.

VOL. XXI DECEMBER, 1925 NO. 12

CONTENTS:

	PAGE
MANCHURIA—THE DANGER SPOT OF ASIA ...	727
MORE OF MR. BRISBANE'S NONSENSE	728
THE EXTRATERRITORIALITY COMMISSION ...	*729
THE JAPANESE OUR GOOD CUSTOMERS NOW, TOO	732
JAPANESE FINANCE AND TRADE	733
THE PORT OF TSINGTAO: ITS HARBOR AND WHARF ADMINISTRATION AND TRADE ...	*734
RECENT INTERESTING BRITISH LAUNCHINGS ...	738
IRON, COAL AND MINERAL OIL ON THE ASIATIC COAST OF THE PACIFIC OCEAN	*739
MACHINERY MANUFACTURING INDUSTRY IN JAPAN	*748
THE STATE RAILWAYS OF THE NETHERLANDS EAST INDIES	*753
CHINA STOCK AND SHARE HANDBOOK	758
ECONOMIC DEVELOPMENT OF FRENCH INDO-CHINA	*759
THE MANILA RAILROADS	*763
MODERN MACHINERY GAINING POPULARITY IN NANKING	765
THE ELECTRIC INCANDESCENT LAMP BUSINESS OF THE WORLD	*766
20-TON CLEAR-ICE PLANT AT KYOTO	*768
SULZER UPRIGHT WATER-TUBE BOILER PLANT IN CHINA	*768
IRON IN THE PHILIPPINES	769
THE TECHNICAL FAIR IN LEIPZIG	774

Illustrated with Maps or Photographs

Registered at the Chinese Post Office as a Newspaper.

ALPHABETICAL LIST OF ADVERTISERS

Admiral Line, The 41
Allan, Whyte & Co., Ltd. 27
Allen & Co., Ltd., Edgar 11
American Blower Co. 50
American La France Fire Engine Co., Inc. 71
American Locomotive Sales Corp. .. 25
American Tool Works Co. 1
Armstrong, Whitworth & Co., Ltd., Sir W. G. 18-19
Associated British Locomotive Manufacturers for China .. 49
Attwater & Sons 48
Avery, Ltd. W. & T... 11

Babcock & Wilcox, Ltd. 36
Bank of Chosen 54
Banque de l'Indo-Chine 56
Bank of Taiwan, Ltd. 61
Berger Manufacturing Co. 73
Bethlehem Steel Export Corp. .. 31
Bliss Co., E. W. 27
Brill Co., J. G. 39
British-American Tobacco Company (China), Ltd. 9
Buhler Brothers 774
Butterfield & Swire 44

Canada Carbide Co., Ltd. 34
Chambers Scott & Co., Ltd. .. 14
Chartered Bank of India, Australia & China 48
Chinese Eastern Railway 50

Daido Electric Power Co., Ltd. .. 28
Dai-Ichi Ginko Ltd. 62
Dai Nippon Brewery Co. 34
Dixon Crucible Co., Joseph .. 70
Dodge Brothers 5

Electricity Department, S. M. C. .. 6
Escher Wyss & Cie 16
Evans & Sons (Wolverhampton) Ltd., Joseph 2
Exchange Bank of China .. 61

Fairbanks Co. 21
Fairbanks Morse & Co. 63
Fuji Gassed Spinning Co. 10

Gaspary & Co., Dr. 14
Gleniffer Motors, Ltd. 10
Goodell Pratt Co. 71
Goulds Manufacturing Co. .. 14
Green Island Cement Co., Ltd., The 20
Greene Tweed & Co. Under Index

Hennef Engineering Works .. 70
Hongkong Rope Mfg. Co. Ltd. .. 20
Hongkong & Shanghai Banking Corporation 59
Hongkong & Whampoa Dock Co., Ltd. 30
Horsfall & Bickham, Ltd. 13
Hotel Statler Co. 53

Imperial Japanese Government Railways 66, 67
Industrial Bank of Japan, Ltd. .. 58
Ingersoll Rand Co. 65
International Banking Corporation 55
International General Electric Co., Inc. 51
International Labour Office .. 72

Japan Sugar Co., Ltd. 6
Jardine Engineering Corp., Ltd., The 12
Jugo Ginko 56

Kanegafuchi Spinning Co., Ltd. .. 2
Kawasaki Dockyard Co., Ltd. .. 33
Kokusai Kisen Kaisha 45
Kuhara Mining Co. 75

League of Nations 72
Link-Belt Co. 63
London Directory Co., Ltd. .. 50

Mather & Platt, Ltd. 3
McConway & Torley Co. 14
Metropolitan Vickers Electrical Co. Ltd, Cover
Mitsubishi Bank, Ltd. 57
Mitsubishi Iron & Steel Co., Ltd... 38
Mitsubishi Marine & Fire Ins. Co., Ltd. 38
Mitsubishi Shoji Kaisha 4
Mitsubishi Warehouse Co., Ltd. .. 38
Mitsubishi Zosen Kaisha, Ltd. .. 39
Mitsui Bank, Ltd. 57
Mitsui Mining Co. Ltd. 4
Mitsui Bussan Kaisha Ltd. .. 26
Mustard & Co. 14

Nippon Yusen Kaisha .. 46, 47
Nobel Industries, Ltd. 22

Okura & Co. (Trading), Ltd. .. 24
One Hundredth Bank, Ltd., The .. 59
Osaka Shosen Kaisha 42
Oster Manufacturing Co. 73

Petters, Ltd... 15

Redpath Brown & Co., Ltd. .. 15
Reuther & Reisert, C. 70
Royal Bank of Canada 61
Ruston & Hornsby, Ltd. 17

Sale & Frazer, Ltd. 8
Shanghai Dock & Engr. Co., Ltd. .. 32
Shanghai Municipal Council 6
Shibaura Engineering Works, Ltd. .. 7
Siemens China Co. 36
Simons & Co., Ltd., Wm. 13
Smidth & Co., F. L. 41
Smith Major & Stevens Ltd... .. 16
South Manchuria Railway Co. 64, 68, 69
Sprout, Waldron & Co. 52
Standard Oil Co., of N. Y. 29
Standard Underground Cable Co... 14
Sturtevant Co., B. F. 63
Sulzer Bros. 774
Sumitomo Goshi-Kaisha 60
Sumitomo Bank, Ltd... 60
Superheater Co., The 73

Thornycroft & Co., Ltd., John I. .. 1
Toshin Soko 40
Toyo Kisen Kaisha 43
Trimont Manufacturing Co. 10

Ujigawa Electric Power Co., Ltd. .. 72
United States Steel Products Company .. ..23, 37, Back Cover

Walworth International Co. 52
Westinghouse Electric International Co. 76
Williams & Co., J. H. 3
Wotan Werke, A. G. 35

Yarrow & Co., Ltd. 21
Yasuda Bank, Ltd. 62
Yokohama Dock Co., Ltd. 34
Yokohama Specie Bank, Ltd. Cover
York Manufacturing Co. 72

TRADE MARK

"PALMETTO"

is the ideal packing for far distant points where the transportation is so long as to affect most packings.

"PALMETTO" IS THE MOST ECONOMICAL PACKING ON THE MARKET BECAUSE

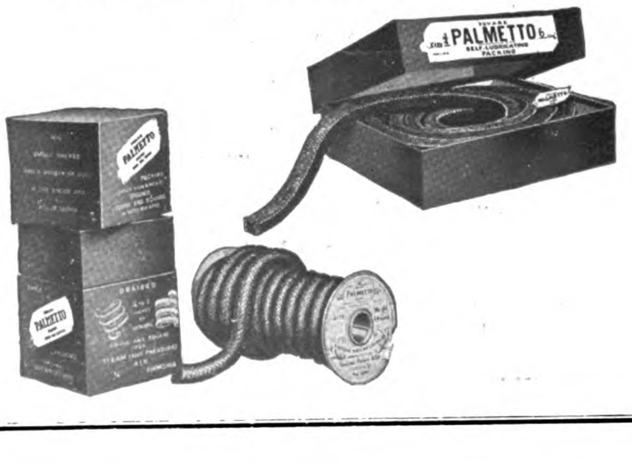
It lasts so long, not so much of it is required.
It contains no rubber, therefore climatic conditions do not affect it—its quality is the same in the tropics as elsewhere.
The quality of "PALMETTO" is always the same as the materials of which it is made are not affected in any way by age.
"PALMETTO" is made to give economical service, not to effect frequent sales.
For steam, especially high pressure, superheated steam and compressed air "PALMETTO" is without an equal.
Free working samples sent to prove the economy of "PALMETTO" long service.

GREENE, TWEED & CO.

Sole Manufacturers,

109 Duane St., New York, U.S.A. Stocks carried by
China, Shanghai — E. W. Langdon & Co.
Japan, Tokyo — Horne Co., Ltd.

AGE AND CLIMATE
DO NOT AFFECT "PALMETTO"
as it contains no rubber or other substance that can be so affected



The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXI SHANGHAI, DECEMBER, 1925 No. 12

Manchuria — the Danger Spot of Asia

Japan Must Protect Her Huge Investment in the Three Eastern Provinces—A Policy of Strict Neutrality in the Internal Affairs of China Cannot Endanger the Peace of Japan

Chang Tso-lin's Difficulties

IT is not often that a matter which is of local political interest in China is referred to in the columns of the *Far Eastern Review*. The situation which has development in Manchuria is so likely to lead to internal difficulties that every detail becomes of primary interest at the present time. During October a war developed between the Chekiang troops and the Fengtien soldiers in Kiangsu. Marshal Chang Tso-lin, who had won a victory during the last war (1924) found himself expanding not only beyond Manchuria but into south China. His army was not only occupied with Manchuria but extended into Kiangsu as far as Shanghai, holding a line from the Siberian frontier to the Yangtze River. It must be noted that many of his most experienced advisers suggested that his line was intensible. It must be noted that his Japanese military adviser is reported to have suggested to him that he was endangering the peace of Manchuria by expanding his forces beyond his powers. Nevertheless Marshal Chang continued to occupy and develop new territories. The war of this year is largely the result of this expansion. It is largely the result of an effort to unify China by force. The Fengtien troops were driven from Kiangsu and Shantung with hardly a fight, and then the most important part of that army rebelled because they objected to what they called Chang Tso-lin's imperialism.

Japan Neutral

It is an open secret in China, that Chang Tso-lin had counted on Japanese support because he believed that Japanese interests were so large in Manchuria that the Japanese would have to break their strict policy of non-interference in China's affairs to protect themselves against the possibilities of economic loss because of the disturbances in that part of the country. But the Japanese adhered to their policy of non-interference. They assisted neither Chang Tso-lin nor any other militarist in the country. They attended strictly to their own affairs. In due course, it would appear as though the great Manchurian warlord were to be defeated and a younger and more energetic element placed in control of the Chinese affairs of Manchuria.

Chang Tso-lin

The career of Marshal Chang Tso-lin is one of the most remarkable in China. He started in a small way in the hills of Fengtien and eventually worked his way into the army. From the lowliest position, he rose until he became the controlling power in the Three Eastern Provinces and the dominating power in Peking. He built up a huge military machine which made him the envy of other militarists and he gave the general impression of invincibility. No one discussed the probability of Chang Tso-lin's defeat; the question was rather: how far would he go? He gave to Manchuria an able administration, much of the credit for which, however, has to go the South Manchuria Railway and the administration of the Kwantung Leased Territory. During his tenure in office, Manchuria developed into one of the richest areas in China, the bean crop, the Fushun colleries, the wheat markets, the industrial and commercial enterprises attracted capital at a time when the remainder of China has been in disorder and the officials have been utilizing commerce only to tax it and to enrich themselves. One thought of Chang Tso-lin principally as an administrator and organizer. One never thought of him as careering through the country on an expansionist enterprise, although he has had to fight and to maintain a huge military establishment to prevent other militarists from coming into his provinces to create chaos and to seize the revenues.

It was, therefore, a disappointment to Chang Tso-lin's Chinese friends as well as to many of the foreigners who had made large investments in Manchuria, that everything was being endangered by this venture to unify China by force, this plan to find fat balliwicks for the lesser Mukden leaders. The rebellion against Chang Tso-lin in his own organization, the insistence on the part of his younger generals that the expansionist policy should be dropped, was not surprising. For there is an overwhelming sentiment among the residents of Manchuria, Chinese and foreign alike, that the Three Eastern Provinces should be kept out of China's civil wars.

Japan's Investments

But to Japan, peace in Manchuria means much more than that. Japan's major economic investment in China is in Manchuria. Japan has done more to build up Manchuria than any other single factor. Japan has fought two wars on Manchurian soil, one of them against Russia, designed to protect her economic life, her national vitality from Russian imperialism. The effect of Japan's war against Russia in Manchuria has been to keep Manchuria as part of the Chinese Empire and the Chinese Republic, for with the weakness of the Chinese Government, a power like Russia could easily have taken Manchuria as she took the Amur region, from China. It was fear of Japan that stayed the hand of Russia. It was memory of the beating at Mukden that prevent Imperialist Russia and Soviet Russia from again seeking to utilize Manchuria as a highway to a warm port in the Pacific, at the expense of China.

Japan has invested one and a half billion yen in the economic development of Manchuria, much of which has been so far-sighted that the returns are not yet to be seen. Out of this huge investment, the real beneficiaries have been the Chinese, who own the land which has increased in value, the Chinese merchants and bankers who have handled the business, the Chinese laborers who have found work. As one goes through Dairen, or Mukden or Antung, the outstanding fact is that in spite of the enormous Japanese investment, everything is Chinese-owned and the wealthiest men of the community are Chinese. To Japan, this is important because from Manchuria must come Japan's supply of food and raw materials and Japan is more than anxious that it should come from a friendly people.

It is a noteworthy indication of this fact that there has never been an unfriendliness toward Japan in Manchuria when other parts of China were seething with anti-Japanese propaganda.

The Bolshevik Plague

The danger then to this investment and trade, to Japan's supply of food and raw materials through civil war, banditry and lawlessness in Manchuria is very great. Furthermore, Manchuria borders on Korea and disorders are epidemic like plagues. Without a sound government in Manchuria, those places which border on Korea, Chientao and Hunchun, will become centres of anti-Japanese propaganda, where Korean revolutionists and Bolsheviks will gather on Chinese soil to bring misery upon their own people. Japan cannot ignore the possibilities of such a situation, just as the United States keeps an army in Texas to protect the Mexican border, while the Canadian border has been left unprotected for more than 100 years. Where there is chaos the forces of law and order have to protect themselves against the spreading of the plague. The bringing, then, of the civil war to Manchuria, not only affects Japan economically, but politically. It seriously affects Japan's situation in Korea. It raises questions which have been regarded as settled. It is particularly dangerous at this time to the peace of the world that such questions should be raised when Bolshevik activity in China is becoming one of the principal problems of the day.

Soviet Russia thrives on disorder. In countries like the United States, Great Britain, France, Italy, Japan, Soviet Russia can do nothing. As soon as a nation sets her house in order, as Persia for instance has recently done, the Soviet agent and the Soviet policy goes by the board. In China, Soviet Russia and the Bolshevik theory has made no progress in those parts of the country which are orderly and where the people are prosperous. In Manchuria, close to the Siberian frontier, where the people know the Bolshevik better than in other parts of the country, Soviet Russia has had no influence. Just as the Chinese of Manchuria are friendly to the Japanese, so are they antagonistic to Soviet Russia. That is because they are prosperous and happy and have devoted themselves to trade and commerce and industrial enterprises under a well-administered government.

Now that there is a possibility of disorders and civil wars in Manchuria, the situation may change. The people have come under the heel of contending militarists. They will be illegally taxed. They will be driven to exasperation by the contending soldiers destroying their fields and their crops, quartering themselves in their homes and barns, seizing their horses and cattle, shaming their women. The Manchurian, under such circumstances, will become a prey to the evil doctrines of the Bolshevik just as in Kwangtung he has become subject to the Soviet agent after fourteen years of constant and unending civil war. Men's political ideas are not altogether unaffected by the bread they eat. The Bolshevik agent follows on civil war and disorder as the vultures come down on the dead in the battlefield.

Self-Protection

Japan cannot ignore such a situation. To the United States and Great Britain the possibility and extent of Bolshevik activity in Manchuria may be an interesting academic question. To Japan it involves the very life of the nation. China may not care what the Russians do in this country; but Japan cannot risk a possible destruction of her national integrity, of her civilization through the disintegrative propaganda of Bolshevism. It would be a lesser evil for Japan to fight Russia on the soil of Manchuria than to allow the Soviet agents to do to Manchuria what has already been done to Mongolia.

Facing such a situation, Japan is straining her neutrality to the point where it is begining to hurt. Japan has been scrupulously neutral and non-interfering in the present civil war. Japan has watched her interests and position in Manchuria endangered without raising a finger to protect them, because of a desire to prove to the world and to China that the " Change of Policy " announced after the Washington Conference was a sincere expression of Japan's point of view *vis-a-vis* China. Now Japan is again faced with a critical problem arising out of the imperialistic designs of Chang Tso-lin. The wonderful work of Japan in Manchuria, her huge investment in that country, her vested interests there, may be wiped out through the overweening desire of a Chinese warlord to become master of the whole of China with Manchuria as his base. Furthermore, Japan is in the position of being faced by her arch-enemy Soviet Russia in Manchuria because the disorders to which the Three Eastern Provinces are to be subjected through the civil wars, no Chinese opposition to Russian aggression can avail. **In a word, at a moment when Japan is doing everything that a sovereign, self-respecting nation can do to win the good-will of the Chinese people and to make every possible concession to China, she is faced with the need of protecting her own national life which is closely bound up in the Manchurian situation. On the development of this problem hinges not only the peace of Asia but of the whole Pacific.**

More of Mr. Brisbane's Nonsense

IF Mr. Brisbane, the war-maker, knows as little about the Pacific situation as he does about China, it is more than unfortunate that he is being permitted to influence so large a public opinion in America. The following is taken from one of his daily editorials :

> China you may be interested to hear, is *hanging bandits in Shanghai.* For a while a disorganized government was unable to furnish hangmen and protection for the hangings.
>
> Partial order being restored, *12 Chinese robbers were hanged* before thousands of spectators yesterday, after having been paraded through the streets. *Six will be hanged every day for the next 30 days.*
>
> Chinese take death calmly. When criminals are sentenced to be beheaded, a dozen or more will walk out, kneel down in a row, *and wait for the headman to come along and chop their heads off,* not one trying to escape. They are not nervous.

The italics are ours and they are used to indicate an untruthful statement. No hangings have taken place in Shanghai. Mr. Brisbane may refer to the shooting of some criminals who had had a trial in a court in this city, but there has been no wholesale hanging of bandits. We do not know who gives Mr. Brisbane his information. But however it comes to him, it is inaccurate, careless and wrong. A man in his position cannot afford to be caught red-handed in this way. He ought to be more careful.

The importance of Mr. Brisbane's remarks, however, are not in their inaccuracy nor in the slender information upon which they are based. The importance lies in the fact that almost everything Mr. Brisbane says about the Far East or the Pacific is about the same. It is stuff which rests upon the most slender basis of fact, upon some isolated detail, upon some exaggerated gaucherie. Yet Mr. Brisbane would make war on the Japanese, he would involve the United States in serious international complications, he would stir up world-wide animosities—all for what reason ? Simply because he lacks information, because he is unable to get at the facts himself, because he is willing to use his name and his intellect to foist upon his fellow countrymen half truths.

Arthur Brisbane and the Hearst papers have for years been the principal enemies of Japan in the United States. If a war should ever take place between the United States and Japan, Mr. Hearst and Mr. Brisbane will have to be blamed for the years of enmity and bitterness, for the constant propaganda, for the hatred and racial prejudice which they have engendered. If their information is all of a kind with the editorial which we have reproduced, are they not doing an incalculable mischief to their own country, by misinforming their own people ? It is impossible to believe that the great Hearst organization cannot get at the truth if it wants the truth. It is impossible to believe that they publish the drivel they do about the Far East without having an ulterior motive. Yet, the Far East can be to them as open a book as it is to those who really seek the truth.

Important Contract for Glasgow—Great Airship Shed for India

We are informed that the Armstrong Construction Company Limited, who are Associated with Sir W. G. Armstrong, Whitworth Co., Ltd., have been entrusted by the Air Ministry with the construction and erection at Karachi of one of the largest Airship Sheds in the world.

The whole of the steelwork for this great structure will be fabricated at the Company's Works at Gerniston, Glasgow.

The Shanghai Bund—Pride of the Foreigners in China—built upon swampy and reclaimed land

The Extraterritoriality Commission

Called to Meet on December 18 while the Guns of Rival Parties are Booming under Peking's Walls

THE Tariff Conference and the Commission for the investigation into the advisability of abolishing extraterritoriality were provided for by Washington Treaties. The Tariff Conference was delayed because France refused to ratify the Washington Treaties as long as the Gold Franc question was unsolved. The commission did not come to China because the Chinese Government requested it to stay away. The May 30 Affair, which evoked such strong nationalistic sentiments throughout China, brought about a condition which made it inevitable that all the provisions of the Washington Treaties should be enforced or the treaties declared useless. The Tariff Conference is now in session, although under difficulties because of the civil war in the country and the actual fighting within the vicinity of Peking. Nevertheless, China has made tremendous gains at that Conference ; greater gains than either at Versailles or Washington and if the treaty, as finally written, does not provide China with a completer sovereignty, a greater equality, it will only be the fault of China's militarists who sacrifice every national purpose, every national consideration to their own private interests.

The Extraterritoriality Commission is to meet in Peking but it is doubtful if the delegates can reach there at the appointed time. The delegates are to consider

That the Governments of the Powers above named shall establish a Commission (to which each of such Governments shall appoint one member) to inquire into the present practice of extraterritorial jurisdiction in China, and into the laws and the judicial system and the methods of judicial administration of China, with a view to reporting to the Governments of the several Powers above named their findings of fact in regard to these matters, and their recommendations as to such means as they may find suitable to improve the existing conditions of the administration of justice in China, and to assist and further the efforts of the Chinese Government to effect such legislation and judicial reforms as would warrant the several Powers in relinquishing, either progressively or otherwise, their respective rights of extraterritoriality ;

That the Commission herein contemplated shall be constituted within three months after the adjournment of the Conference in accordance with detailed arrangements to be hereafter agreed upon by the Governments of the Powers above named, and shall be instructed to submit its report and recommendations within one year after the first meeting of the commission ;

That each of the Powers above named shall be deemed free to accept or to reject all or any portion of the recommendations of the Commission herein contemplated, but that in no case shall any of the said Powers make its acceptance of all or any portion of such recommendations either directly or indirectly dependent on the granting by China of any special concession, favor, benefit, or immunity, whether political or economic.

The Foreigner's Position

The extraordinary position of the foreigner in China has been a subject for the expression of violent emotions on both sides. The foreigner has felt that he has built up a position for himself by his initiative, capital investments and hard work ; that the concessions and settlements, the spheres in which he may live, are marshes and swamps, rocks and out-of-the-way places, reconstructed largely if not entirely through his energy and ability, in the course of years into magnificent cities, the equal in many respects of cities in Europe and America. Huge capital investments in industry, trade and land-ownership have been made on the assumption that there would be no radical change in the legal position of the foreigner in China, where he is under the jurisdiction of his own officials, where he lives under his own laws and is judged by judicial officers appointed by his own government. The whole fabric of foreign trade and commerce, of foreign life in China, is interwoven in this system of extraterritoriality. To readjust would entail huge expenditures and work great hardships.

The foreigner, furthermore, fears the Chinese official and his system of taxes and courts. Life in China does not impress one with either the ability or the integrity of Chinese officials and the Ostroumoff Case in Harbin, the Eugene Chen case in Peking and Tientsin and hundreds of similar cases throughout the country do not impress one with the equity or justice of Chinese courts. The imposition of illegal taxes, the habit of militarists of imposing forced loans and the failure of so many officials to differentiate between the public and the private purse, naturally cause many foreigners to fear that in the event of the abolition of extraterritoriality, they, their property, their trade, perhaps even their lives would be placed in jeopardy.

The Missionaries

The missionaries seem to take quite a different attitude. Although many of the missionaries live in the interior and are therefore more subject to any evils in the Chinese governmental system than foreigners living in the cities under the protection of foreign managed police forces, the principal missionary bodies in China, American and British, have gone on record as favoring a speedy readjustment of China's treaty relations so that the treaties may be more equal and the clauses to which the Chinese take objection be taken out. The missionaries have issued statements on this subject and have developed a very strong public opinion, particularly in the United States favorable to the Chinese point of view.

The Chinese View

The Chinese themselves, almost without exception, regard the treaties as antequated and as objectionable to an independent and sovereign nation. They object to extraterritoriality, to the concessions and settlements. They object to the extraordinary privileges of the foreigners and to the conditions which exist in the foreign concessions. They object to the extension of extraterritorial privileges to Chinese living in foreign concessions. The Chinese want the whole system scrapped. Where, however, some Chinese differ from others, is that the radicals would do away with these conditions by the stroke of a pen, while the more conservative men are seeking for a constructive program, for a formula which will insure economic stability during an interim period of readjustment.

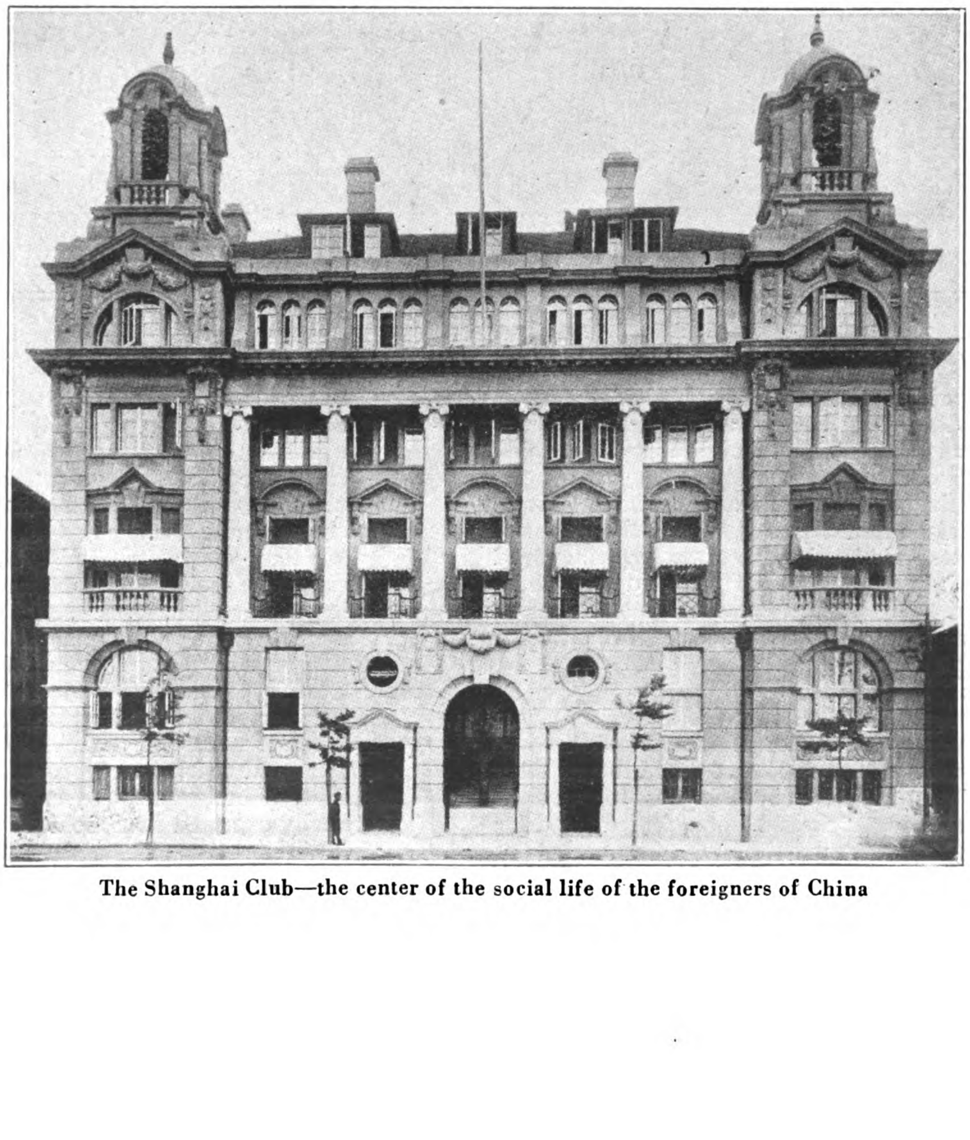
With this view liberal foreigners to a very large extent agree. It is becoming more and more difficult for foreigners in China to maintain the stand that the treaties which were first written eighty-three years ago are unchangeable under any circumstances. It is becoming more difficult to make men believe that conditions in China are worse than in many of the Balkan states or in some parts of Europe which have suffered from the war. The situation in China is bad enough, but the confusions involved in the utilization of a system extraterritoriality makes it even worse. The Chinese, like the Japanese, take umbrage at being regarded as an inferior race, when as a matter of fact, they have a large and populous country, most of which is productive and progressive in spite of political disorders. They point to the increase in trade, in industry, in the development of education, in spite of the civil war and the attendant disorders. They claim that their courts are satisfactory to them in the respect that they are constantly improving in legal methods and in integrity and that if the Chinese are willing to live under those courts, the foreigner who comes to China, whether to make money or preach religion ought to live under those courts, just as the Chinese who goes to a foreign country might have to come before a court in which there is an inherent prejudice against the yellow man. In a word, if the trade is worth anything at all, it is worth the submission to Chinese law. The Chinese want the concessions abolished because they form enclaves, economic and political, endangering the political integrity of China as well as providing a cause for anti-foreign disturbances as nationalism among the people develops. In a word, whether the system is to be changed slowly or rapidly, the Chinese and many foreigners living in China, feel that it must be changed. And they believe that if it is changed with the co-operation of the foreign powers, there will be less bitterness, less jealousy, fewer pin-pricks afterwards, but if the foreigners adopt a die-hard attitude, a national anti-foreign cataclysm is bound to ensue which will bring misery to China and will defeat the purposes of the foreign powers.

The Yokohama Specie Bank Building on the Bund, Shanghai—an office building of quality

The Kailan Mining Administration Building in Tientsin, a monumental structure

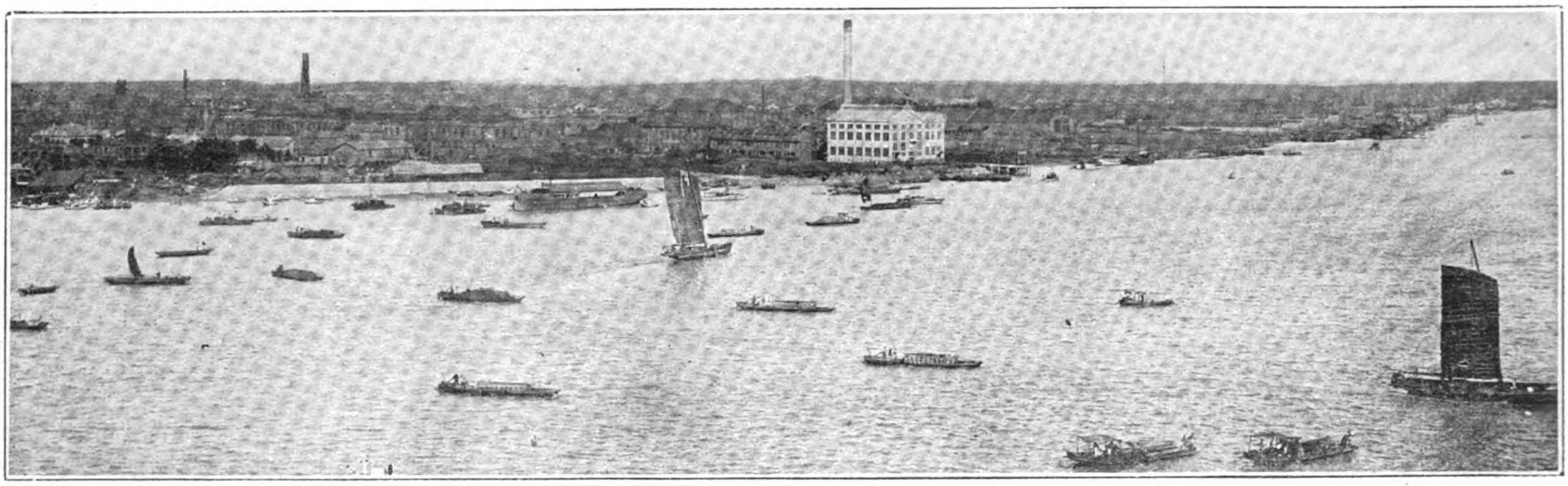
What the Foreigner Wants

In any consideration of a problem of this character, it is necessary to be broad-minded and to recognize the fact that trade and commerce thrives better in an atmosphere of friendship than in the constant wrangling and hatred which arises from one people regarding itself as oppressed and other nations as the oppressors. It is true that the foreigner has built up a huge vested interest in China, that he had a huge land investment in the concessions and that his business enterprises involve millions of dollars. It is also true that these investments are just as much in danger of financial losses rising out of nationalistic, anti-foreign movements as from the incapacity of the Chinese government to provide an adequate system of government. What the foreigner wants in China, is not a continuation of the present system indefinitely as much as protection of life and property so that he might be able to do business here as elsewhere, so that he might be able to obtain a reasonable profit on his investments in the country. He would like to see a good government established that there might be an increase in business, in the development of natural resources, in the opening of mines, the building of railroads, etc. He wants an end to this constant straining of political questions at a time when what is necessary is not politics but reconstruction, not talk but action.



The Shanghai Club—the center of the social life of the foreigners of China

If a formula can be worked out which would give the foreigner the protection he seeks to life and property and return to China full sovereignty, conditions in China would improve. The task of offering the protection is up to China. That is one of the duties of a sovereign power. The day China can end banditry, can put a stop to disturbances of trade, can provide free movement on the highways and can afford the ordinary protections under its police power usual in a sovereign state, there will be no excuse, no justification for a continuation of the present system. The only

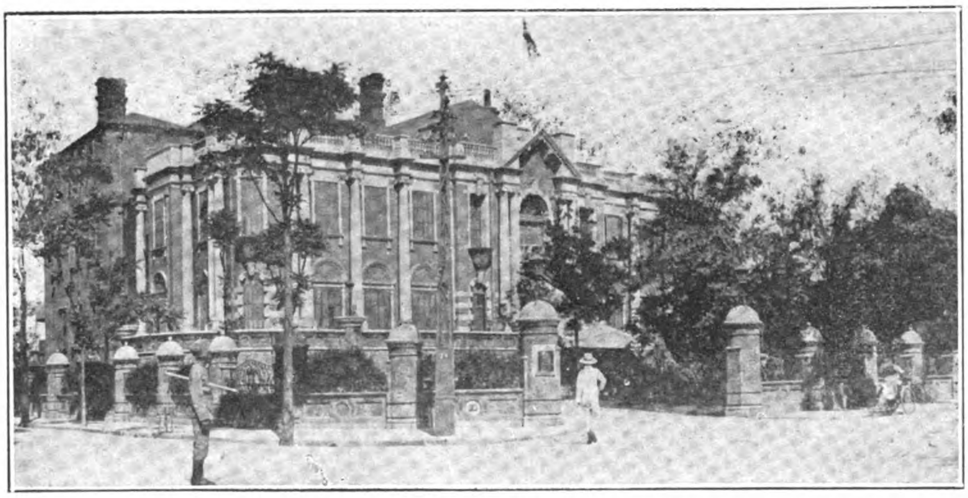


The Japan-China Spinning and Weaving Company at Pootung, opposite Shanghai, in Chinese territory

justification at the present time is the disorder in the country. The only claim that foreigners have to their own governments affording them protection is that there is no one else to protect them, that the Chinese government is unable to control the militarists who have usurped the functions of government and who when defeated turn into highwaymen who levy upon the population in the vicinity of their camps. It is this alone which is responsible for any desire that the present unequal treaties should continue.

The passing of laws, the enactment of codes, the drawing up of plans for the reorganization of courts are insufficient for guaranteeing law and order in a nation. China must have more than that. There must be the will to obey the law. There must be a sense of law. In the past, China has been governed by whim, whether that whim be imperial or republican, whether the expression be an imperial decree or a presidential mandate. Several constitutions have been drafted but none of them have effectively become the law of the land. A criminal and civil code has been worked out but they have not become applicable in wide areas. In a word, China is still without a modern governmental machinery after fourteen years of effort in that direction. It is not that there are no competent men in China. It is not that China could not work out a governmental system. The reason for this is that progress in China is impeded by the militarists, by their civil wars and their selfishness. The day these men submit to a civilian organization, conditions would so improve that the foreigner could easily afford to risk his life and property to the mercies of the Chinese government.

For civilian government is more or less the same the world over. There are weak governments and strong governments and they follow each other in periods of prosperity and depression. If a government is legally constituted, orderly conducted, its strength or weakness does not matter so much. In China, it is not a question of a weak government or a strong government, as that just now there is no government at all. There is simply a central clearing house in Peking which keeps the powers from withdrawing recognition while everybody does as he pleases throughout the country. Therein lies China's weakness.



The Tientsin Club—Another British Institution in China

The Japanese are Our Good Customers Now, Too

THE changing attitude of Americans toward Japan, the result of a better understanding of our trade relations, is perhaps not more succinctly stated than in an editorial in the *Davenport, Iowa, Democrat*. Coming from a middle western community, the statement is all the more valuable, as the Middle West in the United States is usually impervious to friendships abroad. The inherent meaning of the 100 per cent. Americanism, so often too glibly used as anti-foreignism in American communities, is not to despise those who happen not to live on the American continent, but rather to meet in fairness and bigness of heart the nations of other continents which are struggling for a place in the sun.

The editorial follows :

It is not so long ago, is it, that our idea of the Japanese was of a lot of little people working long hours in factories and underselling us on matches and tooth-brushes and lots of other things. Their imitative qualities, their willingness to work and their low standards of living promised, some feared, to drive a lot of our own manufactures even out of our home markets.

To-day we hear little of that, while we find reports of American exports showing that the Japanese are buying our own manufactures in quantities seven times as great as before the war, and probably growing larger every year. The change includes some interesting features, to be observed in statistics coming from the trade record of the National City Bank of New York.

Japan has no steel, so it is not surprising to find that in 1923 she bought of us steel sheets worth 8 million dollars, iron and steel bars about 2 millions, tin plate 4½ millions, and rails for railways 3 millions.

She likes our autos, too, and bought passenger cars 2 millions, motor trucks 3 millions, auto tires and casings 1 million. Needing gas to run the cars, she bought petroleum products, gasoline, lubricating and illuminating oil, 10 millions.

Motion picture films account for another million, and the newer levels of life in Japan are reflected by millions spent with us for electrical heating and cooking devices, gas stoves, ranges and water heaters, internal combustion engines, telephone and switchboard apparatus, adding and calculating machines, phonographs, player pianos, radio apparatus and electrically operated household devices.

Ordinarily a report of manufactures and exports is rather dry reading, but against a background of the old Japan and of our supposed disturbed relations with the island empire, these details from our commercial relations are full of interest.

Japanese Finance and Trade

By T. Aoki, Manager, London Agency of the Bank of Japan

THE finances of Japan have expanded considerably during the past ten years, owing to various Government undertakings, which were necessary in accordance with economic development, as well as with increased administration expenses induced by the higher price level. The Budget for the current year amounts to the huge sum of Y.1,615,000,000 this being an increase of over 149 per cent. when compared with the expenditure for 1914, which was Y.648,000,000. The inevitable result was that the Government has had to keep a balance between revenue and expenditure by raising big sums in loans every year, and the public debt, which at the end of 1916 was Y.3,050,000,000 increased to over Y.4,742,000,000 at the end of 1924, an advance of 55 per cent. In addition, the Government issued annually renewal loans amounting to several hundred millions of yen. This caused a tightening up in the money market, and general economic conditions hardly warranted the further expansion in expenditure. The limitation of naval forces agreed upon at the Washington Conference relieved the burden to some extent. Further, the successive Governments made strenuous efforts to readjust finances and to reduce expenditure with a view to correcting any defects in past financial undertakings, and so relax the tension of the Money Market. With this object in view, the Government, in compiling the Budget for the current year, curtailed the sum for expenditure considerably, thus showing a reduction of Y.91,000,000 when compared with the previous year. The public loans to be raised during 1925 will also be minimised. By adopting these measures the financial standing of Japan can be said to have been placed on a strong foundation.

Monetary Conditions

The monetary position of Japan has undergone a fundamental change side by side with the growth of national wealth. Its foundation was made stronger and the scale larger by the establishment of the credit system and the expansion of currency. The development of note issues by the Bank of Japan, as shown by the following table, may prove this :—

NOTE ISSUE OF THE BANK OF JAPAN.

(At the end of each year.)

	Million Yen.		Million Yen.
1914	385	1920	1,439
1915	430	1921	1,546
1916	601	1922	1,558
1917	831	1923	1,703
1918	1,144	1924	1,662
1919	1,555		

The general undertone of the money market has continued firm, from the post-war boom until its reaction period. Therefore, the discount rate of the Bank of Japan, which is the standard of the market rate, has been fixed as high as about 8 per cent. per annum since 1919. But in view of the recent monetary easiness, in consequence of the readjustment of business conditions, and in order to promote the recovery from the damage of the earthquake, the Bank of Japan has reduced its discount rate to 7.3 per cent. per annum. The possibility of a further reduction in the near future is regarded as not unlikely in certain quarters. The banking business in Japan has hitherto been in the hands of too many banks in all parts of the country. This, naturally, prevented the smooth financing of trade, and caused useless banking competition, often not only endangering their own management, but even hazarding the public interest. This being so, financial authorities have recommended the amlgamation of certain banks with quite satisfactory results. As the number of banks continues to decrease the basis is strengthened through the growth of capital, as will be seen from the table below :—

BANKS IN JAPAN.

(In Millions of Yen.)

	Number.	Paid-up capital.	Deposits.	Advances.
1914	2,155	645	2,312	2,870
1915	2,151	651	2,796	3,079
1916	2,143	677	3,816	3,958
1917	2,114	775	5,703	5,322
1918	2,091	899	8,025	6,976
1919	2,052	1,205	9,694	9,153
1920	2,039	1,627	9,681	9,348
1921	2,015	1,736	10,265	10,022
1922	1,980	1,868	10,093	10,434
1923	1,935	1,894	10,516	11,355

Foreign Trade

The tendency of the overseas trade showed a promising aspect after the period of post war reaction, and the total volume of trade became larger year after year, while exports increased and the excess of imports over exports was reduced. But the severe distress of the earthquake brought in its train a large importation of goods required for reconstruction, and caused unprecedented adverse conditions, and a consequent decline in the exchange rate. This, however, may be regarded as a temporary phenomenon, entirely due to extraordinary circumstances, for signs are already observable of a slight recovery in the foreign trade for the first half of this year as compared with the corresponding period of last year. The subjoined table shows the recent progress made :—

(In Millions of Yen.)	Exports.	Imports.	Total.	Excess of Exports of Imports.
1921	1,252	1,614	2,866	*361
1922	1,637	1,890	3,527	*252
1923	1,447	1,982	3,429	*534
1924	1,807	2,453	4,260	*646
First half of 1925	1,081	1,487	2,568	*406

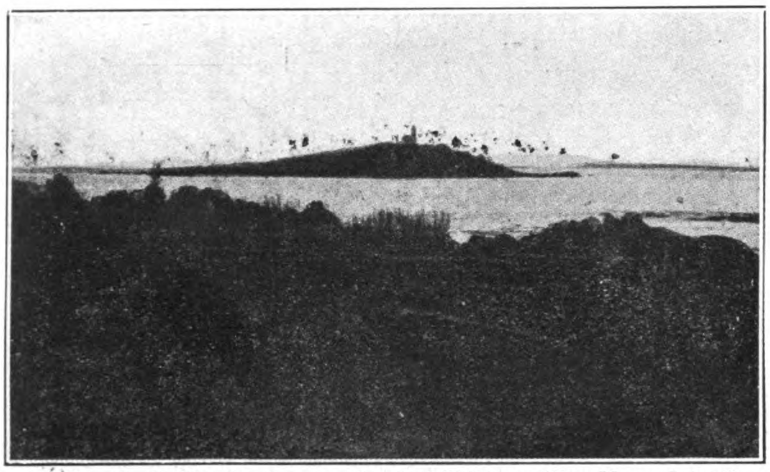
*Excess of Imports.

The prices of commodities which soared rapidly since the war have shown a declining tendency recently, in accordance with the similar trend in Great Britain and the United States of America. This fall in prices should give full advantage to Japanese goods in the world's markets, and also prove a check to imports, and reduce the cost of living and wages. The index mumbers of whosesale prices in Tokio are as follows :—

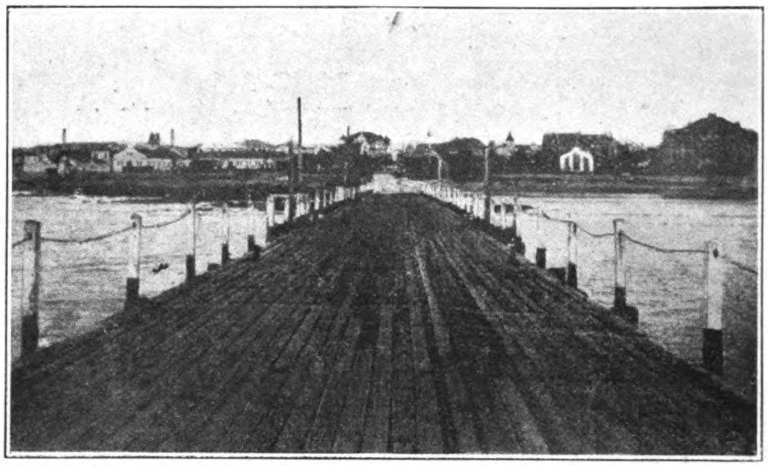
1914 (July ...	... 100	1924 (Average)	... 217
1920 (Average)	... 272	„ (May)...	... 215
1923 „	... 209	1925 „ ...	... 209

Aftermath of the Earthquake

Economic readjustment and restoration have been carried on steadily since the post-war reaction of 1920, and by 1923 most of the unsound businesses which had been established after the war disappeared, while those of strong standing alone survived. Unfortunately at this stage the unprecedented catastrophe of the great earthquake in September caused a setback. Since the stricken area was limited to a comparatively small part of the country, and did not belong to the industrial centre, the producing power of the principal industries was not greatly affected. The confusion and unrest caused by the shock, however, soon quietened down when proper emergency measures were adopted by the Government, the Bank of Japan and other financial authorities. Many thousands of millions of yen were needed for the purpose of restoring the devastated area, and to meet the situation the Government raised a loan amounting to Y.550,000,000 in the London and New York markets. From that time onwards the work of restoration and reconstruction has been carried on successfully and in accordance with the scheme laid out.



Bay South of City showing the Original Tsingtao (*Tao Means Island*) with Light House



Steel Pier in South Bay, formerly used by Germans for their Naval Department Entirely. Looking straight up Shantung Road, Lu Ta Mining Co. Office on Right

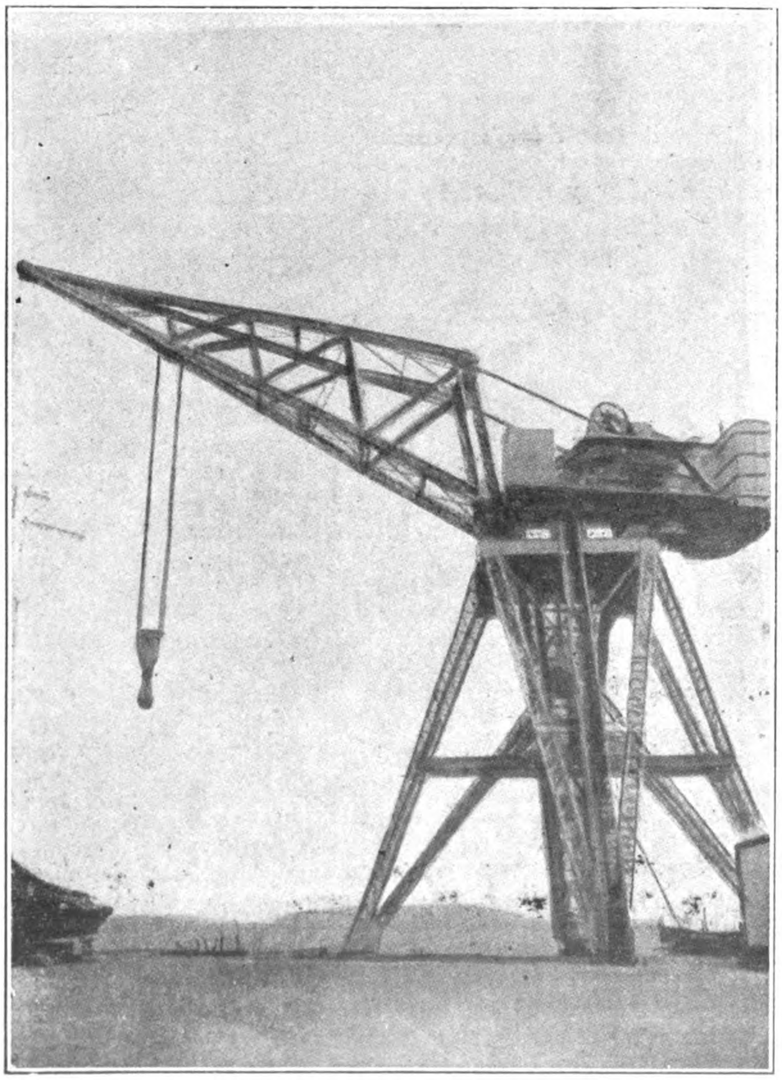
The Port of Tsingtao: its Harbor and Wharf Administration and Trade

Jick G. Wong, M.A.C. and A.E.

THE Port of Tsingtao occupies an unique position as it is the natural gateway of the Province of Shantung. It is the terminus of the Kiaochow-Tsinan Railway which runs through the heart of the Province, passing through rich agricultural districts and having branch lines reaching into the coal fields. The Railway connects with steamers, thus direct transportation by land and sea is facilitated. Tsingtao, although not so well known as Shanghai as a port, is nevertheless one of the best commercial ports China possesses, being situated on the peninsula which projects into the deep and wide Kiaochow Bay, sheltered on its northeast by the Laoshan Range and surrounded on the south, east and west by water. Being so situated its suitability for a harbor is unequalled. The climate is favourable all the year around and the temperature through the different seasons is averaged at about 55 degrees Fahrenheit. Its healthy atmosphere and scenic views are not to be found elsewhere along the coast of China.

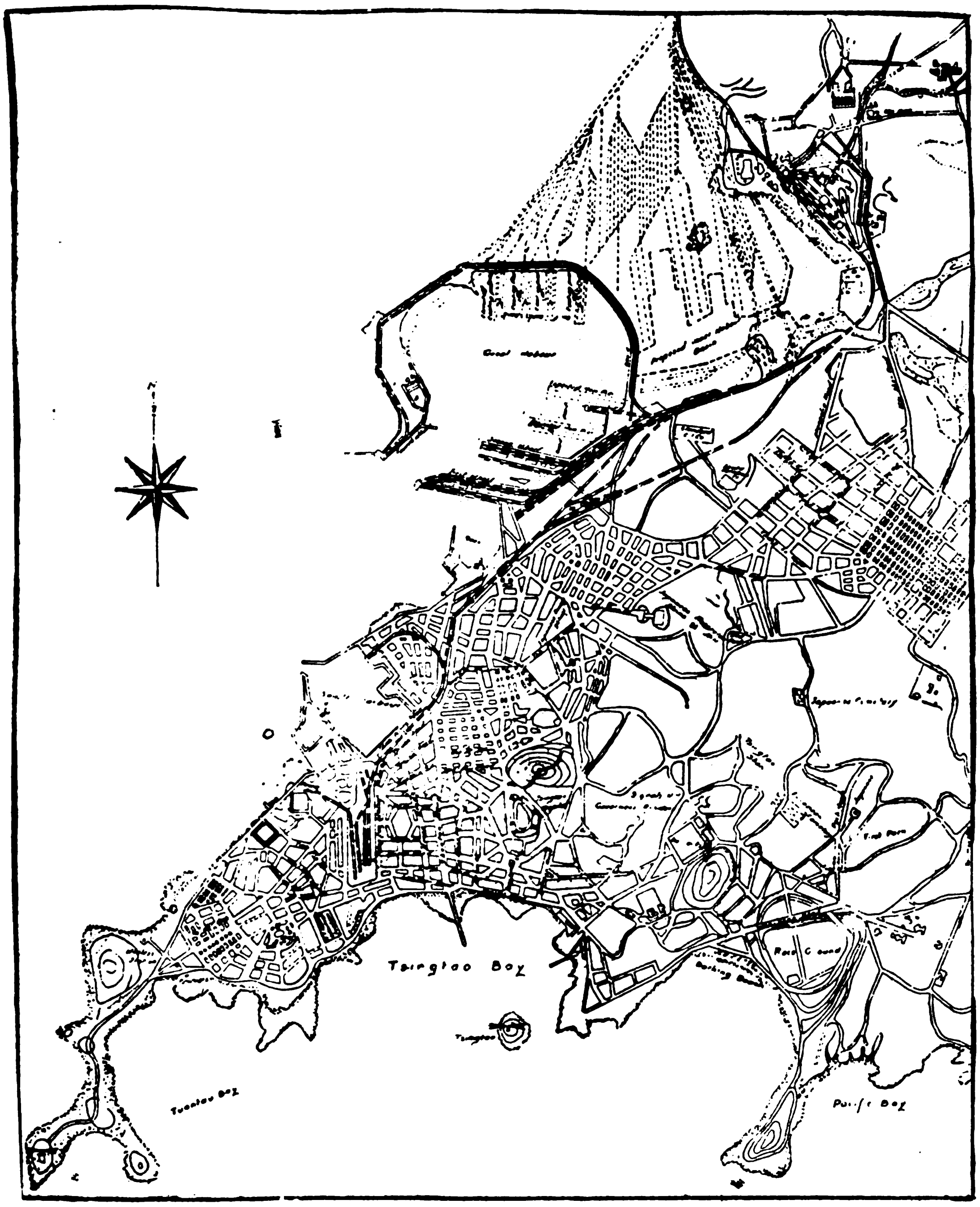
The Harbor Construction

Germany had long sought to have a centre for her trade in the Far East so when she managed to secure the lease of the Kiaochow Territory from China in 1898 serious consideration was given for the development of Tsingtao in view of the natural facilities by land and easy access by water which this port possesses. Previous to the despatch of the German Squadron to the East (1897) the famous Harbor Engineer Georg Franzius, Builder of the Bremen Harbor was sent to Tsingtao to study in detail the water course, depth of water, tidal current, wind direction, topographical and geological aspects. Franzius's plan forthe construction of the harbor was adopted by the German Government. According to the plan advantage was taken of the places where reefs and islets were found for the construction of the long break-water which was accomplished at comparatively small expense in spite of the magnitude of the work. This break-water not only protects the harbor from the strong northwest wind which is a regular visitor of the Kiaochow Bay, but also prevents the mud silt from coming into the harbor, which heretofore flowed from the mouth of the Yellow River during the southeast monsoon season and occasioned many afflictions to Kiaochow. At the wharves and along the bund are warehouses, railway tracks, cranes and all necessary equipments for the future development of trade, all these evince the efficiency of and great pains taken by those who studied and planned such momentous work in those days.



150 Ton Electric Crane on Wharf No. 4

As a result of the careful working out of the plan of the above mentioned break-water the current which was heretofore swift at the entrance of the harbor has been made to flow gently. The harbor entrance and the position of the wharves have been so arranged and at such angles as to make the handling of ships easy. Up to the present no accident has occurred. Although this may



Plan of Tsingtao Showing Area of Reclamation Project for the Proposed Coaling Piers and Freight Terminal

(It is proposed to reclaim areas " A " " B " and " C " by 1930 in order to provide facilities for the exportation of 1,200,000 coal)

be due to the alert handling by ships' officers, still a great deal of credit must be attributed to the skill and attention of the engineer who planned for the construction of the harbor.

The harbor together with the wharves were completed in 1906 at a cost of 30,000,000 marks. The following figures gives some idea of the size of the harbor :—

(a)	*Break-water ;*	Great Harbor, 2,990 meters × 20 meters.
		Small Harbor, 586 ,, in length.
(b)	*Entrance ;*	Great Harbor, 269 ,, wide.
		Small Harbor, 100 ,, ,,
(c)	*Water Area ;*	Great Harbor, 1,550.00 square paces. (or 1.16 sq. mile)
		Small Harbor, 136,000 square paces. (one pace = 5 Chinese feet)
(d)	*Depth of Basin ;*	Great Harbor, mean 31 feet.
		Small Harbor, ,, 19 ,, (in vicinity of floating pier)

The Small Harbor is used mainly for Chinese junks, small steamers and launches. The Great Harbor is deep enough for ships drawing eight meters at the neap-tide. The mean difference between high and low water is 12 feet.

Having foreseen the importance of Tsingtao as a trade centre and the Kiaochow Bay as a strategic naval base for her Far Eastern Squadron, the German Government spared no pains in fortifying the port and in developing the harbor and wharves.

Wharves No. 1 and No. 2 could accommodate 12 steamers of 6,000 tons each at one time, while on these two wharves are built seven warehouses with a capacity of 60,000 tons of cargoes. There was originally a floating dry dock of 16,000 tons capacity but was later taken to Japan after the Japanese got control of the port. The berthing quay line of the various wharves and piers are as follows :—

1st Wharf, 766 meters.
2nd Wharf, 1,111 meters.
3rd Wharf, 186 meters. (for inflammable cargoes)
4th Wharf, 1,175 maters. (for salt, coal and ores)
Wooden pier, 123 (for launches)
Small Harbor, 2,455 meters. (for junks)
Floating Pier, Small Harbor, 75 meters (for minor steamers)

The Wharf wall has a section of four meters wide from top to bottom with perpendicular faces, and at each spacing of ten meters along the wall are placed fenders while iron mooring posts and extrafloating fenders are placed every forty meters. The mooring posts, being built of strong material, have been regarded as superior in quality to all others found elsewhere in China.

The godowns along the harbor and the warehouses on the wharves are built of brick with galvanized iron plates for roofing. They are all properly designed with plenty of light and ventilation.

On Wharf No. 4 there is a stationary electric crane of 150 tons capacity for the loading and unloading of bulky and heavy cargo of over 30 tons. Besides thisc rane there are two floating cranes, one of 30 tons capacity and one of 22 tons capacity. There is also one car crane of 4 tons capacity.

The water supply equipment consists of 24 hydrants for the four wharves, each hydrant has a capacity of about 15 kilolitres per hour. On wharves No. 1 and No. 2 there is a total of 12 telephones so arranged as to be easily connected with ship telephones. For goods stored in open spaces the Wharf Office has 344 pieces of canvas for protection against rain.

Three steam launches are provided for mooring and towing purposes, the largest being of 134 tons while the smallest 64 tons. For general purposes four other small launches are maintained, the largest being 16 tons and the smallest 5 tons. One lighter made of steel of 200 tons capacity is used for carrying bunker coal.

Storing ground is as follows :—

(a) Coal storing ground, capacity about 63,000 tons.
(b) Salt storing ground,
At Great Harbor, capacity about 4,000 tons.
At Small Harbor, capacity about 15,000 tons.
(c) Ore storing ground, capacity about 30,000 tons.

Storing ground is as follows :

(*d*) Ground for lease at Great Harbor, about 55,000 square paces.
(*e*) Ground for lease at Small Harbor, about 18,000 square paces.
(*f*) Storing ground on Wharf No. 1, 1,466 square paces.
(*g*) ,, ,, No. 2, 8,338 ,, ,,
(*h*) ,, ,, No. 3, 1,049 ,, ,,
(*i*) Temporary storing ground at Small Harbor, about 10,125 square paces.

The seven warehouses on Wharves No. 1 and No. 2 have a total area of 9,157 square paces, while there are 20 warehouses and godowns along the water front having a total area of 7,618 square paces. (one pace=5 Chinese feet).

Equipment for the moving of goods consists of 15 miles of railway sidings, 3 miles of light railway, 110 cars, 119 large carts, 8 heavy carts and 390 minor carts. The railway tracks run on all four wharves so that loading and unloading of cargoes can be made direct from steamers to cars or *vice vresa*.

The number of wharf coolies for the general moving of cargoes average from 1,000 to 3,000 men, each capable of working about 3 to 4 tons per day of ten hours. The Tsingtao Wharf Corporation Stevedores, and T. Adams & Co. provide the coolies. The Stevedores get their money from the Harbor and Wharf Administration which collects from the shipping companies for tonnage of cargoes moved. There are sufficient coolie quarters provided by the various Stevedores to accommodate about 1,500 men.

Besides the above mentioned equipments and facilities for the handling of cargoes there are numerous light-houses, buoys, fog-sirens, beacons, whistling buoys, etc. for the safety of navigation within the harbor.

The Administration of the Harbor and Wharves

The administration of the harbor and wharf affairs has gone through various steps before arriving at the present system. The following were the various changes made due to the changes in control of the port.

At the beginning the Wharf Office personel consisted of only four Germans. Then the business was simple, as it did no other direct wharf business except examining the account books of the companies which paid wharf dues and assigning berthing space to the various steamship companies. The Harbor and Wharf Administration is now organized as follows :

DIRECTOR
ASSOCIATE DIRECTOR OR HARBOR MASTER
Department of General Affairs :
Archivés and Documents Division.
Miscellaneous Work Division.
Repairs for workshops. Stores for supplies.
Accounting Division.
Statistical and Auditing Division.
Inspecting Division.
Branch Office at Small Harbor.
Department of Wharf Affairs :
Stevedore Division.
The third Wharf. The fourth Wharf. Tool Stores.
Shipping and Landing Cargo Division.
Warehouse Division.
Custody Warehouse.
The First Wharf.
A-Warehouse. B-Warehouse.
C-Warehouse. D-Warehouse.
The Second Wharf.
F-Warehouse. G-Warehouse. H-Warehouse.
Department of Harbor Affairs :
Marine Division.
Tsingtao Flag Station and Great Harbor Flag Station.
Steam Launches,—The Saturn, The Uranus, The Pole Star, Sa Shu Chuan.
Signal and Equiping Division.
Tcha-lien-tao Light House.
Tai-kung-tao Light House.
Yu-nie-shan Light House.
Horse-shoe Reef Watch-house.
Ship Mooring Division.
Tugboats,—The Venus, The Jupiter, The Mercury, The Neptune.
Department of Engineering Affairs :
Civil Engineering Division.
Cement Brick Factory.
Mechanical Engineering Division.
Engineers' Office Steam Launches.

Revenues and Expenditure of the Harbor and Wharf Administration

The charges collected by the Harbor and Wharf Administration are : for towing, working cargoes on board and on wharf, stevedore charges, wharfage fee, storage, warehousing, ship repairs, etc. The total revenue collected for 1923 amounted to $1,047,326 while the expenditure for the same year was about as follows :

To salary of staff	$ 295,672
,, material for light-houses	3,000
,, coal	34,000
,, repairing quays	960
,, machineries	1,200
,, office equipment	8,000
,, other materials	4,800
,, miscellaneous	32,368
,, working cargoes, stevedore	315,000
Total amount paid out	$ 695,000
Surplus for 1923	352,326
Total	$1,047,326

The returns for 1924 shows that the revenue has increased by about 20 per cent. to $1,203,718. At present the Administration has plans for the extension of Wharf No. 1 and the construction of a dock yard but as these two works would cost several million dollars nothing definite can be done as the annual surplus has been allocated for the up-keep of the Directorate-General and for meeting deficits occurring in other Departments of the Port Administration.

Relation Between Wharf and Railway

As stated in a previous paragraph the Wharf Office was under the Railway management during the Japanese occupation, but now it is a separate organization so frequently the Railway encounter great difficulties in the transferance of freight. Accordingly with the idea of doing away with the present inconveniences the Railway Authorities have negotiated many times with the Wharf Administration but so far nothing definite has been accomplished toward the solving of the problem. The best plan would be for the Railway to take over the management of the wharves. The Railway could pay the Port Administration a lump sum at fixed periods. Obviously such an arrangement would effect great saving in the administrative expense which would be used for the future extensions and improvements necessary to meet the expected increase in the volume of trade. Having control of the wharves the Railway could then make definite plans for the development of the wharf facilities which would bring great benefits to both the Railway and the merchants in the increased speed in moving cargoes. As the volume of traffic carried by any Railway is more or less governed by the capacity of the terminal facilities the Railway must try every means to get control of the wharves, or to have the power in deciding and carrying out all improvements and extensions necessary for the handling of the future increase in trade which is bound to come.

A Plan for the Extension of the Terminal Facilities

"The volume of traffic which a line would carry cannot exceed the capacity of the terminal" is more true to our Line than to any other as the amount of goods exported from this port is very great, especially with regard to the exportation of coal. Mr. T. Ohmra, Traffic Manager of the Kiaochow-Tsinan Railway, a prominent Japanese Engineer and former Adviser to the Ministry of Communications, estimates that by 1930 the coal production along the Kiaochow-Tsinan Railway will reach 2,460,000 tons of which about

one-half of this amount would be for export. The Tzuchuan Colliery is expected to produce over 1,400,000 tons while the Poshan, Takunlun and other mines to produce about another 1,000,000 tons annually. In order to handle this amount of coal for export it is of the utmost importance to provide a storage yard sufficient in size to store at least the amount of coal for one month so as to meet fluctuation of the water and rail transportation. The area of such a storage yard must be at least 200 *mows*. (one *mow*=6,000 Chinese square feet).

Besides the storage yard, means must be provided for the transhipment of coal from the coal piles to the steamers. Accordingly it is proposed to reclaim the portion "A," "B," and "C," making an opening through the break-water of 600 feet wide and using lighters to approach the coal piles. The areas "A," "B," and "C" to be protected by a masonry bulk-head which would give sufficient berthing space for more than 20 lighters of say 80 tons each in capacity at one time. It will then be possible to load 5,000 tons of coal in one day to five steamers anchored in the harbor. It is estimated that about 1,000 tons per day by means of lighters can be handled. This would meet the requirement of exporting 1,200,000 tons per year. The cost of reclamation of "A," "B" and "C" with bulk-head, tracks, bridges, etc. is estimated as follows :—

Reclamation with bulk-head	$1,176,000
Tracks, 10 km. using old 60-lb. rails	100,000
Bridges and buildings	250,000
Signals and safety appliances	35,000
Total ...	$1,561,000

The bridge across the cut in the break-water would be only a temporary structure until the whole reclamation scheme is completed, then the bridge would not be required. For rental of the coal storage yards resulting from the reclamation of "A," "B" and "C," it is estimated to bring in a revenue of about $100,000 besides which there would be the usual charges for berthing space, loading, etc.

The Germans certainly had great foresight in building the Kiaochow-Tsinan Railway for if one will study the map of China it is at once apparent what immense possibilities there are for the future of this Line with its vast hinderland and sea-port terminal. Had it not been for the Great War the Germans no doubt would have long extended this Line westward into the coal fields of Honan and Shansi Provinces. The Peking Syndicate owning the coal mines in Honan and operating the Tao-Ching Railway had long sought to connect the eastern terminus of the Tao-Ching Railway with Tsinan thereby giving them the shortest route to sea. From Tsinan to connect with the Tao-Ching Railway is only a stretch of about 200 miles through a practically flat country. The cost of this connecting line should not exceed $20,000,000 Mex. When this connection is made the Tsingtao terminal must be enlarged to meet the conditions required for the exportation of coal. Accordingly it is proposed to reclaim the portion of the Kiaochow Bay north of the break-water and build the four coaling wharves as shown in plan. The completion of such a scheme would give sufficient facilities for the handling of the coal coming over the Kiaochow-Tsinan Railway when the Railway is fully developed.

The principal products of Shantung are those from mines and farms, consequently the amount of trade in this Port varies with the season. The busiest time of the year for exports begins with November and ends at the beginning of June of the following year. During this period the harbor activities present a very lively scene. The principal exports are coal, cokes, salt, groundnuts, groundnut oil, iron ore, ore, eggs, tobacco leaf, soft-wood, etc. In 1922, 382,858 tons of coal were brought to the wharves by the Railway. Other items were, 22,817 tons coke, 40,320 tons iron ore, 15,490 tons groundnuts, 1,978 tons of tobacco leaves, 1,064 tons of dyestuff, and 4,334 tons of wheat bran. At Erh-Shih-Li-Pu, a station on the Kiaochow-Tsinan Railway and 178 kilometers from Tsingtao, the British-American Tobacco Company has a large plant for the collecting and curing of tobacco leaves. The tobacco company gives every help to the farmers in the cultivation of tobacco which is very suitable for the soil of the district mid-way between Tsingtao and Tsinan. In view of the greater value of the tobacco crops over the ordinary farming products it is likely that more and more tobacco will be cultivated in this region. The principal imports are raw cotton, cotton cloth, cement, cotton yarn, iron, machinery, wood and planks, match material, kerosene, mats, etc. Of the imports the principal items carried by the Railway were as follows for 1922 :—iron plates and iron ware 16,904 tons, kaoliang 85,072 tons, woods 27,216 tons, cement 7,896 tons, raw cotton 7,544 tons, coal pitch 7,151 tons, kerosene 5,817 tons, cereals 5,054 tons, match material 4,079 tons, cigarettes 3,383 tons, brooms 3,253 tons, and cotton yarn 1,696 tons. The large importation of kaoliang was an unusual thing for this harbor but brought about by the breaking down of the transportation system of the Peking-Mukden Railway caused by the Chihli-Mukden War in 1922.

The Kiao-Au Administration

The former German Leased Territory of Kiaochow which passed to the control of Japan during the Great War was returned to China as a result of the Washington Conference. After taking back the Kiaochow Territory from Japan the Chinese Government established the present Kiao-Au Administration with a Director-General at its head for the administration of the affairs within this territory. All public utilities such as water works, harbor and wharf facilities, electric works, telephone system, etc. having been built by the German Government and later extended by the Japanese became the properties of the present Administration. Consequently the management of these public utilities form several Departments of the Kiao-Au Directorate-General. In the Treaty between China and Japan for the retrocession of the Kiao-Au Territory it was stipulated that 20 per cent. of the Customs receipts shall be allocated to the Directorate-General for the maintenance and improvements of the Port of Tsingtao. The Customs remaining under control of the Central Government with its foreign Inspector-General on account of the foreign loan obligations. For 1923 the Customs' contribution amounted to over $400,000.

The following figures show the Budget of the Kiao-Au Administration for the year 1924. At the present writing the actual figures could not be obtained, only the figure for the total receipts of the Harbor and Wharf Office available being the amount of $1,203,718 for 1924.

1924 Budget of the Kiao-Au Administration

Revenue :		
Harbor and Wharf Office		$1,000,000
Water Works Office		288,000
Telephone Office		250,000
Agricultural and Forestry Bureau		24,000
Contribution from Customs (20 per cent.) ...		460,000
Finance Dept. (taxes)		
Land rentals	$400,000	
Ground tax	100,000	
House rentals	100,000	
Business tax	20,000	
Vehicle tax	26,000	
Miscellaneous tax	15,000	
Sanitation fee	84,000	
Miscellaneous receipts ...	24,000	
		779,000
Total estimated receipts		$2,801,000
Expenditure :		
Directorate-General		$ 240,000
Police Dept. (including water police)		530,000
,, ,, uniforms		50,000
,, ,, Sanitation Division		70,000
Harbor and Wharf Office		695,000
Water Works Office		120,000
Telephone Office		120,000
Finance Dept.		80,000
Public Works Office		325,000
Educational Bureau		100,000
Agricultural and Forestry Bureau		68,400
Bureau of Foreign Affairs		40,000
Pu Chi and Li Tsun Hospitals		34,800
Military and Naval Establishments and Courts		80,000
Observatory		20,000
Chemical Research Dept.		30,000
Commercial Museum		6,087
Official Gazette		12,000

Isolation Hospital	$ 22,000
General Miscellaneous	240,000
Total estimated expenditure ...	$2,883,287

In closing perhaps it would not be out of place to give a little description of the City of Tsingtao. It is well laid out, very much like any coast town one would find in any European country. The streets which are well lighted, are wide and having broad sidewalks. The principal streets have sheet asphalt covering, while streets on steeper grades are all paved with granite stone blocks. The architectural effect is principally German, interposed with foreign style houses built by the Japanese. There is a modern sewage system and every house has its flush-closet. The houses here are not like those of other cities where they are generally surrounded by a compound wall. The principal attractions are the fine beaches, perhaps the best in the Far East, excellent motor roads, and attractive parks and boulevards. In the summer months people from all over China come here for their summer holiday. During the Japanese occupation the Forest Park was planted full of cherry trees so each year at the end of April hundreds of people from nearby towns as well as the residents of Tsingtao fill the Park to enjoy the beautiful scene of the cherry blossoms and this Cherry Blossom Festival which the Japanese started is being kept up by the present Administration. The hills surrounding Tsingtao are covered with motor roads besides there is a fine motor road of over 38 kilometers leading to the top of the Laoshan Mountains. The Grand Hotel Company operates two large hotels, the Grand Hotel and Annex situated in the centre of the residential quarters and the Strand Hotel at the principal beach. The most imposing building is the present Directorate-General which is of granite construction and contains over 160 large rooms. It was built by the Germans and used as their seat of Government. This buildings, together with the many forts on the hills and around the Bay, reminds one of the former greatness of the Germans and their thoroughness in any undertaking. The population of Tsingtao for 1923 was estimated as follows :—

Chinese	276,700
Japanese	16,800
Other foreigners	430
Total	293,930 (approx)

Taking everything into consideration it is seen that Tsingtao, with its fine and well laid out streets and its superb harbor and excellent wharf facilities, is destined to play an important part in the development of not only Shantung Province but that part of China between the Lung-Hai and the Chung-Shih Railways, and its degree of prosperity will indicate the progress of development in this part of the Country.

Recent Interesting British Launchings

THERE have recently been several very interesting launchings of vessels destined for the Eastern trade, in England, among them being the Alcinous for Messrs. Alfred Holt & Company, the Sirdhana for the British India Steam Navigation Company, Limited, for their regular service and the Malabar for Messrs. Burns, Philp & Company, Limited of Sydney, for their service between Australia, New Guinea, and the Islands of the Pacific. The following are brief particulars of the several vessels.

Alcinous

The Alcinous was launched from the Cartsdyke Shipyard of Messrs. Scott's Shipbuilding & Engineering Company, Limited, Greenock on October 6. She is a twin-screw motor-ship, built for the passenger and cargo service of Messrs. Alfred Holt & Company. The dimensions of the vessels are 425 feet long by 54 feet 6 inches wide by 31 feet 9 inches in depth, with a gross tonnage of about 6,300 tons. The vessel is equipped with 20 powerful electrical winches for the rapid handling of cargo, and complies in every respect with the latest requirements of the Board of Trade and Dutch authorities for passenger carrying, including emergency dynamos, boat-turning-out gear, etc. The life saving equipment consists of 12 large life boats, two of which are fitted with Fleming's patent hand-propelling gear.

All the weather decks are sheathed, and the conveniences for the type of passenger carried are of a very high order. An interesting point in connection with the design of this vessel is that she is the first of Messrs. Alfred Holt and Company's fleet to have the machinery placed at the after end.

The vessel is propelled by two sets of eight-cylinder four-cycle Diesel engines, supplied by Messrs. Burmeister and Wain, of Copenhagen. These engines develop about 3,700 b.h.p. under normal running conditions. The engine room auxiliaries are all electrically driven, as are the deck machinery, steering gear, and refrigerating plant. To supply power for these and also for lighting and cooking purposes four auxiliary Diesel engines, each direct coupled to a dynamo, are fitted in the engine room. In addition to these there is an emergency dynamo situated on the centre castle deck. This supplies current to run the emergency pilge-pump, wireless telegraphy and certain lighting circuits in the event of the main electric units becoming totally disabled. An oil-fired auxiliary boiler is fitted in the engine room, and supplies steam for distilling, fuel-oil heating, etc.

Sirdhana

On October 5, Messrs. Swan, Hunter, and Wigham Richardson, Limited, launched from their Neptune Works a steel screw passenger and cargo steamer named the Sirdhana, which they are building to the order of the British India Steam Navigation Company, Ltd. The Sirdhana is similar to the Santhia, built at the same works for the British India Steam Navigation Company, Limited, which has been running satisfactorily on her service since the early part of the year. The steamer is built of steel with teak decks. She is 450 feet in length by 57 feet 9 inches broad by 36 feet 6 inches moulded, and is designed to carry a deadweight of 9,500 tons on a draft of 27 feet.

The machinery consists of twin-screw triple-expansion steam engines, which, with the boilers are also being constructed at the Neptune Works of Messrs. Swan, Hunter and Wigham Richardson, Limited, and are designed to propel the vessel at a speed of 13 knots. Amidships there will be comfortable well-finished accommodation for 30 first class passengers, including a large dining saloon on the bridge deck, with entrance hall, lounge and smoking room on the promenade deck above. There will also be excellent accommodation for 30 second class passengers on the same decks, including nine state rooms, a dining saloon and smoking room. Part of the upper deck and 'tween decks can also be used for carrying native passengers, up to about 3,000 in all.

The auxiliary machinery includes a steam windlass, steam steering gear, and 12 steam winches, together with the usual derricks, etc. There is electric light throughout. The refrigerating plant installed has been supplied by Messrs. J. & E. Hall Limited of Dartford. Bitimastic solution and enamel has been applied to bunkers, coal shoots, tank-top, boiler-room tank, bilges, shell plating, main inlet box, tunnel well, aft end of poop deck and water-way, upper and main deck stringer plates, as well as covering to the flat of deck plating. The ventilation will be very ample, as the vessel will trade in the Tropics, and there will, of course, be a wireless installa tion, a large number of steel lifeboats, steam heating, and refrigerating machinery, together with the necessary insulated store-rooms for the ship's provisions.

Malabar

The single-screw motorship Malabar, constructed by Messrs. Barclay, Curle & Company, Limited, for Messrs. Burns, Philp & Company, Limited, of Sydney, for their services between Australia, New Guinea, and the Islands of the Pacific, completed successful trial trips on October 9, the mean speed attained being 14 knots. After the trials the Malabar left for Avonmouth, from which port she proceeds to Sydney with passengers and cargo. Attending the trials on behalf of the owners were Viscount Inchcape and Mr. W. G. R. Snellgrove, whilst the builders were represented by Mr. Noel E. Leek, Mr. William Ewing, and Mr. Archibald Gilchrist.

(Continued on page 747.)

Iron, Coal and Mineral Oil on the Asiatic Coast of the Pacific Ocean

By B. P. Torgasheff

IT appears that just before the Great War, or in its very beginning Wells wrote: "Europe will have to descend from her altitude; the Pacific Ocean will become the arena for the happenings in the world and determine the future of the latter."

Without going into the trend of history or any analysis of the causes, we would only like to state that the above deduction of Wells will appear as perfectly correct to anyone following the evolution of the economy of the world. The Pacific Ocean has become long since already the arena and centre where the economic interests of Asia, Europe and America are interwoven, and the problem of the nearest future of the countries surrounding the same, has certainly been focussed in the universal attention.

The United States of America undoubtedly is the most developed and richest country on the Pacific, however the centre of gravity of the entire Pacific problem has to be looked for not on the American but on the Asiatic shores of this Ocean.

The Pacific coast of the United States cannot boast of its natural resources. Even now, and the more so as the time will pass on, the Pacific States will have to rely upon Asiatic markets both for raw products and the sale of their own manufactured products. As regards the general importance of the Pacific Ocean for America as a whole, one should not forget the words Theodore Roosevelt said, that its future was dependent "upon the other side of the Pacific Ocean."

The general simplified view taken in respect of the Asiatic coast was the same as the one adopted toward colonies in other parts of the world, viz. this coast was considered only as a cheap market of raw products for European and American industries. There are a great many countries which still stick to this point of view, and they will have to pay heavily if they fail in due time to take account of the actual and effective importance of the Asiatic East.

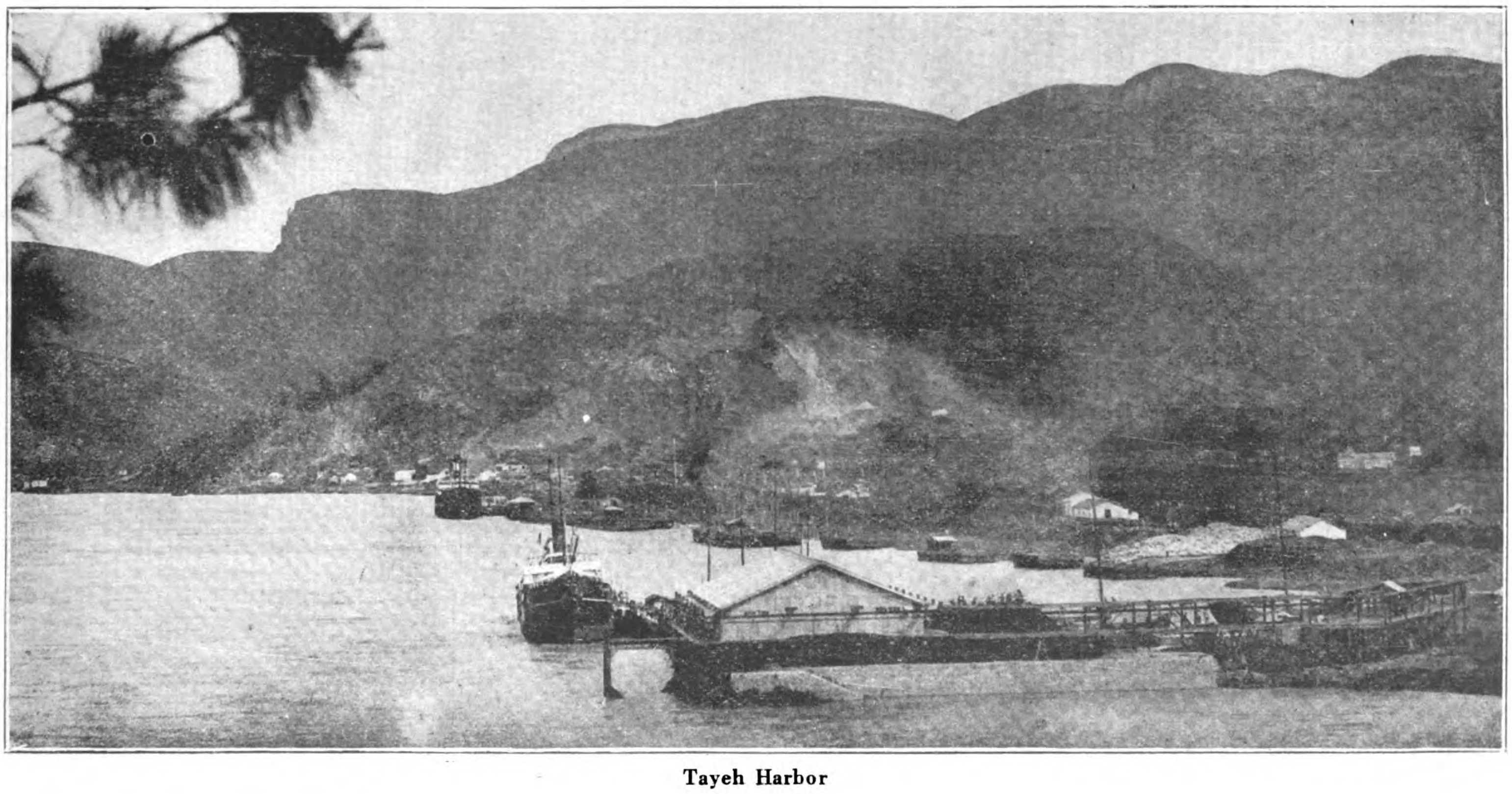
More than one third of the entire population of the earth are congested upon the coast of the Pacific Ocean, and they live in conditions very unsimilar to those prevailing on the Congo or in Borneo. It is true, China became the foremost raw products market for Europe and America, but China's future lies in the domain of industries. It is in this respect that China with a population of almost 500,000,000 is one of the most important factors in the economic problem of the Pacific Ocean.

It is true that China, as well as other parts of the Asiatic coast of the Pacific, has been too little explored, but there may be no doubt that the country possesses great resources both of universal and local importance. Compared to China such countries as Australia, the Netherlands Indies, Indo-China and Siam are but of secondary importance. Japan is comparatively speaking poor in natural resources and this is the principal cause of her desire to expand on the Asiatic continent in order to maintain the level of her industry.

The Russian Far East takes a position quite apart.

Its assets are rich natural resources of worldwide importance, such as mineral deposits and forests, and certain other favorable conditions for the creation of a local Far Eastern industry. But it has certain drawbacks, which at present consist in a sparse population, the insufficiency of ways of communication, which actually deprive three quarters of its territory of any possibility of economic utilization.

However, proceeding to an investigation of the opportunities and prospects of industrialization of any part of the Pacific coast, this part should not be taken as a separate entity and form the point of issue for independent deductions. The central location of China with its population of almost 500,000,000, making the country a market with a potentially very great purchasing capacity, largely offsets the weak point in the Russian Far East, viz. the sparsity of its population. Owing to quite a number of causes, which will be mentioned below, everything is taking such a turn that an industrialization of China will doubtlessly lead to an industrialization of the Russian Far East as well.



Tayeh Harbor

The old viewpoint upon China and other parts of the Asiatic coast as exclusively raw products markets and the attempt to treat them as colonies has already brought many negative results, and created the actual tangle of international relations in the Far East. In an indirect way it is also responsible for the abnormal development of certain branches of industry in Europe and America. On the other hand, and this is the most important, this foreign policy has held up the natural development of industries in all the Far East for several decades. China as an export market is already getting poor, but not because its stock of raw products has become depleted, but owing to more serious economic changes occurring in the country. Actually a great many people realize that the rapidly growing wants of the Chinese population of many millions are creating more attractive prospects for the local manufacturing of certain raw products instead of exporting them abroad. An old tradition induces people to say that China is a wild country and unsafe for the investing of foreign capital; as a matter of fact, however, other causes are responsible for the fact that capital was not invested in Chinese, industries. Europe and America were against the development of industries in Asia, which might threaten their own industrial enterprises.

Many things have changed since. The War showed that in Europe itself a further concentration of industrial establishments in such larger centres as London and others, was connected with a risk for the capital invested. No more faith is placed into the soundness of the social structure of Europe and by scattering itself all over the world the capital wishes in a certain way to insure its right to further existence.

If in former days foreigners invested their money in China only in raw products and railways necessary to carry the former to the ports, now one may already observe another tendency—to find a way for the investment of funds into the local industry and develop ways of communication of a general industrial importance. It should also be mentioned that native capital is growing in China, though at a slow pace, and it is very characteristic that the same is to be found exclusively in industries which are being organized according to modern European methods.

It is too difficult a task to compound all the data showing the potential opportunities for a development of industries in China.

Certain figures, however, are too characteristic not to be quoted immediately. Thus, for instance, the textile industry in China is only of very recent origin. In 1900 there were no more than 200,000 spindles in China. In 1912 this figure rises to 841,000 and in 1921—to 3,165,000. This industry is growing with a firm pace and in spite of all talkings about the crisis in China, it still manages to find the necessary funds.

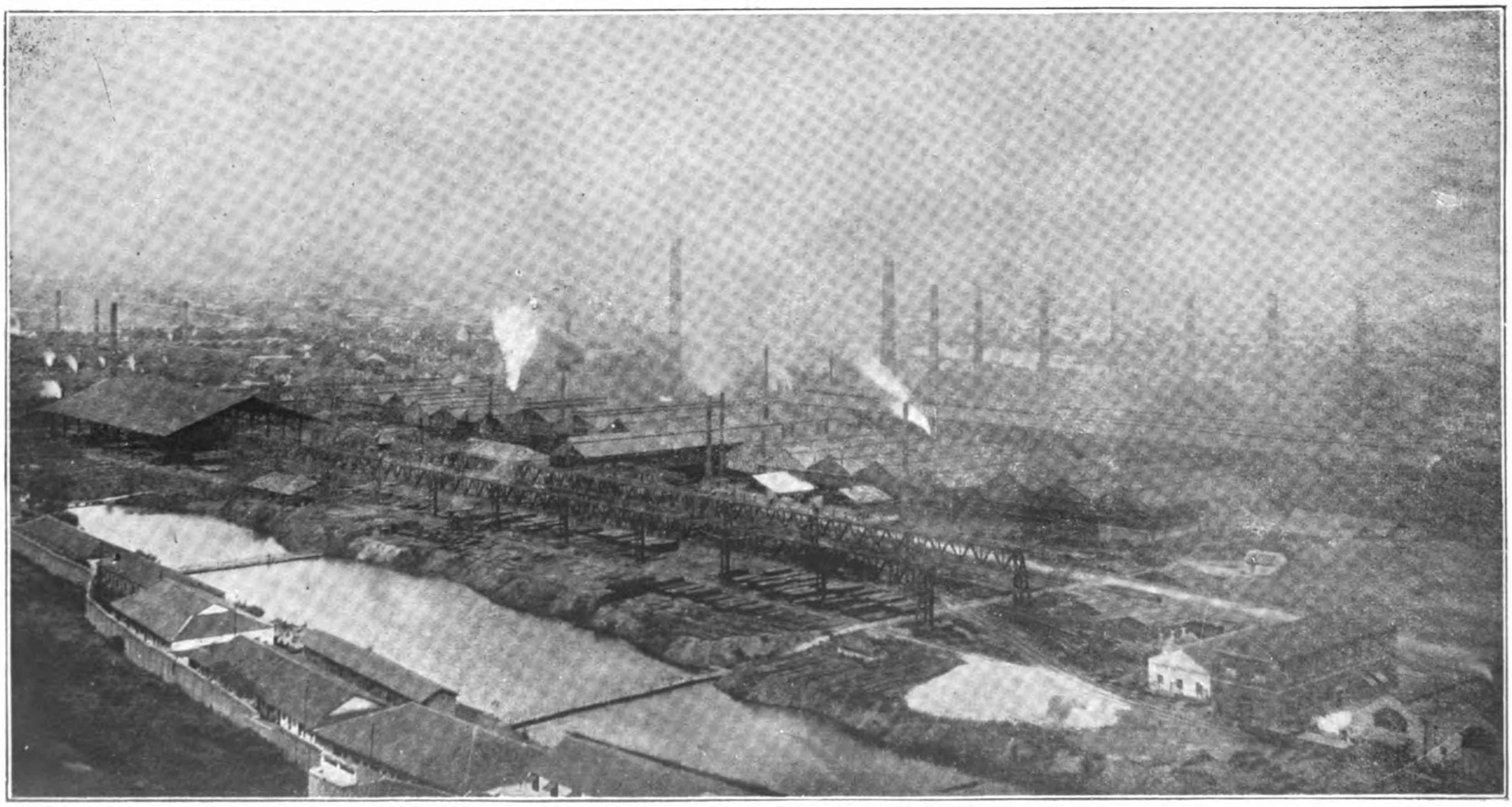
The consumption of cotton piece goods is growing quite as rapidly (in spite of the fact that the average state income of China is calculated at not more than $2.00 per head). Therefore it would be quite unreasonable to say that China could be compelled to depend upon imported piece goods for any length of time. It has become clear a long time ago that the same may profitably be manufactured on the spot. Japan realized this to a great advantage for herself. One may assert with an almost absolute certitude that the textile industry will be one of the most important manufacturing industries in China.

Mr. Julian Arnold, the American Commercial Attache in China, one of the most active leaders of the foreign economic policy in China, considers that the pace of industrialization of China is extraordinarily rapid and, therefore, he foretells that should China develop as rapidly as in the course of the past six years, it will have up to 40,000,000 industrial workmen instead of the several hundred thousand at present.

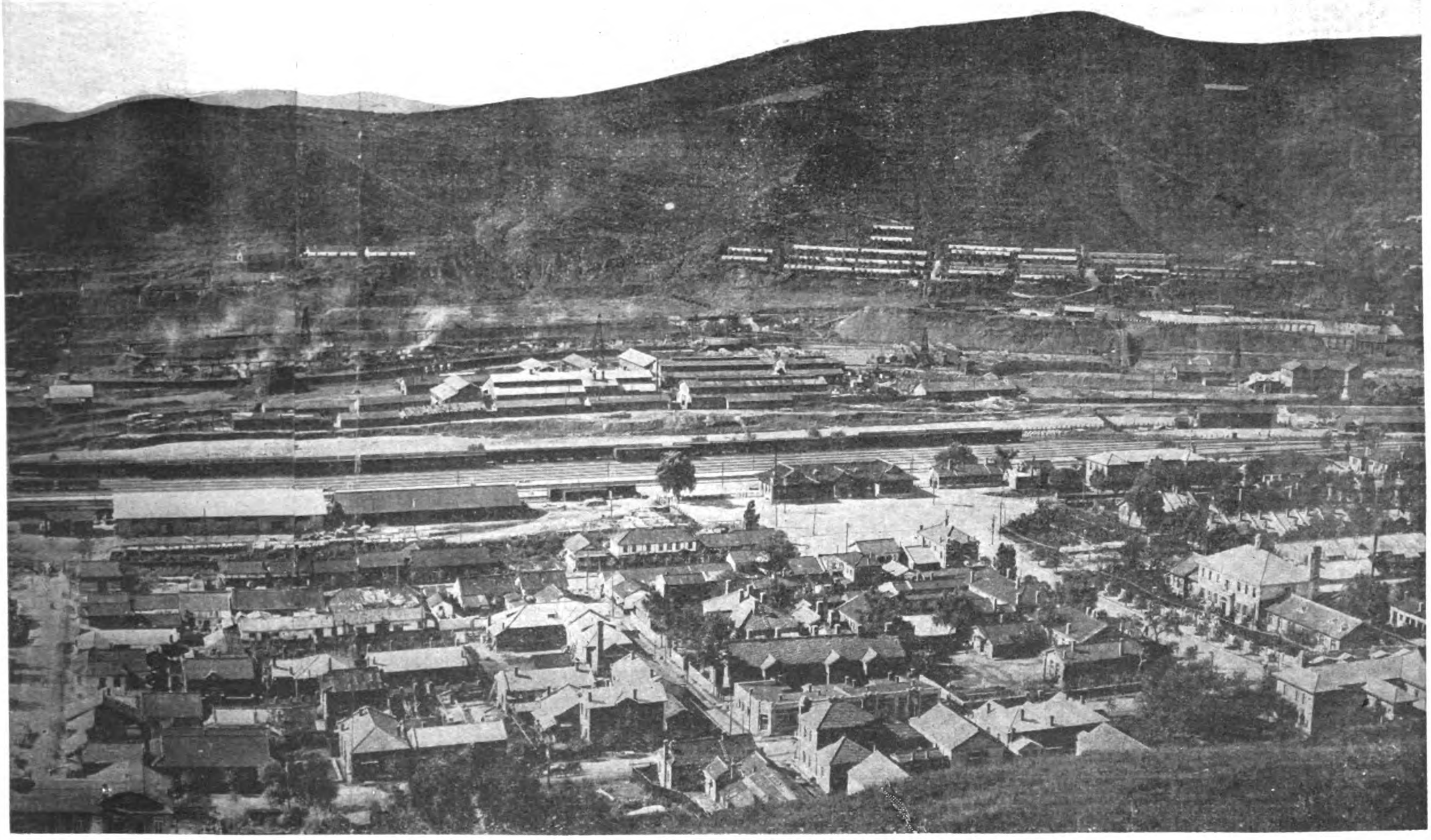
The political and economic interests of many countries are intricately intertwined on the Pacific Ocean. But the capital will only look for lines of a least resistance, in other words opportunities still untapped. On the Asiatic coast there are two such opportune territories: China and the Russian Far East. Capital will find a good investment in China—in railroads of industrial importance and in the textile industry. The tournament actually fought out between Japan and England for the cotton business, has given tremendous advantages to the former owing to the fact that she began herself to manufacture piece goods for China on her proper territory and in China itself.

Large quantities of metals, machinery, etc. the imports of which will certainly increase in proportion with the development of industries in China, will be required for the construction of railways and the textile industry. A normal development of the textile industry, however, and a regular commercial, not only concessionary, building of railroads are calling for the creation of a native metallurgic industry in the Far East.

Compared to America or England the Asiatic coast of the Pacific Ocean—inasmuch as it has been explored so far—does not seem to be very rich in iron ore and coal deposits. Therefore a



General View of Hanyang Iron and Steel Works



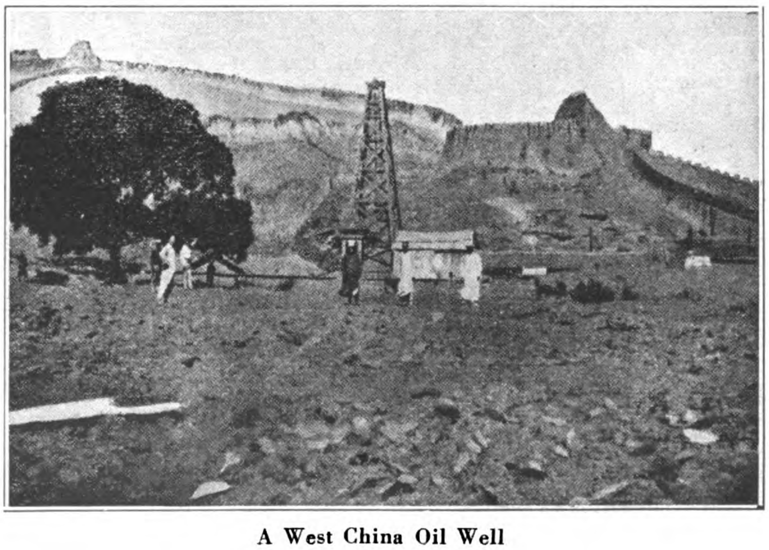
Furnaces and Principal Coal Workings

very important question arises where to find the most convenient spot for the formation of a metallurgic centre. This matter is of such importance that it is being studied practically already. For the time being it is difficult to say where a native metallurgic industry will arise on the Asiatic coast and the scale of such an industry. This question is not quite clear as yet. One thing, however, may be considered as certain that is, that the favorable natural conditions will vest the Russian Far East with an important part in this direction.

Coal

The metallurgic industry requires coal and iron and the same must be obtainable in especially favorable combinations as regards their relative deposits and the corresponding qualities for the coal and ore. On the Asiatic coast of the Pacific Ocean one finds coal and iron ore deposits. This coal and ore, however, has been so little prospected for the time being, that there is not the slightest possibility to establish with more or less certitude the location of the centre of the future metallurgic industry in the Far East.

Japan is the only country in the Far East where prospectings have been undertaken in a satisfactory way, but their results were negative. The Japanese isles are generally poor in deposits of ore, particularly iron ore. The Japanese coal is poor in quality and its deposits are insignificant in comparison to the pace at which industries are developing in the country.



A West China Oil Well

According to Japanese sources of information and placing on record all the known coal deposits in the insular empire, including deposits of a width of not less than 2 feet and a depth of up to 2,000 feet below the sea level, the entire coal deposits of Japan are estimated at only 822,000,000 tons as against 3 billion tons in the Russian Far East and 23 billion tons of Chinese coal.

The Pacific coast of the United States is very well prospected, but its coal deposits are not very considerable. They suffice only for the requirements of the native American industries at their present stage of development and for a period of approximately from 25 to 30 years. The total coal deposits of the entire territory of the United States are estimated at 4,200,000,000 tons, but the local consumption is tremendous. The United States consumes annually over 700,000,000 tons. For a number of years already America has experienced a shortage of fuel which was covered only by kerosene. There is therefore nothing astonishing in the well known fact that in recent years the United States very attentively investigated the question of a possible organization of the supply of cheap Chinese coal to the United States.

The coal deposits of Australia are estimated by the Statesman's Year Book at 166,337,000,000 tons and owing to quite a number of reasons they may be considered having a purely local importance only.

In Indo-China the largest coal deposit is the one of Honggay, not far from Haiphong. The latter is also of a purely local importance.

The only countries possessing more or less abundant and free coal reserves on the whole Pacific coast are the Russian Far East and China. Inasmuch as one approaches these reserves from the standpoint of figures they do not appear very considerable. However, the still unexplored enormous areas in the Russian Far East and China, particularly in the first-named country, give a hope to expect a discovery of new large deposits of coal and ore.

According to even most conservative estimates of the more or less known deposits of coal in China and the Russian Far East, they contain a reserve of up to 27,000,000,000 tons of coal.

Out of this quantity according to calculations of Drake and Inouye the reserves of China consist of :

6.252 million tons anthracite
17.183 ,, ,, bituminous coal,

or a total of 23.435 million tons of coal.

The figures of Ahnert and Polevoi, which cover only a few of the more or less known deposits, show that the coal reserves in the Russian Far East represent about 3,000,000,000 tons, of which 2,000,000,000 are Sakhalin anthracite.

There exist certain more optimistic statements regarding the coal reserves in China. Thus, for instance, Prof. Ting, representative of the Chinese Geological Committee at Peking, estimates the coal deposits in China at 45 billion tons. Julean Arnold, American Commercial Attache in China and the American Professor Fernand, the latter having especially come to China for this purpose, state that the coal reserves in China are of up to 1,200,000,000,000 tons.

Any more or less systematic prospecting has never been effected in China nor has even a simple inspection ever been made of all coal deposits in a very few districts. It is, therefore, difficult to say which of the above figures is nearer to truth. In any case the coal deposits in China consist of many billions of tons.

Taking Prof. Ting's figure of 45 billions tons as probable then at the rate of the English and American normal consumption per individual (about 6 tons per individual) this reserve would suffice for only 15 years. The present-day consumption of coal in China, however, represents only the modest figure of 2.6, poods per individual (20,000,000 tons per annum for 450 million individuals).

The principal deposits of coal in China lie at a rather great distance from the industrial centres of the country. The principal coal mines are in Shansi province, where the reserve is estimated at 5.800 million tons. Other deposits are in the provinces of Chihli, Honan, Hunan, Szechuan, Shansi, Yunnan and Kweichow.

Compared to the number of Chinese population the actual output of coal in China is quite insignificant. In recent years the total production of coal in the whole of China amounted to about 40,000,000 tons, of which Prof. Ting estimated that 20,000,000 tons were produced with modern mining methods and the balance by crude native mining procedure.

Government statistics for 1920 give the following figures for the total output of coal in China (exclusive of Japanese mines):

	Tons.
Chinese mines with modern equipment ...	3,720,000
,, ,, ,, primitive native ...	6,020,000
Government owned mines	780,000
Foreign mines	8,980,000
Total	19,500,000

The most important mines in China are those controlled by Japanese and British capital, to wit :

(*a*) The Fushun mines owned by the South Manchuria Railway, with a yearly production of about 3,000,000 tons.

(*b*) The Kailan mines of the Kailan Mining Administration, controlled by British capital. Located in Chihli province. Annual output about 4,000,000 tons.

(*c*) The Pinghsiang mines in Hunan near Hankow. They work for the Hanyang Iron Works and produce up to 1,500 tons of coke per day.

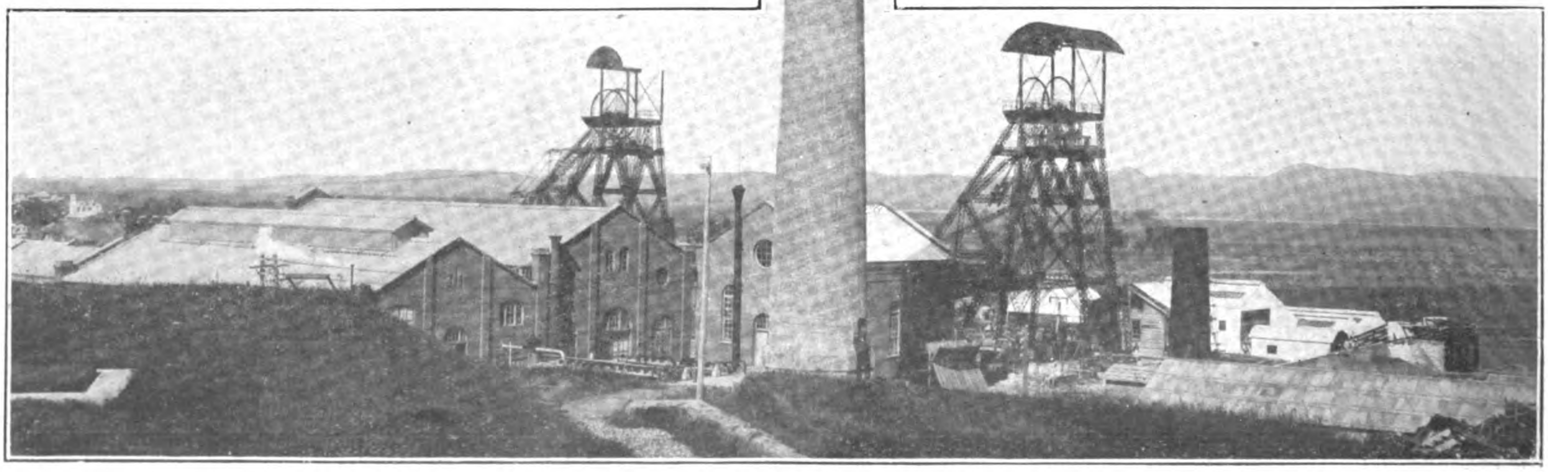
The existing knowledge of the Chinese coal shows that only very few of its sorts are suitable for metallurgic purposes. If we add to this that the reserves of some of the best coal are already under direct or indirect control of Japan—in South Manchuria and on the Yangtzekiang, we will understand that the opportunities for large foreign capital to invest in the metallurgic industry are getting smaller from year to year.

In respect of the Russian Far East the position is different, in spite of the above mentioned lesser (as compared to China) figure of the coal reserve. Generally speaking, the coal reserve of the Russian Far East has never been exactly and completely summarized, and therefore it would be premature to compare the respective figures with those established for China. Polevoi and Ahnert are known by the conservatism of their estimates and deductions and their figures are not comparable to the compilations of the American Arnhold. Arnhold, Ting, Drake and Inouye have calculated thousands of billion tons of coal on the entire territory of China, of which as a matter of fact three quarters are just as little explored as regards coal reserves, as the Russian Far East.

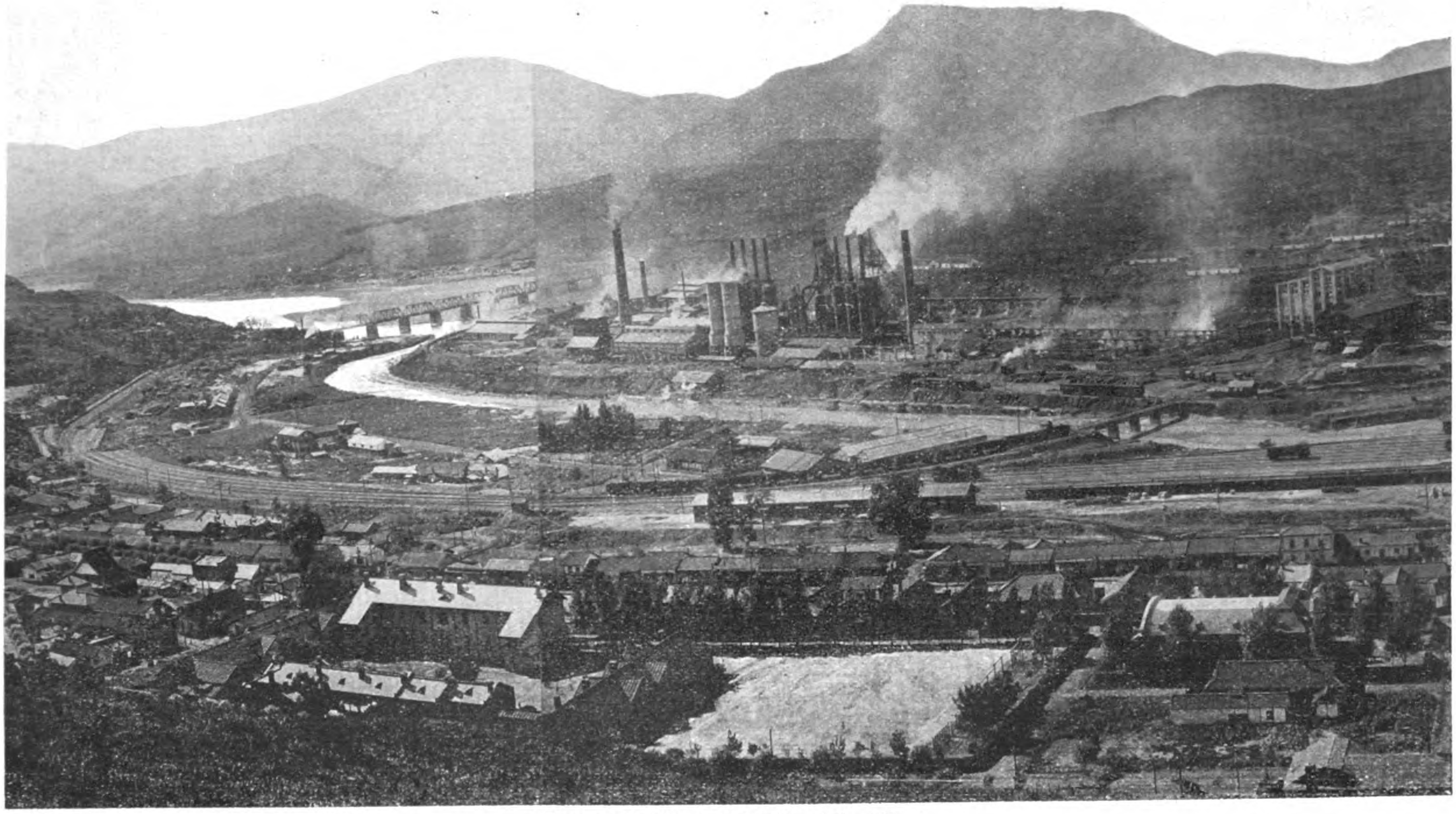
Ahnert and Polevoi simply exclude from their summaries such deposits which have only been registered but not investigated. Their estimates do not cover large districts in Transbaikalia and the Maritime province, nor do they include the entire province of Kamchatka and a considerable part of Amur province.

Regarding the above quoted estimates of the coal and iron reserve of China and the Russian Far East the following should be noted. An exact investigation of the mineral resources of any country stands in direct proportion to its industrial development. We know, for instance, that the British coal reserves are of the maximum extension, because the industrial position of England made it possible to explore all coal deposits and even seams of a two inch thickness. America is also very well explored, however, had it remained in the same state of development as China, its coal reserves would probably be estimated in very modest figures. Provide China and the Russian Far East with a railway net such as in the United States, and then one may presume, that the coal reserves in the Far East will be expressed in much larger figures than the known enormous reserve in America.

Up to the present time the Russian Far East produced only quantities sufficient to cover its own needs. Thus the general consumption amounted to 120 million poods, of which the railways used up to 70 million poods, the remaining 32,000,000 poods being consumed for other requirements.



The Fushun Mines



Panoramic View of the Penchihu Blast

Out of this total quantity Sakhalin supplied 5 million poods and the Maritime province—42 millions. The Geologic Committee estimated the total coal reserve in the Russian Far East as follows :

	Lignite	Bituminous coal
	[millions of tons]	
Transbaikal province	100	—
Amur province	400	5
Maritime province over	50	300
Sakhalin Island, over	10	2,000
Total over	560	2,305

The figures, certainly, do not cover the known but yet unprospected coal deposits in a large area of the provinces of the Amur and Kamchatka.

Taking the Russian Far East such as it is now, it should be said that all its coal, except certain coal mines in the Maritime province and Sakhalin, is of only local importance. However, certain coal deposits in the Amur province, and particularly the deposits in Kamchatka, as soon as they are prospected, may easily obtain a great importance for the outside world. A number of coal deposits in the Maritime province and the coal in the Russian half of the island of Sakhalin, are undoubtedly located most favourably for the purposes of metallurgy in the whole of the Far East. Their quality is appropriate and iron ores are found quite near from them.

From the estuary of the Amur river there stretches to the north-east a coast line of a length of almost 4-5,000 versts, which has geologically very little been explored. Coal deposits have been found there in quite a number of spots. Should even only a few of these deposits consist of high grade coal, their value will nevertheless be very considerable, because one may trust that they will be important for the whole of the Far East.

Iron

As regards the reserve of iron ore, it should be said that both China and the Russian Far East have even less been surveyed in this respect than in the respect of coal. For the Russian Far East there exist the conservative calculations of Ahnert, covering, however, but seven prospected deposits of iron, and only for the time being, we consider them the largest. It should not be forgotten, however, that not seven but more than one hundred various deposits of iron ore have been placed on record in the Russian Far East. Thus in 1923 the Far Eastern Geologic Committee kept a record of 137 registered deposits of iron ore, viz.;

in Transbaikal province	70
,, Amur province	22
,, Maritime province	36
,, Kamchatka province	9
Total	137

It will remain to the future to establish the nature and importance of these deposits.

According to the summarised records of the Geologic Committee (in 1923), the seven explored deposits of ore have the following composition :

	In million tons				
	Magnetite	Bog-ore	Hematite	Iron sands	Total
Olga and Sudzukhe ...	1.95	0.11	—	—	2.06
Sergievskoie	0.15	0.12	—	—	0.27
Posiet	—	—	—	1.11	1.11
Nikolaevskoe	—	0.8	—	—	0.8
Malohinganskoie ...	—	—	2.6	—	2.6
Transbaikalia [Baliaginsk]	2.2	—	—	—	2.2
Total	4.3	1.03	2.6	1.11	9.04

Ahnert estimates that the total ore in these deposits amounts to only 294 million poods, or 4.9 million tons, distributed as follows :

Olginskoie	120 million poods
Sudzukhe	14 ,, ,,
Sergievskoie	14 ,, ,,
Malohinganskoie	50 ,, ,,
Nikolaievskoie	50 ,, ,,
Baliaganskoie	46 ,, ,,

According to calculations made by the Vladivostok Geologic Committee the above mentioned 9,040,000 tons of the ore contain about 3,930,000 tons of metallic iron.

John Cook, an American who recently lived several years in the Russian Far East, published in the foreign press (The China Weekly Review) his data regarding the mineral riches of Eastern Siberia, wherein he estimates the reserve of iron ore in the Russian Far East at 565 million tons. Compared with the data of the Geologic Committee this figure is absolutely phantastic, but still it is very characteristic inasmuch as it prove the easiness with which Americans are apt to describe unexplored regions in figures of millions and billions, as we saw above in respect of the mineral resources of China.

The most optimistic Russian estimates of the more or less surveyed deposits in the Russian Far East so far have given the figure of 900 million poods, or 15 million tons of ore, however, without taking into consideration more than a hundred of registered though unsurveyed deposits in the Transbaikal, Amur and Kamchatka provinces, no Russian geologist having as yet ventured to guess at the approximate importance of these reserves.

The normal demand for iron in the Russian Far East equalled about 4 million poods of metallic iron before the war, which would necessitate an annual output of 8 million poods of ore and 10 million poods of coal, provided that the iron be produced on the spot. As a matter of fact this was not the case. The only iron works in operation in the Russian Far East — the Petrovsky Works in Transbaikalia, used 490,000 poods of ore as a maximum, producing 242,000 poods of pig iron. All the other iron was always received from the Ural.

As regards coal, the iron ore deposits of the Russian Far East are in a markedly unfavourable position in Transbaikal province, where there are many (70) iron ore deposits, but almost no coking coal is to be found. The Malohingansk deposits of hematite find an appropriate coal only in China in the estuary of the Sungari river, or must obtain the same from Sakhalin by the Amur river way. However, there is a hope that a survey of the Bureinsk coal will improve this unsatisfactory position. The Nikolaievsk deposit as well as certain ore deposits in the Maritime province find the necessary coal both on Sakhalin island and in the Maritime province.

There exist no authoritative data regarding the reserve of iron ore in China. The Chinese Geologic Committee* published a respective summary for the first time on 1921, with the reservation, however, that it had taken the figures from various foreign sources, and that undoubtedly these figures were considerably exaggerated. This survey estimates the total ore reserve in China at 677,099,000 tons, containing about 350 million tons of metallic iron. The principal deposits of iron ore are located in the following provinces of China :

Chihli	91,479,000 tons of iron ore
Hupeh	52,660,000 ,, ,,
Anhwei	50,000,000 ,, ,,
Mukden	387,580,000 ,, ,,
Kiangsu	35,000,000 ,, ,,
Shantung	29,000,000 ,, ,,

A maximum estimate of the possible reserve of iron ore in China establishes the same at about 1 billion tons, in other words it equals ¼ of the reserve of the United States, 4/5 of the reserve of the United Kingdom, ⅓ of the reserve of France and ⅓ of the reserve of Germany.

Of the known deposits the most favourably located in respect of coal are the iron ore mines in the province of Hupeh, in the Yangtze valley, in the district of Tayeh. By granting a loan in 1912 to the Chinese Hanyehping Company Japan placed under her de facto control one of the most interesting metallurgic combines in China, viz, the Hanyang Iron Works in the vicinity of Hankow, the Tayeh iron mines and the Pinghsiang coal mines. We do not know whether the respective figures are exaggerated or not, but Dr. Hsi Kung-Chen in his work entitled "Contemporary China," says that the reserve of the Tayeh iron mines may be estimated at about 700,000,000 tons.

At the present time according to recent statistics the annual production of iron ore in China amounted to 1,400,000 tons, of which over 300,000 tons are exported to Japan and over 1,000,000 tons are manufactured into iron in China itself, mostly by Japanese capital. These figures, necessarily are not complete, because the production of metallic iron at works amounted to 500,000 tons and by crude native manufacturing methods—to 300,000 tons. There exist eight metallurgic works in China of which two are still in construction, which will soon be finished. The principal of these are as follows :

1. The Hanyang Works near Hankow, with a yearly output of about 150,000 tons of iron.
2. The Anshan Works at Moukden, with an output of 150,000 tons met. iron.
3. The Penchihu Works, Moukden, with an output of 80,000 tons met. iron.
4. The Kailan Mining Administration, Chingwantao, with an output of 80,000 tons of met. iron.

According to official information of the American Commercial Attache the iron ore reserve of China should be estimated as follows: China disposes of 400,000,000 tons of iron ore appropriate for the smelting of metallic iron with modern methods of manufacturing. Besides the country possesses 300,000,000 tons of ore which is only suitable for the smelting of iron by modern methods, and 300,000,000 tons of ore suitable only for re-smelting by native primitive methods, for purely local needs.

Until quite recently the consumption of iron in China amounted to the very modest proportion of 0.0008 ton per capita (1.9 Russian pound as against 1 pood in the Russian Far East and 10 poods of iron in the United States of America). The population of China, which now approximates 500,000,000 individuals taken at the more conservative estimate of only 450,000,000, therefore, consumes not more than 380,000 tons of iron per year. These figures refer to the year 1916, but the consumption of iron by the people since that year is not considered to have increased, and if the output of iron has been growing recently, this should be explained not by any increased local consumption, but by a special manufacture of iron in China for Japan by Japanese capital. This is the reason why in the export tables of the Customs one finds very considerable figures representing the export of iron from China. Leaving machinery aside, the export of iron from China at the present time almost by 500,000 tons exceeds its import.

According to summarized data for a number of recent years the production of pig-iron in China fluctuated between 200 and 300,000 tons per year, of which quantity from 160 to 200,000 tons were exported, mostly to Japan. At the same time China imported annually over 300,000 tons of iron and steel; therefore the consumption of iron in China itself may be put at 400,000 tons. According to Tegengren this figure should be increased by 170,000 tons of pig-iron produced in China by crude native methods. Thus, the general consumption of iron and steel in China should be taken as from 550 to 600,000 tons per year.

The consumption of iron in China is actually quite insignificant. According to Tegengren, who quotes figures for 1924, the annual consumption of iron per head of the population in China amounted to only 1.4 kilogramms, whereas the average per head consumption in the world equals 40 kgr. The comparative figures are as follows :

United States	250 Kgr. per. annum & per head
United Kingdom	130 ,, ,,
Germany	130 ,, ,,
Sweden	85 ,, ,,
Russia	30 ,, ,,
Japan	14 ,, ,,
China	1.4 ,, ,,

Admitting a rapid development of the present low industrial standing of China toward the present position of the Russian Far East with its consumption of one pood of iron per head of the population, then the 450,000,000 individuals in China will annually demand 7,500,000 tons of iron, or for manufacturing of the same—a

*Presumably the Geologic Survey of China

minimum of 15,000,000 tons of ore. With such an average the total reserve of iron ore in China, which is estimated at a maximum of 1,000 billion tons, will last for 66 years only. With the American rate of consumption the entire iron ore reserve in China would suffice for only 5 years.

An attempt of a general summary of the reserve of iron ore in all the territories bordering upon the Pacific Ocean was made by F. Tegengren in his book entitled " Iron ore and metallic industry in China " published in 1924. He estimates all the known and probable deposits of ore as follows :

	tons
China	950,000,000*
Netherland's Indies	800,000,000
Pacific Coast of the U. S. A.	300,000,000
Australia and New Zealand	345,000,000
Pacific Coast of South America	264,000,000
Philippine Isles	200,000,000
Japan and Korea	80,000,000
Malay Peninsula and Br. North Borneo	25,000,000
Russian Far East	5,000,000
French Indo-China	moderate
Siam	,,
Canada	,,
Mexico	,,
Total	2,969,000,000

According to 1920 statistics quoted by Hatch and Kuhn, the known reserve of iron ore in the world is estimated at from 31 to 32 billion tons, with a possible maximum (according to Kuhn) of even 100 billions. If one considers these figures, then the ore reserve of all the countries surrounding the Pacific Ocean represents 9 per cent. only of the known world reserve, and taking the estimate of supposed other deposits—only a little over 2 per cent.

All the Pacific countries as a whole actually consume only 5 per cent. of the world's consumption of iron and metallurgic industry is still so little developed on the Pacific Ocean, that out of these 5 per cent. only one third is manufactured by the domestic industry in these countries.

According to rough calculations made by F. Tegengren the countries on the Pacific Ocean consume the following quantities of iron :

	tons	
Pacific Coast of the U.S.A.	1,500,000	
Japan	1,200,000	
China	400,000	(manufactured by modern process).
Australia	400,000	
Netherland's Indies	200,000	
Russian Far East	100,000	
Philippine Islands	100,000	
Indo-China	100,000	
New Zealand	100,000	
Pacific Coast of S. America	100,000	
Total	4,220,000	

According to statistics of recent years Japan consumes 1,500,000 tons of iron and steel every year, of which over 650,000 tons are produced in Japan proper, Korea and Manchuria and the balance imported. Japan proper, according to Tegengren, scarcely produces more than 250,000 tons of ore, though Japanese official statistics estimate the known and probable ore reserve of Japan at 80,000,000 tons, viz. :

	tons
Magnetite	40,000,000
Hematite	30,000,000
Lemonite	10,000,000

On the Pacific Coast of the United States considerable deposits of high grade ore are found only in California, but they are very inconveniently located beyond the mountain range in a hilly and desert territory. This unfavorable situation is aggravated by the fact that the nearest coking coal is at a great distance from the ore deposits in the states of Utah, Colorado and New Mexico. This explains why pig-iron from Pennsylvania is carried to California and there experiences serious difficulties in competing with imported European pig-iron, which is sometimes sold there 5 or 6 dollars cheaper per ton than the Pennsylvanian product.

Recapitulating the above data of the reserve of iron ore and coal in China and the Russian Far East and comparing them with the reserve of ore and coal in the United States, we get the following figures :

	Millions tons.		
	Russian Far East.	China	U. S. A.
		23,400 (min.)	
Coal	3,000	45,000	4,200,000
		1,200,000 (max)	
Iron ore	4.9	677 (min.)	
	9.0	700	4,000
	15.0	1,000 (max)	

America produces yearly more than 700,000,000 tons of coal, whereby it is running short of approximately 70,000,000 tons, which it has to replace by oil. Though America's coal reserve is very large, but the location of deposits is far from being satisfactory. The coal on the Pacific coast of the United States is of an average quality only as mentioned above, and its reserve may last for another 25—30 years.

The coal and iron ore of China and Russia, inasmuch as the same are exploited already do not represent any tremendous riches which would warrant an industrial development of the respective countries up to the level obtained in America and England. It is true, at the present time the deposits of ore and coal are scarcely being worked in China and in the Russian Far East, but industries are growing in both regions and they will demand coal and ore in the first place.

Petroleum on the Pacific Ocean

" The country which will secure the control of this most valuable fuel, will put its hand upon the riches of the rest of the world. The vessels of other countries will soon be unable to navigate without its oil. And, if it knows how to create its own mercantile marine, it will easily become the master of the entire world sea-borne trade, because to control the maritime ways of communications means to exact a toll from all the other nations. A process of the concentration of industries will take place in this country and its banks will become the clearing centres for the world. History already knows of one such example, when British coal forced Amsterdam to give up to London the rule over the seas,"—this is how Pierre de la Tramerie characterizes the importance of oil in his book entitled " World struggle for oil," which appeared last year and created such a sensation.

The reserves of coal in the crust of the earth are not inexhaustible and they are distributed in such a way, that almost all the developed industrial countries in the world are anticipating a more or less nearly and complete exhaustion of their coal resources, which may radically overthrow their entire material prosperity. This is why the consumption of coal is growing at a tremendous pace. Whole branches of industries are readjusting themselves, and the ways of communication by sea and by water begin to depend upon this new kind of fuel.

The advantages of oil over coal are enormous. The complete installation of a boring hole costs from 100 to 150,000 dollars and as soon as industrial oil is located the subsequent expenses will be trifling. However, coal mines of a secondary importance very often demand a spending of many millions before the first ton of coal is ready for sale. A reduction in the number of labor required represents an enormous saving. Finally, and this is most important : oil possesses very great technical advantages as a fuel.

Crude oil used as a fuel by ships increases the radius of their activity by a least 50 per cent. as against coal. With interior combustion engines the radius of activity of ships is trebled according to general opinion. Quite recently British shipbuilders assert that for shipbuilding industry one ton of oil will be the equivalent of 6 tons of coal. It will suffice to say that even with the present standing of industry a ship equipped with Diesel motors (for oil) can carry in her bunkers a fuel supply sufficient for 57 days of uninterrupted navigation, whereas the maximum period for coal-burning steamships is only 14 days.

*Of these 396,000,000 represent known deposits, and the remaining 550,000,000 tons-probable but unprospected ones.

These advantages of oil and the growing prices of coal caused more than 50 per cent. of the world's tonnage to use the oil fuelling in 1920. New ships are built almost exclusively with interior combustion engines, and old vessels are also gradually being converted into oil-burners. Since 1911 the mercantile marine of the United States consumes 15 million barrels of oil per year. The American railroads annually consume more than 50 million barrels. The largest quantity of oil, however, is used on overland roads in America, i.e. by the automobile traffic. Thus, in recent years the United States consumed up to 85 per cent. of its oil output for the automobile traffic. In a number of other countries this replacing of one kind of fuel by another is also to be observed, not to the same extent however, as in America.

The world's production of oil equalled 759,030,000 barrels in 1921 (1 barrel has 36 gallons ; 6 barrels equal one ton [by weight]). Between the years 1913 and 1921 the world output of oil has doubled and it continues to grow from year to year. In 1921 the output of oil was distributed as follows by countries.

	In thousands of barrels
United States of America	469,639
Mexico	195,064
Russia	28,500
Netherland's Indies	18,000
Persia	14,600
Rumania	8,347
India	6,864
Japan and Formosa	2,600

Poland and Peru produce over 3 millions barrels each, whereas all the other countries have a lesser output than Japan.

In 1901 Russia gave 50 per cent. of the of the world's output of oil, but in 1912 her proportion declined to 20 per cent. already. However, Russia continued to maintain the second place. The principal oil fields were located at Baku where over 800,000 tons of oil were produced annually.

According to Russian official statistics the output of oil in Russia was as follows (in thousands) :

	poods	tons	barrels
1913	564,000	9,400	56,400
1918	245,000	4,080	24,500
1919	273,100	4,500	27,310
1920	232,000	3,800	23,200

In the pre-war years of 1911 to 1914 the annual production of oil was between 560 and 570 million poods. About 69.5 per cent. of this output came from the Baku district before the war and 13.2 per cent. from Grozny. In recent years the Baku district produced the following quantities of oil :

From May to May	Output in tons
1920—21	2,537,000
1921—22	2,799,000
1922—23	3,340,000

In the pre-war years Russia used to export only small quantities of oil, consuming it for her own requirements. Thus the export figure for 1913 is 55,495,000 poods or 5,500,000 barrels.

In the years after the war the official statistics show that the export of oil from Russia amounted to

19,846,000 poods in 1922—23 and
44,156,000 ,, 1923—24,

or 65 per cent. of the pre-war exports.

Since 1918 Mexico has taken the second place among the oil producing countries of the world, her share being about 25 per cent. of the world production.

The world's reserve of oil, as far as the same has been estimated at the present moment, is calculated at 60,000,000,000 barrels according to data furnished by de la Tramerie. Out of this quantity only 7 billion barrels may be produced on the territory of the United States, the balance of 53 billion barrels being located in other countries in various parts of the world. According to data supplied by Melik-Nubaroff the oil reserve in European Russia alone equals 10 billion barrels, or 1/6 of the entire world reserve.

The United States is both the principal consumer and the principal producer of oil in the world. At the present time the United States uses up to 400,000,000 barrels yearly, or an annual average of 70 barrels per head of the population. Almost the same quantity of oil is consumed by the countries in the rest of the world, and their annual consumption is progressing from year to year.

It has been calculated that within the nearest decade the United States will require for its domestic consumption up to 500,000,000 barrels per year. During the same period a large increase in the oil consumption will undoubtedly also occur in other countries. Though the United States possesses only 1/7 of the of the world reserve of oil, still New York up till now has controlled the prices for the world market in oil, because about 70 per cent. of the world output of oil came from the territory of the United States.

In spite, however, of the allmightiness of the largest American oil trust—the Standard Oil Company, the capital of which has grown to U.S. $1,310,000,000,—towards the end of the world war the United States was confronted by another oil trust—the Royal Dutch-Shell of not lesser might and importance (a combine of Dutch and British interests, the policy of which is directed by Great Britain).

The skillful struggle for power with the Standard Oil Company moved along two lines. In the first place, before the Standard Oil Company had realized that the domestic reserve in the United States was insufficient for a complete and permanent control of the market, the Royal Dutch-Shell Company in the meanwhile seized the greater part of all the more important oil deposits in almost all the countries of the world and was unsuccessful only in its attempt to seize the Russian oil (Genoa Conference). Since 1919 the Standard Oil Company began to try to seize new oil deposits in different parts of the world, but wherever its expeditions were sent, they found the doors already closed.

Moreover, the Royal Dutch-Shell managed to penetrate even into the territory of the United States and towards the year 1921 it had seized the financial control over 43 per cent. of the entire output of oil on the territory of the United States, in the result of which fact at the present time the Standard Oil Company refines only 49 per cent. of the American oil, against the former 90 per cent. The Royal Dutch Company has taken a firm hold in a number of states rich in oil, such as Texas, New Mexico, Colorado, Utah, Arizona, Montana, Dakota and Nevada. On the Pacific coast it possesses strong interests in California having seized about 75 per cent. of the entire output in this state.

At the present time the Royal Dutch Company produces over 90 million barrels per year and controls a capital of 22,000,000,000 gold francs. One of its last conquests is the almost complete seizure of the Mexican oil, the control over the Suez Canal, and, which is very characteristic—over the Panama Canal as well.

This is not the place to dwell upon the political aspect of this beginning struggle for oil, but it would be necessary to note that the Pacific Ocean will certainly have to become one of the greatest battle grounds of this economic oil war (unless this war becomes of a wider scope).

The Pacific Ocean is already now the arena of the largest international commerce. The future of the United States, as seen by Roosevelt and many others depends, if not absolutely, at least very closely upon relations with the markets on the coast of Asia. Asia and Oceania taken together provide raw products to the United States for a value of over one billion gold dollars. Its tonnage on the Pacific Ocean is large even now and is progressing from year to year. The Asiatic coast is very densely settled, its population equalling one third of the entire population of the globe. Its industry is gradually paving its way and its economic opportunities are tremendous.

As stated above, oil is accompanied by quite exceptional opportunities as regards the expansion of economic influence in new markets. Oil is to be found in several points on the Pacific Ocean and in very large quantities. It is, therefore, more than probable that oil will play not a small part in the beginning Pacific era of human history.

As a small illustration of the opportunities oil may find upon the Asiatic coast of the Pacific Ocean one may point to the extensive plans of the United States (which were not realized owing to protests on the part of England, Russia and Japan), to cover China with a system of railways and organize regular automobile traffic routes in interior of China and Mongolia. According to these plans it was proposed to supply these new ways of communication with 120 million barrels of American oil yearly.

On the Pacific shore of the United States oil occurs (leaving aside Alaska, which has but little been prospected in this respect, and where no work has been started so far), in California only, where it is found in large quantities. However, in California it is mostly not owned by Americans, but controlled by the Royal Shell interests.

Besides, oil is to be found in Columbia, Peru, Bolivia, Chile and the Argentine, where all the principal deposits are also controlled by the Royal Shell. In the southern part of the Pacific Ocean oil occurs in New Zealand and the Netherland's Indies, particularly rich seepages being discovered in the island of Borneo. This oil is also owned by the Shell interests.

On the Asiatic shores of the Pacific Ocean oil was discovered in China, where in the province of Shansi the Standard Oil Company holds a concession. It is expected that a line of oil deposits stretches from the coast in the direction via Shansi to Burma. Indications of Oil are found on the north-western border of China with Mongolia and also in Szechwan and Kansu provinces. Small reserves of oil exist in Japan, as we shall see below. In the Russian Far East oil occurs in several localities, and it seems that in great quantities it is to be found in Russian Sakhalin. Lastly, new discoveries of oil deposits, which are very promising, have been made in Kamchatka.

The pace at which the domestic consumption is growing in the United States does not admit of any possibility of large American exports of oil to the continent of Asia. The Australian and Borneo oil products will principally move in the direction of European exports, which tendency may be observed even now. For this reason, obviously, all the countries intending to remain political factors on the Pacific Ocean, will have to look out for and seize oil reserves on the Asiatic coast of this Ocean.

The Standard Oil Company obtained its concessions in the province of Shansi in 1914. According to American reports the Company spent about US$2,000,000—and found oil suitable for industrial purposes, however, in insufficient quantities to proceed to an immediate work. These reports, however, refer to the beginning of works in this province, when the holes bored did not exceed 2,000 feet. The work is being continued but the results ar unknown.

Oil is of tremendous value and importance for Japan, which requires it both for her navy and mercantile marine. For the navy alone a ready reserve must be held of 64,000,000 tons for war-time emergencies. The domestic oil reserve in Japan, however, is quite insignificant and the oil itself is of low quality.

The output of domestic oil in Japan is insufficient even is spite of the very low consumption of the country at the present time. Owing to this fact more than 50 per cent. of the oil produced in Japan has to be imported, as shown by the following figures for 1920 :

	Domestic output cases	Imports cases
Kerosene	1,174,000	2,725,000
Gasoline	663,000	226,000
Lubricating oil	1,657,000	326,000
Light oil	2,214,000	176,000
Total	5,708,000	3,493,000

An acute demand for oil and the shortage of domestic resources explain Japan's insistance to obtain oil concessions in Russian Sakhalin, and such facts as for instance the distilling of oil from oil-containing shale in the province of Mukden, and, finally, serious experiments made in the laboratories of the South-Manchuria Railway Company at Dairen to obtain an oil for industrial purposes from Manchurian soya beans.

It would be premature to make a definite statement regarding the oil opportunities in the Russian Far East. It is widely known however, that the Sakhalin oil certainly is an oil of industrial importance, and that this importance obviously is considerable if first the Americans and then the Japanese were so keen after getting the respective concessions. Seepage have also been discovered in the system of the Lena river. They have not been prospected so far, it is true, but will have a convenient water outlet towards the Pacific Ocean by the Nelkan and Ayan rivers. Adding to this the Kamchatka oil, which is also an industrial oil as may be deducted from the reports made by Polevoi, then one will realize that the Russian Far Eastern oil may soon become a most important factor in the economy of the Pacific Ocean.

Recent Interesting British Launchings

(Continued from page 738.)

The leading particulars of the Malabar are as follow :—

Length 360 feet, breadth moulded 48 feet 6 inches, depth to upper deck 25 feet 3 inches ; gross tonnage 4,500 tons ; deadweight carrying capacity 4,600 tons. The vessel has been built under special survey to Lloyd's 100 A. class, in addition to which she embodies all the requirements of the British Board of Trade and the Australian Navigation Act.

The propelling machinery, which has been installed by Messrs. John G. Kinnaid & Company, consists of one set of Burmeister and Wain type Diesel engines on the four-stroke single-acting principle, having eight cylinders developing 2,700 b.h.p.

Accommodation is provided for 163 passengers in one, two, and four berth cabins, with large, airy public rooms, consisting of dining saloon at fore end of the bridge, with an auxiliary dining saloon on the upper deck, also smoking saloon and music room whilst the main entrance on the bridge deck has an open balustrade well immediately above the dining saloon, and is furnished as a lounge.

All of the state rooms and public rooms are tastefully furnished and decorated, and the problem of keeping the rooms cool and airy has been met by the provision of mechanical ventilation on the punkah louvre system. Large insulated store and provision rooms are provided, and the entire 'tween decks forward are insulated for the carriage of fruit and frozen meat, the necessary temperatures being maintained by two CO2 refrigerating plants. The refrigerating plant installed has been supplied by Messrs. J. & E. Hall, Limited of Dartford. The cargo-handling arrangements are very complete, consisting of five large hatches served by ten electric winches and fourteen derricks working on the Union purchase system. The steering gear and windlass are electrically driven, and the passenger galley range is oil-fired.

The Dredger "Woodford"

Messrs. William Simons & Co., Ltd., Renfrew, launched from their Works to-day (3-9-25) the Twin Screw Bucket Hopper Dredger " WOODFORD " which they have constructed for the Port of Spain, Trinidad.

As customary with the Builders, the " WOODFORD " was launched with all its machinery on board, complete ready for work.

The Hull and Machinery have been constructed to Lloyd's highest class.

The Hopper has a capacity of 150 tons, the bucket ladder being designed to dredge to a depth of 24-ft.

The vessel is propelled by two sets of compound surface condensing engines, steam being supplied from one cylinderical Multitubular Boiler, arranged for burning coal or oil fuel.

The " WOODFORD " has been built under the direction of Messrs. Coode, Fitzmaurice, Wilson & Mitchell, Consulting Engineers to the Crown Agents for the Colonies.

As the vessel left the ways, she was named " Woodford " by Mrs. Carmichael of London.

Machinery Manufacturing Industry in Japan

By Eisaburo Kusano

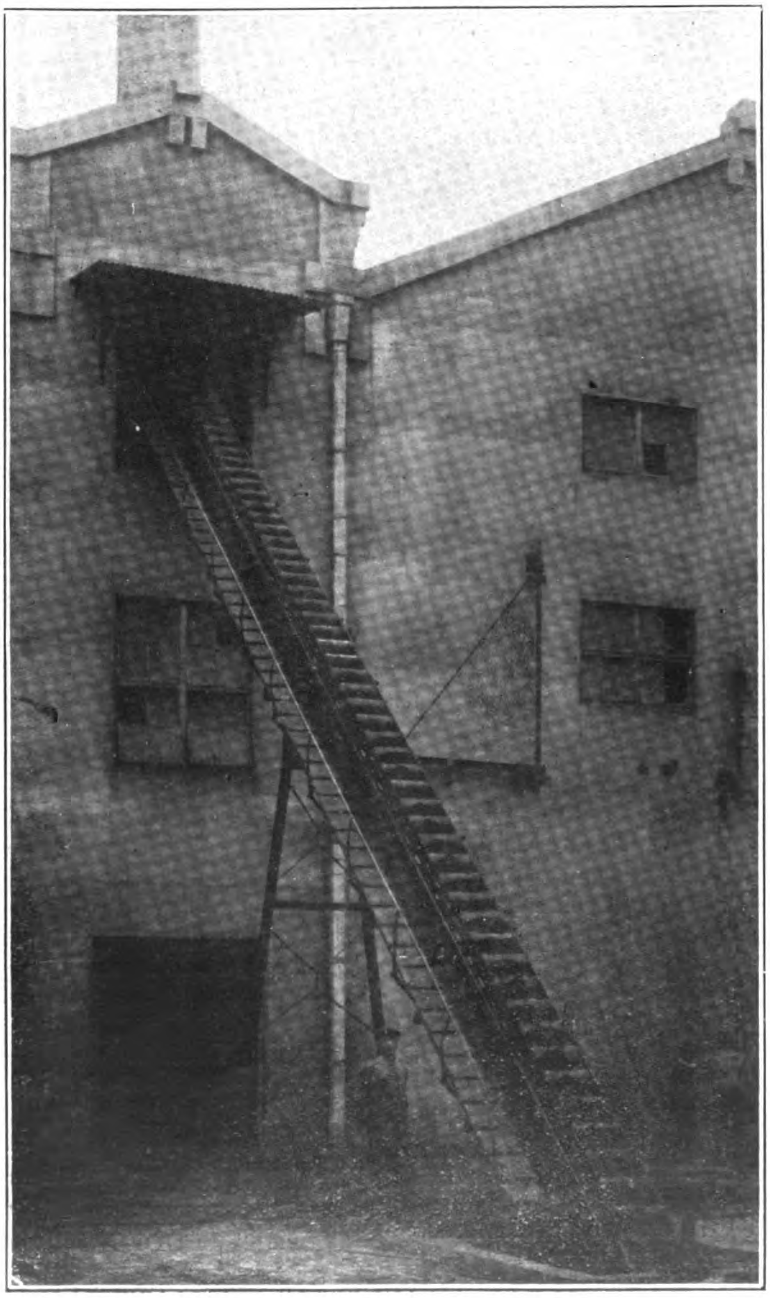
THE machinery and machine tool manufacturing industry in Japan now stands at a turning point whether it will remain one of Japan's important industries and make further developments, or whether it will retrograde to a position of less importance.

Like most of the important manufacturing industries of Japan to-day, machinery and machine tool making was first indroduced into this country by the Government, which built the first machinery manufacturing workshop at Mita, Tokyo in 1879. Eight years later, Shibaura Seisaku-je (The Shibaura Workshop) was erected by Mr. Tanaka, this being the first private owner machiney manufacturing workshop in Japan. In 1890, the Hiraoka Rolling Stock Manufacturing Works was founded. Following the leadership of these factories, the machinery and machine tool manufacturing industry has made a gradual but steady progress. Immediately after the Sino-Japanese War there were 170 of these workshops, including 30 plants which used motors. The number of workmen totalled at 7,849, at that time.

During the war boom, which followed the Russo-Japanese war the number of works and workers were increased almost by four times. But drastic business readjustment was bound to come after such an extraordinary development, and when the business depression set in, both the number of workshops and work men registered sharp decreases.

The outbreak of the European War, however, brought an unprecedented activities of the manufacturing industry in Japan, as Japan's market abroad was immensely extended owing to the absence or decrease of supplies from the European countries.

The development of the shipping resulted in the prosperity of the iron casting, boiler making, and the manufacture of various other materials. There are many workshop outfits, the manufacture of which began during this war boom in Japan. Indeed, the present day progress of the machinery and machine tool manufacturing industry in Japan was mainly attained during this period, when the advanced European countries were too busy to pay attention to their industrial activities. When the business depression set in following the cessation of the war, however, all branches of this industry, like other lines of business, began suffering from the depression. The revival of the manufacturing industry in the advanced European countries was particularly responsible for the depression. The decrease in the demand for arms, in addition, gave a heavy blow to Japan's machinery manufacturing industry. The shipbuilding industry, which is the largest in scale of the machinery producing enterprises, was the first to suffer from the depression, and other workshops also shared the difficulty of maintaining the operation.



Trough pan conveyer, capacity 30 tons per hour, manufactured by the Japan Elevator Mfg. Co. Installed at the Power Plant of the Godo Cotton Spinning Co., Ltd., Osaka.

The following table gives the rise and fall of the machinery producing industry in Japan, before, during, and after the European War :

(In Y.1,000)

Items: No. of Works Y.387 1913, Y.590 1918, Y.526 1920;

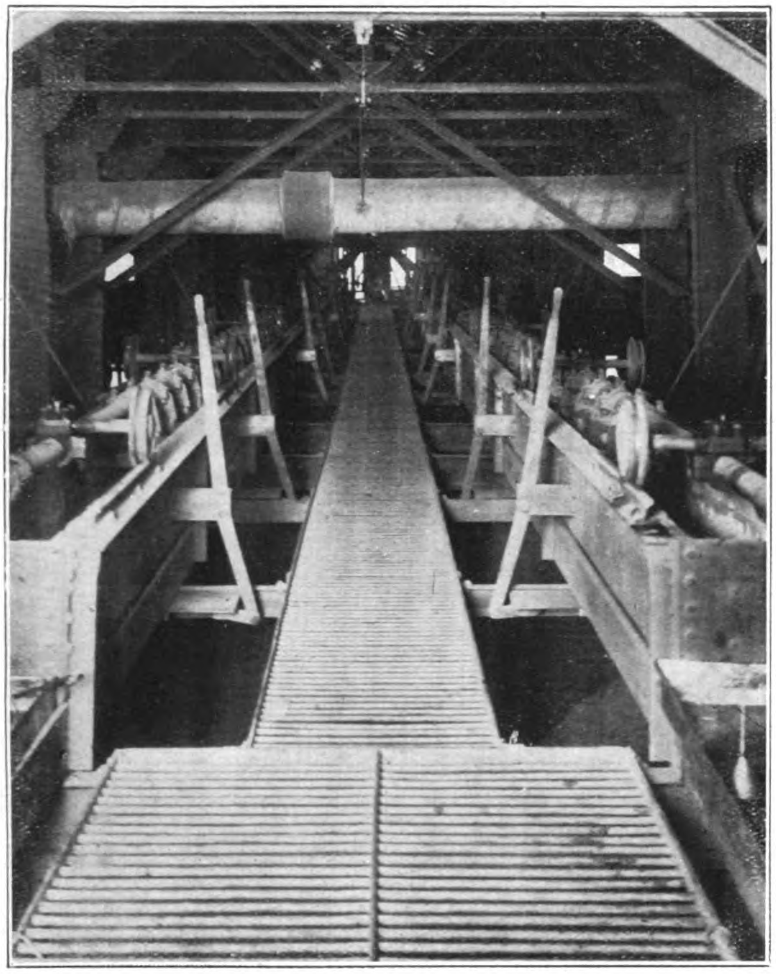
Items: Authorized capital Y.114,300 1913, Y.365,200 1918;

Items : Paid-up capital Y.63,460 1913, Y.116,449 1918 ;

Items: No. of work men Y80,762. 1913, Y.95,227 1918, F.162,724 1920;

Items: Annual production Y.-97,200 1913, Y.816,300 1918, Y.605,290 1920 ;

According to investigations made by the Department of Agriculture and Commerce, and published by the Department of Commerce in July, 1925, (The Department of Agriculture and Commerce were divided into the Department of Agriculture and Afforestation the Department of Commerce and Industry, a short time previous to the publication), there were 3,744 machinery and machine tool producing workshops in Japan at the end of 1923. The number of employees reached 260,394, including 11,807 technicians. Details follow :

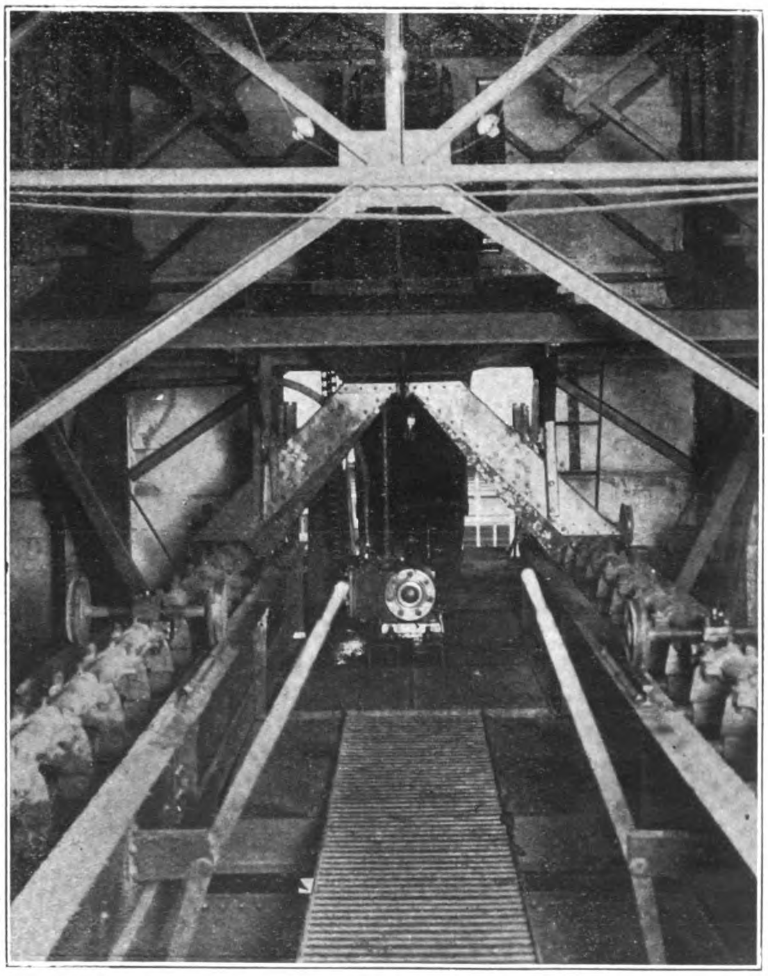


Happy's coal conveyer made by the Japan Elevator Mfg. Co., for the Godo Cotton Spinning Co., Osaka.

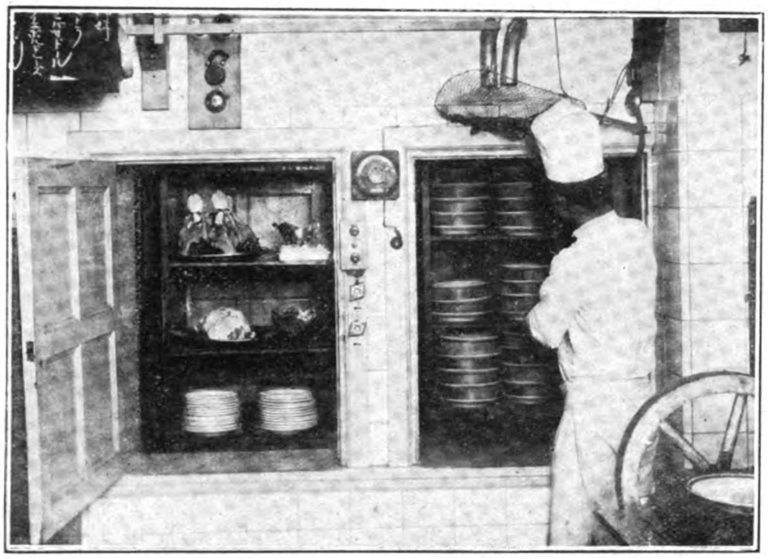
	Workshops	Aggregate total of employees	Techni-cians	Opera-tives	Clerks
Boilers, gas producing machinery mfg. industry ...	74	1,585	64	1,396	84
Motor mfg. industry	256	7,192	472	6,121	440
Electric machinery and supplies producing industry ...	343	29,788	2,397	23,876	1,873
Agricultural, civil engineering, and building machinery mfg. industry	169	2,308	74	2,028	165
Mining machinery mfg. industry	36	1,263	74	1,033	38
Spinning machinery mfg. industry	314	9,242	414	7,965	523
Metalic and woodwork machinery mfg. industry ...	265	4,498	234	3,962	222
Other machinery and machine tool mfg. industry	475	7,834	328	6,850	460
Crane and conveyers mfg. industry	19	1,031	84	855	55
Pump and blowers mfg. industry	82	2,840	147	2,454	178
Clocks and metres mfg. industry	235	7,636	380	6,554	514
Cameras and lenses mfg. industry	47	1,575	83	1,296	68
Musical instruments and talking machines mfg. industry	27	2,943	146	2,614	118
Arms mfg. industry	22	17,909	759	15,715	458
Rolling stocks mfg. industry ...	682	42,442	2,401	35,514	1,707
Shipbuilding industry	278	106,059	3,205	98,446	2,428
Airplanes mfg. industry ...	10	7,734	254	7,151	201
Others	404	6,515	293	5,653	383
Totals	3,744	260,394	11,807	229,475	9,915

The Department of Commerce and Industry has recently published that there were 47,786 factories employing more than five operatives at the end of 1923. This figure included 35,360 factories which were operated by motors. The spinning mills were the largest in number which totalled at 18,014. Next came the foodstuff manufacturing factories, the number of which amounted to 9,502, followed by the machinery and machine tools producing workshops, the number of which reached 3,744, including 3,174 which were operated by motors. The annual production by these 3,774 machinery and machine tools manufacturing workshops reached Y.392,065,000 in 1923, the details of which follow :

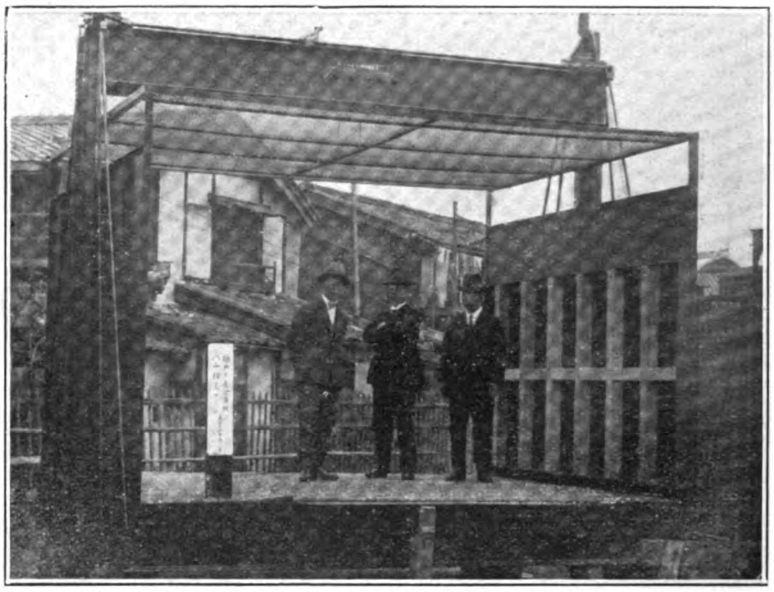
Industry	Annual Production (In Y.1,000)
Boiler mfg.	Y. 1,476
Gas producing machinery mfg.	411
Motors mfg.	15,338
Generators, transformers, electric motors mfg.	14,203
Electric machine tools	43,375
Battery, electric signals mfg.	6,878
Electric bulbs mfg.	16,315
Insulator mfg.	56,390
Agricultural tools mfg.	4,445
Refining machinery mfg.	1,717
Spinning machinery mfg.	16,923
Metalic work machinery mfg.	7,410
Saw-mill equipments mfg.	2,180
Lathe, boring machine, etc., mfg.	1,055
Pottery equipments mfg.	1,015
Paper mfg. machinery mfg.	678
Chemical industrial machinery mfg.	931
Foodstuff mfg. machinery mfg....	2,687
Printing machine mfg.	3,532
Type-founding apparatus mfg.	1,364
Other mechanical industrial apparatus mfg. ...	3,297
Crane mfg.	1,575
Pumps mfg.	6,117
Blowers mfg.	383
Weights and measures mfg.	4,706
Metres mfg.	3,492
Clocks and watches mfg.	5,436
Instruments used in physics and chemical researches	827
Medical instruments	—
Kinetoscope	57



Happy's coal or ash conveyer manufactured by the Japan Elevator Mfg. Co. Installed at the Godo Cotton Spinning Co., Ltd., Osaka.



Electric lifts made by the Japan Elevator Mfg. Co., for the Kitahama Building, Osaka. Speed, 120 feet per minute.



8,000 lb. freight elevator cage (14'×10') manufactured by the Japan Elevator Mfg. Co., Ltd., and sold to the Mitsubishi Warehouse Company, Kobe.

Industry	Annual Production (In Y.1,000)
Spectacles	1,191
Musical instruments	2,539
Gramophone	1,767
Arms and munitions	3,692
Rolling stocks	54,099
Steamers and other vessels	72,719
Ship's fittings	3,891
Airplanes	3,100
Vaults	1,877
Gas outfits	225
Waterworks outfits	717
Lamps	140
Pulley	1,746
Others	19,939
Total	Y.292,065

NOTE.—The slight difference in the total is due to omission of the figures under Y.1,000.

Japan imports machinery and part thereof mainly from the United States, Britain and Germany. In 1924, Japan imported Y.64,683,000 worth of them from America, Y.35,736,000 from Britain, and Y.16,249,000 from Germany.

Japan's total imports and exports of machinery and parts thereof are as follows :

(In Y.1,000)

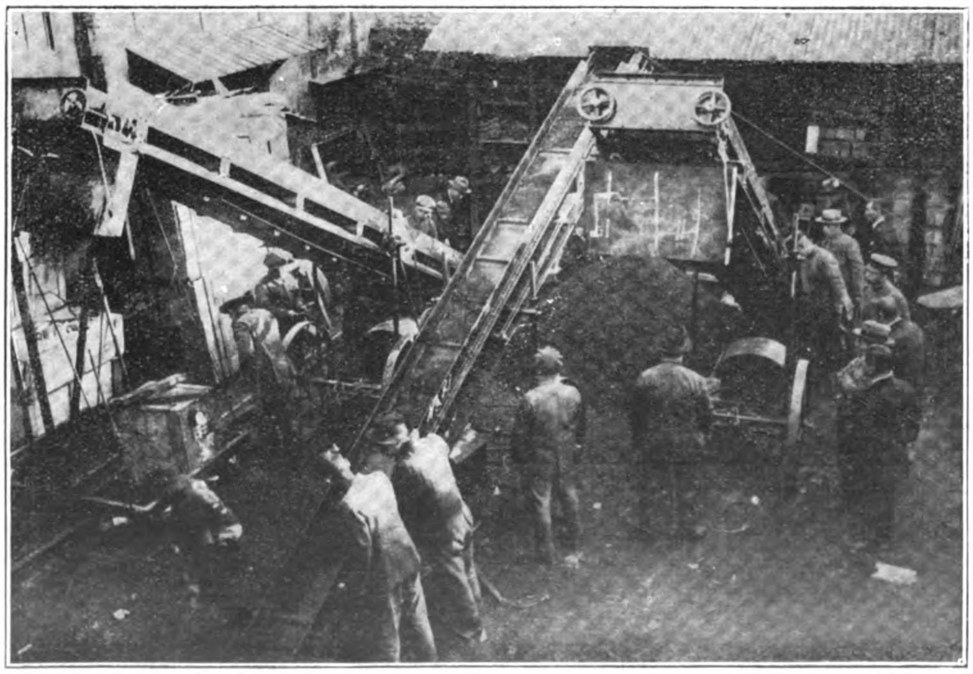
Imports 103,940 1923, 129,523 1924, 46,478 Jan.-June, 1925.

Exports 10,904 1923, 9,632 1924, 4,679 Jan.-June, 1925.

The amount of the imports of machinery and machine tools ranks about the third of Japan's entire imports in value, while that of exports is about the 15th in value, showing that Japan machinery and machine tool manufacturing industry has a great deal to advance. One of the important causes of the inactivity of this industry in Japan is that the production of iron is small. Japan imported Y.199,958,000 worth of iron, inclusive of bar, plate, etc., and this amount is next to raw cotton, the importation of which is the largest in Japan.

The importation of iron ore in 1924 amounted to Y.10,914,000. This illustrates the fact that the iron industry in Japan is not active.

In short, from the view point of trade, Japan's machinery manufacturing industry has not made much progress, and consequently, it does not render much services to Japan's finance.



Portable scoop conveyer undergoing experiment made by the Japan Elevator Mfg. Co., for the Osaka Army Arsenal. Capacity 60 tons of coal per hour.

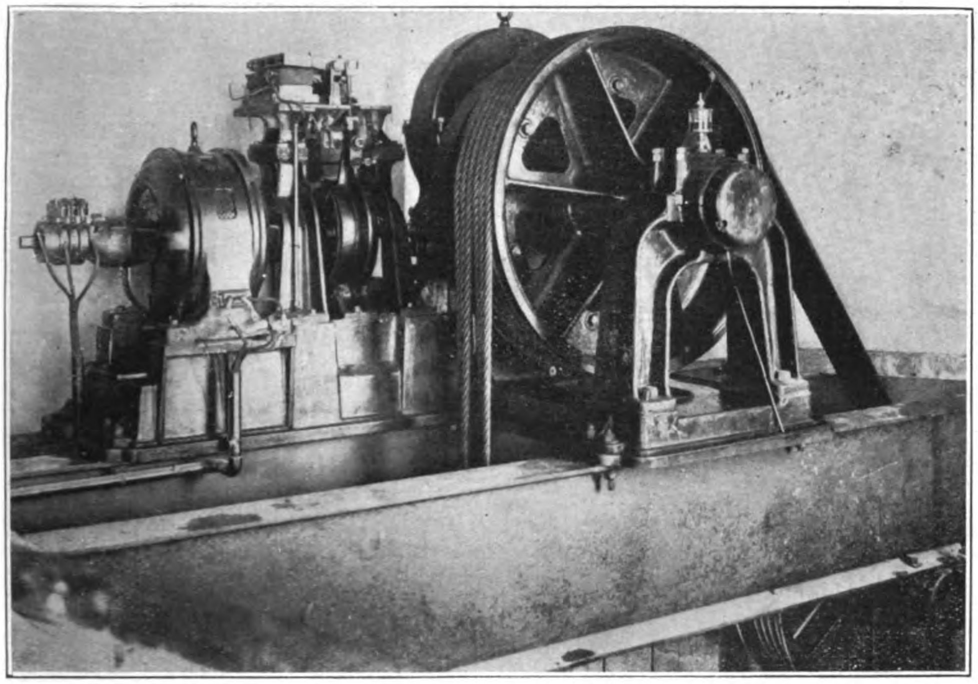
Motor Manufacturing Industry

The motor manufacturing in Japan began in 1908-9. When the European war broke out, motors were being turned out at the Nagasaki and the Kobe works of the Mitsubishi Shipbuilding Yard, the Kawasaki Dockyard, the Hitachi Engineering Works, the Motor Manufacturing Company, Ltd., the Arakawa Workshop, the Dengyosha Engineering Works, and the Ebara Works.

Among the influential makers of motors to-day are the Niigata Iron Works, the Ikegai Iron Works, the Mitsubishi Internal Combustion Engine Mfg. Works, and the Kobe Steel Foundry, in addition to the foregoing workshops.

At present, the annual production of motors reaches Y.15,000,000 in value, although this is a remarkable decrease as compared with 1919 when the annual output exceeded well over Y.50,000,000. But there is no comparison between the motors manufactured to-day and those turned out during the European war boom in points of quality and variety.

The Kawasaki and the Mitsubishi Shipbuilding Yards now turn out water-tube boilers of large capacity, such as used in



Winding engine for electric elevator, manufactured by the Japan Elevator Manufacturing Company, capacity 10,000 lbs., speed, 100 feet per minute, power, 30 h.p.

Two speed passenger elevators made by the Japan Elevator Mfg. Co., for the Osaka Shosen Building (O.S.K.), Osaka.

warships. The Kisha Seizo K.K. (The Rolling Stock Mfg. Company) has recently produced 600 h.p. Tacoma type boiler. So far as vertical and cylinder boilers are concerned, Japan hardly need to import them from foreign countries. The technical progress made in the manufacturing of steam turbin is particularly remarkable; the Mitsubishi Internal Combustion Engine Mfg. Works has recently produced large steam turbines which were directly connected with the 12,000 kilobolt unpare and 8,000 kilobolt unpare generators, and sold them to the Osaka Electric Light Company Ltd., which has been municipalized by the city of Osaka since 1924. Diesel engines are now produced almost at every workshop in Japan.

With all its magnificient progress made by the machinery manufacturing industry, however, it cannot keep pace with the progress of general manufacturing and electric industries. Consequently, steam turbines of high quality, large type hydraulic turbines and belton turbines are still imported from foreign countries, where better machinery is sold at lower prices than in Japan.

The principal drawbacks of Japan's motor manufacturing industry in producing good ones at cheap price are (1) high price of iron materials, and (2) insufficiency of the technical progress. Observers believe, however, that if the technique of making them witnesses more progress, the disadvantage in obtaining the iron materials will be made up. But owing to the general financial depression since the termination of the European war, Japan's motor manufacturing industry has not had the opportunity of making speedy technical progress. In short, the motor manufacturing industry is still in the period of trial at present.

Electric Machinery Mfg. Industry

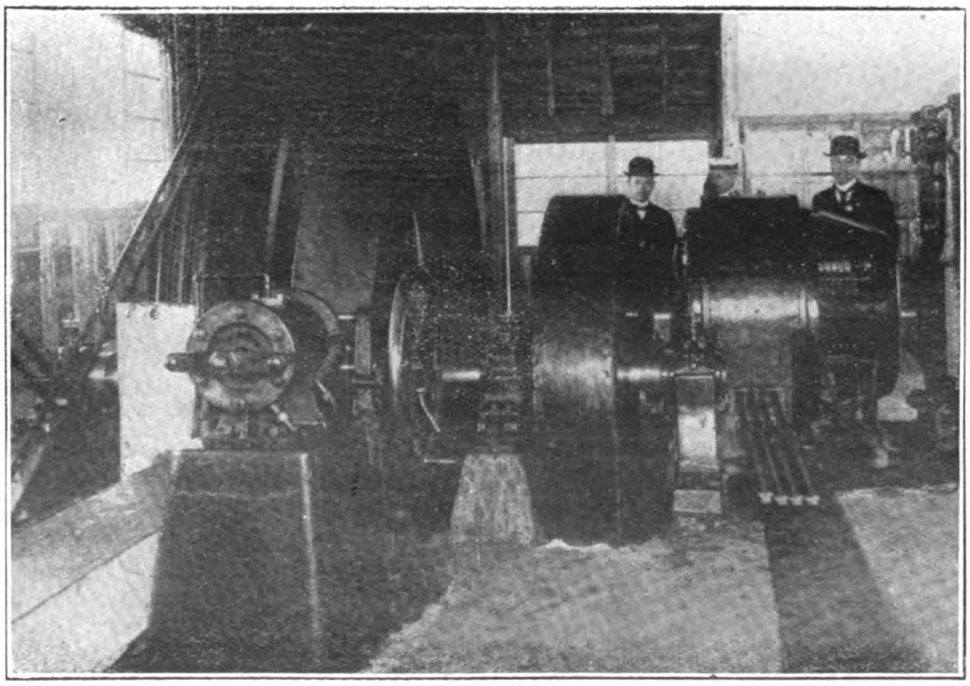
Most of the manufacturing industries in Japan, which displayed amazing activities during the European war boom, have hardly recovered from the reactional business depression. The electric machinery manufacturing industry, however, has been an exception to the general rule. Moreover, it is becoming more and more promising, favorably influenced by the ever-growing prosperity of the electric industry in this country.

It was in about 1891-2 when the Shibaura Works began manufacturing electric machinery for the first time in Japan. In 1896, Tokyo Denki K.K. (The Tokyo Electric Company), which is the first maker of electric bulbs, was established. Three years later, Nihon Denki K.K. (the Japan Electric Company) was organized.

The first phase of development of the electric machinery manufacturing industry was made during the Russo-Japanese war boom, when numerous electric companies were established.

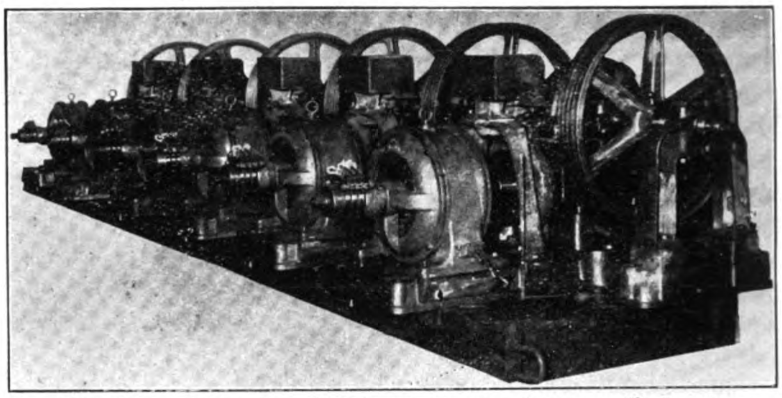
The Osaka Electric Bulb Mfg. Company and the Osaka Electric Machinery Mfg. Company were established in 1911. In 1912, the Oki Electric Company was organized.

At the end of 1914, there were 26 factories which produced electric machinery, and the authorized capital of these totalled at Y.14,510,000. The number of employees reached 5,258. The annual production of the electric machinery was valued at Y.8,510,000. During the European war, Japan needed a great deal of electric machinery, but the importation of them was difficult, eventually resulting in the unprecedented activity of electric machinery manufacturing



Cable car (funicular railway) speed, 7 miles per hour, steepest grade 1/4, one tram car carries 90 passengers manufactured by the Japan Elevator Mfg. Company, and sold to the Shiki-Ikoma Electric Railway Co., Ltd.

Electric conveyer of raw cotton, capacity, 300 packages per hour, weight of a package is from 500 to 700 lbs. made by the Japan Elevator Mfg. Co., sold to the Mitsubishi Warehouse Co.



Winding engines for electric passenger elevators all six of them were made by the Japan Elevator Mfg. Company for the Department of Communications, capacity, 2,000 lbs. speed 180 feet per minute

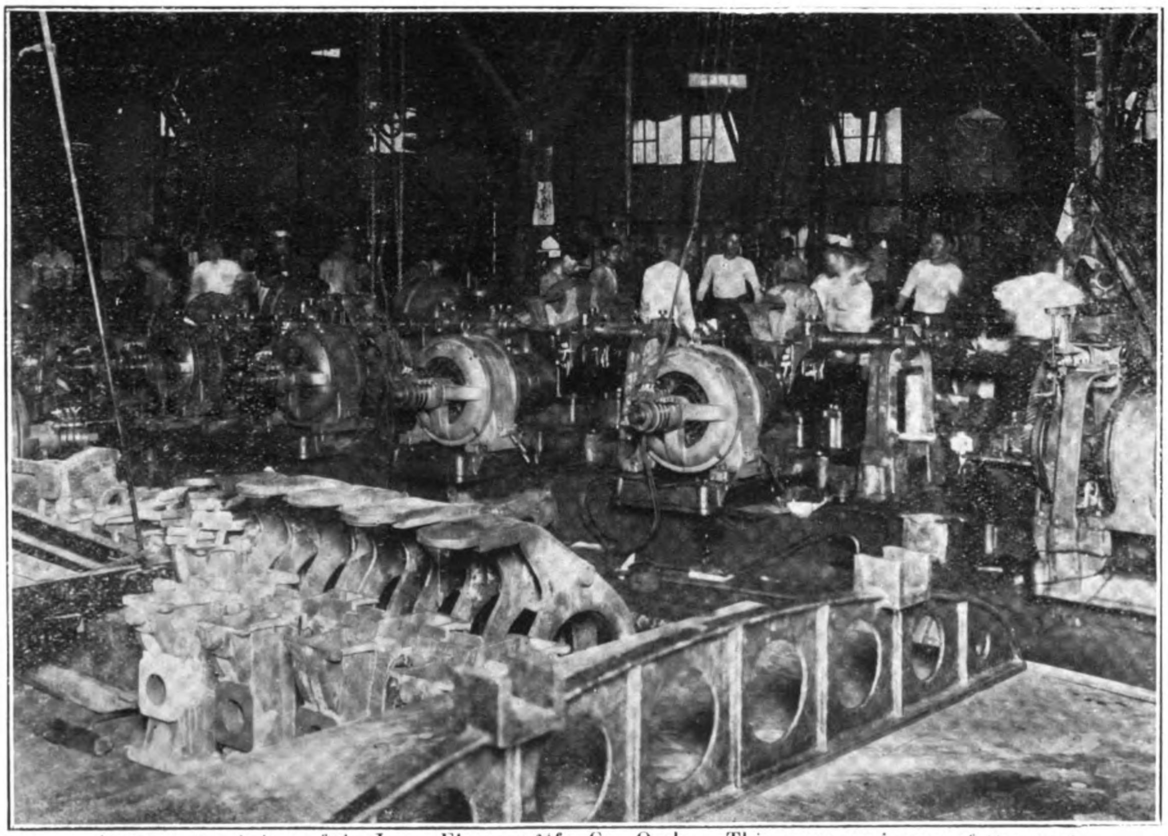
industry. This gave rise to organization of more electric companies. Among these were the Japan Electric Battery Company, the Yasukawa Electric Machinery Mfg. Workshop, the Meidensha Engineering Works (all of these established in 1917), the Kawakita Electric Company, the Yuasa Dry Cell Mfg. Company, the Toyo Electric Machinery Company (established in 1918), and the Kobe Works of the Mitsubishi Electric Company which was founded in 1919.

In 1920, the number of factories manufacturing electric machinery increased to about 120, and 20,000 kilobolt unpare generators were produced. At present, Japan made electric motors and generators are widely used in steel and copper rolling, at spinning and weaving mills, in chemical industry, in running tram-cars and heavy cranes. Japan can be independent from foreign supply so far as electric fans and telephone and telegraphic apparatus Moreover, the Japanese producers are exporting a large quantity of electric machinery to China, Kuantung Province, India, Australia and Asiatic Russia.

As for generators and electric motors of large capacity, however. Japan cannot advantageously compete with foreign producers, The electric heaters, the use of which is becoming a fashion of the day in Japan, and some other special electric apparatus are still imported into Japan from European and American countries in large lots.

One characteristic of Japan's electric machinery manufacturing industry is that prosperous electric firms are running business in cooperation with influential foreign companies, e.g., the Shibaura Engineering Works co-operates with the General Electric Company. The Osaka Electric Machinery Manufacturing Company and the Kawakita Electric Company, which have no special relations with prominent foreign electric companies, are not showing praise worthy business results.

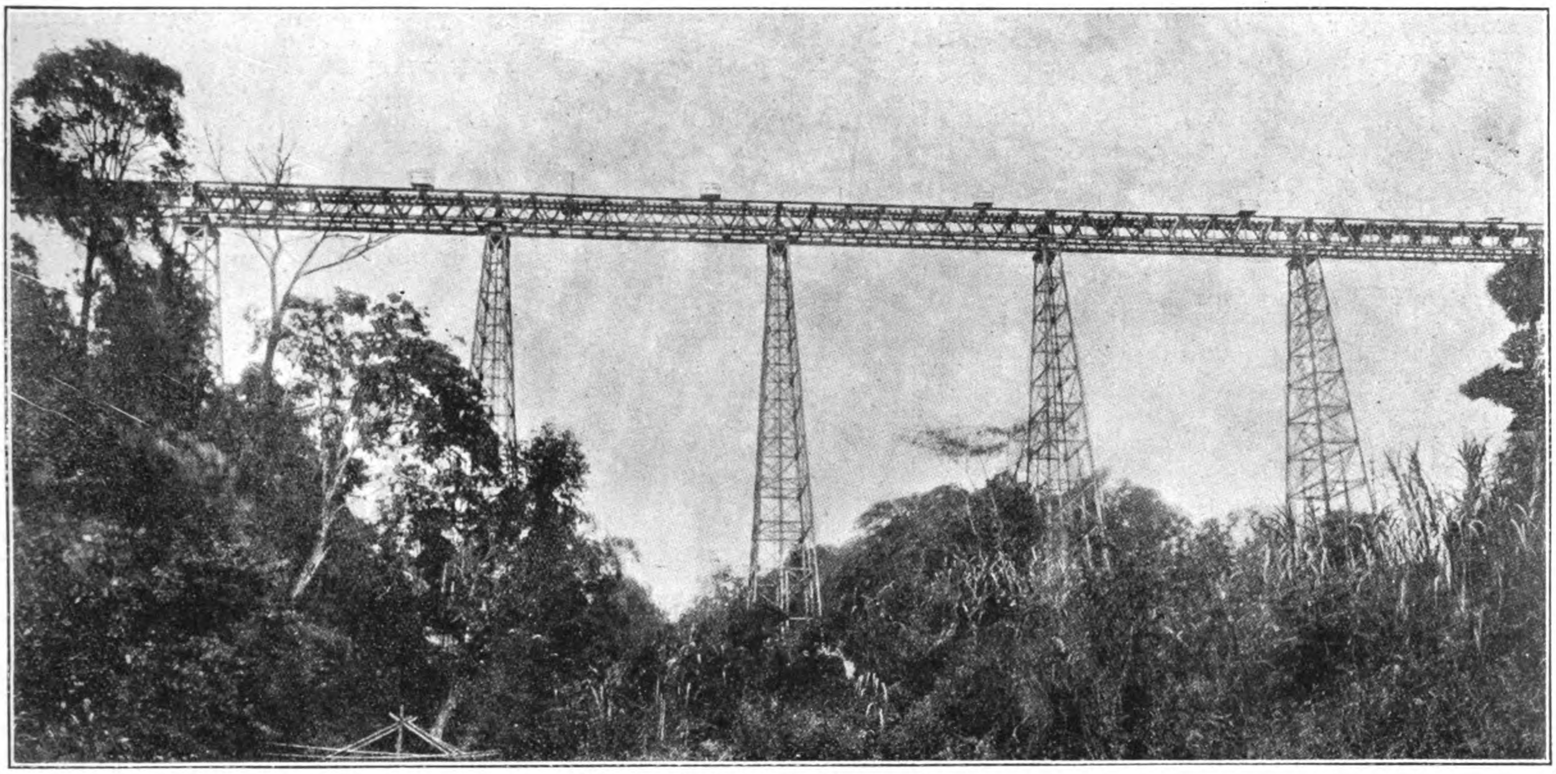
The one weakness of the electric machinery manufacturing industry in Japan is the high price of raw materials. But judging by the facts that it is showing a rapid technical progress and that the electric light and power supply industry is continuously growing prosperous, the electric machinery manufacturing industry in Japan is one of the most promising industries in Japan.



Assembly workshop of the Japan Elevator Mfg. Co., Osaka. This company is one of the most influential elevator and conveyer manufacturers in Japan. It employs 150 workman, who work under personal instruction of Dr. Kakutaro Hori, Managing Director of the Company.

Slaughter Houses, Tientsin

The slaughter houses at Tientsin, have just been enlarged by the addition of a meat cooling and freezing plant supplied by Sulzer Brothers, Winterthur. An innovation of this kind of installation is the facility with which the cold air supply can be regulated, thus allowing of very different temperatures being attained in the various cold rooms. In fact, it is not only the amount of cold air, but also its refrigerating effect which is regulated by adjusting the current of air in accordance with the amount of cold required and the temperature of the rooms. This arrangement eliminates the necessity of adjusting a number of regulating valves, always a very difficult operation to execute properly, and only requires the adjustment of two simple valves. Separate cooling rooms are provided for beef and pork, as well as separate cold rooms and freezing rooms. An overhead rail allows the carcases to be easily and quickly transferred from one locality to another. The cold required for cooling and freezing is produced by two Sulzer compressors, each of which is capable of producing two-thirds of the total amount. Each section has not only its own air cooler but also its particular set of machines and apparatus.



Railway Bridge on the Preanger Line

The State Railways of the Netherlands East Indies

By "Djembatan"

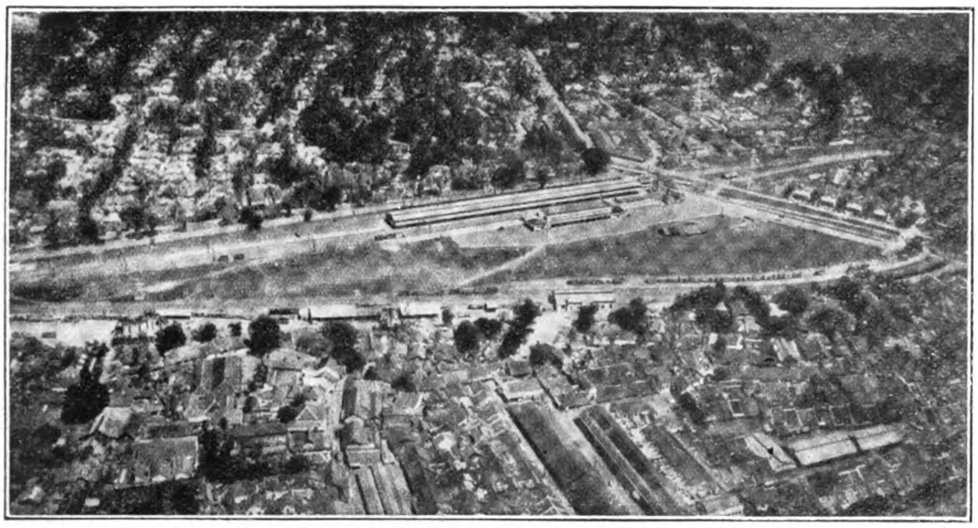
EXACTLY 100 years ago the world was startled by the news that a certain George Stephenson had invented a steam engine which could run on rails and draw a load of passengers and goods at a speed of from 10 to 15 miles per hour. When we read of the first journey of the "Rocket," as this locomotive was called, and learn that it was only allowed to be used on condition that it was preceded by a man on horseback carrying a red flag, and then gaze around us at the modern rolling stock in use on the railroads of the present day, we can hardly believe that such a development could have taken place in this comparatively short time, and yet if we compare the present transport facilities in these islands, and especially those of Java, with the conditions prevailing here 75 years ago the contrast is even more remarkable.

It is a co-incidence that where this year the centenary of the invention of the steam locomotive has been celebrated in England the State Railways of Java have also in April last registered their fiftieth anniversary: it will thus be seen that fifty years elapsed after the introduction of the railway before steps were taken to provide Java with an iron road, so that those responsible for its rapid development undoubtedly deserve the highest praise for their efforts which have been crowned with such remarkable success. Let us take a glimpse at the transport conditions prevailing here seventy five years ago, when the railway was still in its infancy, even in the European countries.

It is hard to imagine a country such as Java, which owes its greatness to its agricultural industry, without railways to transport the produce from the various estates in the interior to the ports of shipment. Practically all the produce from the estates, which were then to a large extent in the hands of the government, had to be brought to the coast by means of horse and bullock carts so that it does not require much imagination to realise that any progress in the economical development of the island was out of the question. The result was that produce, stored in the warehouses inland, was allowed to rot, whilst ships were forced to wait in harbour, sometimes as long as six months, before they could leave with a full cargo. We who live in the twentieth century find it difficult to realise that such conditions of chaos existed only a comparatively short time ago.

Principal Workshops between Weltevreden and Meester Cornelis

A few leading men of the time suggested the introduction of the



The Station at Weltevreden opened this year

railway as a solution of the problem, but the majority of the government officials were against this proposition, even though the railway had already proved its worth in other countries : they preferred to endeavour to improve matters by the importation of mules, camels and elephants, but these died off like flies and in the meantime the freights rose by leaps and bounds.

It was not until the year 1875 that a law was passed in Holland permitting the government of the Indies to commence laying a railway line to be operated by the State and it can be imagined with what enthusiasm this news was received in the Colony, even though this sanction was only in respect of a short traject between Sourabaya and Pasoeroean and Malang. The 6th of April, 1875 was regarded as a turning point in the economical history of the Netherlands East Indies and it will be seen that the Colonial Government was not slow to take advantage of their newly acquired powers. This line was completed on the 20th of July 1879, a gauge of 1,067 M. being used.

It must, however, not be forgotten that previous to this private companies had succeeded in obtaining concessions for the exploitation of railways, of whom the principal was the Netherlands Indian Railway Company, which still exists to-day. This company had to cope with almost unsurmountable financial difficulties but, with the help of the Government, it succeeded, in completing the whole of the railway net contemplated. It is impossible within the scope of this article to give a detailed account of the progress of the State Railways during the first years of their existance, but for the sake of comparison it may be mentioned that in 1898, thus 23 years after the introduction of the railway into Java, more than 8,000,000 passengers were carried on the State lines alone, as a result of which more than 3,500,000 guilders were received from the passenger traffic, whilst the transport of goods brought in a further 6,000,000 guilders. At this date communication had already been established between Batavia and Sourabaya via Buitenzorg, Bandoeng, Tjibatoe, Maos, Djokja, Solo, Madioen and Kertosono. Only two small sections of this line were then still in the hands of private companies namely the traject Batavia-Buitenzorg and Djokja-Solo.

In addition to this other private lines were being exploited between Djokja and Malang, Maos and Bandjarnegara and Cheribon-Semarang-Joana with branch lines to Blora, Willem I and Solo. Further the Goverment had by this time completed a whole network of railways in the Residencies of Besoeki, Pasoeroen and Kediri in East Java.

Let us now turn our attention to the progress which had been made in the Outer Possessions. In Sumatra the first line to be constructed was from Olee Lheue to Kotaradja, a distance of 4 k.m., which was used exclusively for strategical purposes, and opened for traffic in 1876. It was not until 1883 that a private company, the Deli Railway Company succeeded in obtaining a concession for the exploitation of several lines and after this the development of the iron road on this island was rapid. In 1894 the line Emmahaven-Sawa Loentoe was opened chiefly for the transport of the coal obtained from the Sawah Loentoe mines, to the coast, whilst in 1895 a further 33 k.m., from Fort de Kock to Pajacombi was added to this traject.

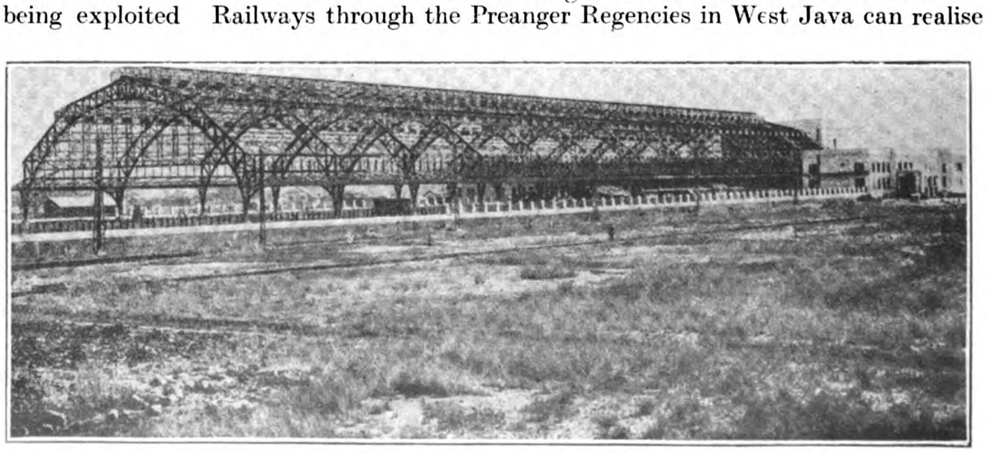
Sumatra was at this period the only island in the Outer Possessions which could boast of an iron road and even at the present day the only other island on which a railway is being exploited is Celebes, where the Celebes Steam Tram, which also falls under the State Railways, maintains a service from Takalar to Macassar. Owing to the need for strict economy the extension of this line to Maros, Tanette, Pare-Pare and Singkong has had to be postioned.

At the present day the State Railways with 2857 k.l.c. and 12 private companies with 2557 k.m. of railway provide a network of communications throughout Java which have in no small degree assisted in the economical development of the island and in obtaining for her the position of an important producing country.

It must be mentioned here that the railways of the Netherlands East Indies divided into two classes i.e. the railroad proper and the so-called steam tram. The latter must not, however, be confused with the street tram as it is known in Europe and elsewhere where the word " tram " is used in connection with steam or electrically driven conveyances for local traffic in towns, but in Java, Sumatra and Celebes the steam tram is to all intents and purposes a railway communication between towns, with this difference that certain regulations have to be observed with regard to speed. The principal reason for the introduction of this class of communication was one of economy as owing to the reduced speed at which these trams travel, the laws providing for the protection of the line and especially level-crossings are less severe and consequently the costs of expoitation are considerable less than those of a railway which is compelled to provide efficient methods for the protection of life and property. All the private companies, with the exception of the Netherlands Indian Railway Company, belong to this category and even this company owns 652 l.c. of tramway out of a total mileage of 863 k.m. in operation. In Sumatra, the Government operates at the present time the following lines : West Coast 284 k.l.c. Lampong Line (South Coast) 110 k.m. Palembang Line (South Coast) 284 k.m. and Acheen 511 k.m., in addition to which the Deli Railway Company operates over 473 k.m. of line on the East Coast, so that this island, which according to all reports, has a wonderful future in front of it, is abundantly provided with means of communication.

If we look at the map of Java we shall see that the island is extremely mountainous, especially in the Western and Eastern districts and for this reason we must appreciate even more the enterprise and skill of the Dutch engineers who have, notwithstanding difficulties and obstacles, succeeded in providing the island with a network of railways which as far as extensiveness is concerned, is second to none in this part of the Far East.

Those who have had the good fortune to travel on the State Railways through the Preanger Regencies in West Java can realise



Roof of the Tandjong Priok Station

to some small extent the natural difficulties with which the pioneers of the iron road have had to contend, but let us not forget that Dutch engineers are world famous and it is they who have made the seemingly impossible possible. When we pass over the bridges, mighty steel structures spanning gorges hundreds of feet deep, where far below the mountain torrents are racing in their mad rush to the sea, we cannot but fail to offer a silent word of thanks and praise to those who have brought this wonderful region of "The Granary of the East" within the reach of all. The mere fact that at one spot on the line through the Preanger, five railway bridges can be seen from the train speaks volumes for the obstacles which have been overcome by sheer endurance and skill—a veritable victory of Science over Nature. It has often been said that the railways are the arteries of a country and Java is no exception, for without her railways her trade would collapse : how could the numerous sugar, rubber and other estates transport their produce to the coast for shipment and in return receive the machinery and supplies necessary for their factories, if it were not for the extensive system of railway communications which she possesses.

It is certainly to be regretted that during the last few years the development of the railways of the Netherlands East Indies has been retarded owing to the need for drastic economy : Many new schemes for the extension of the existing lines have had to be postponed and it is only upon the return of better conditions that the Government will be able to carry out the programme which it has under contemplation. Lines on the islands which have so far no rail communications are also under consideration and it is certain that as soon as the financial situation improves steps will be taken to extend the already extensive railway net both in Java and the islands of the Outer Possessions.

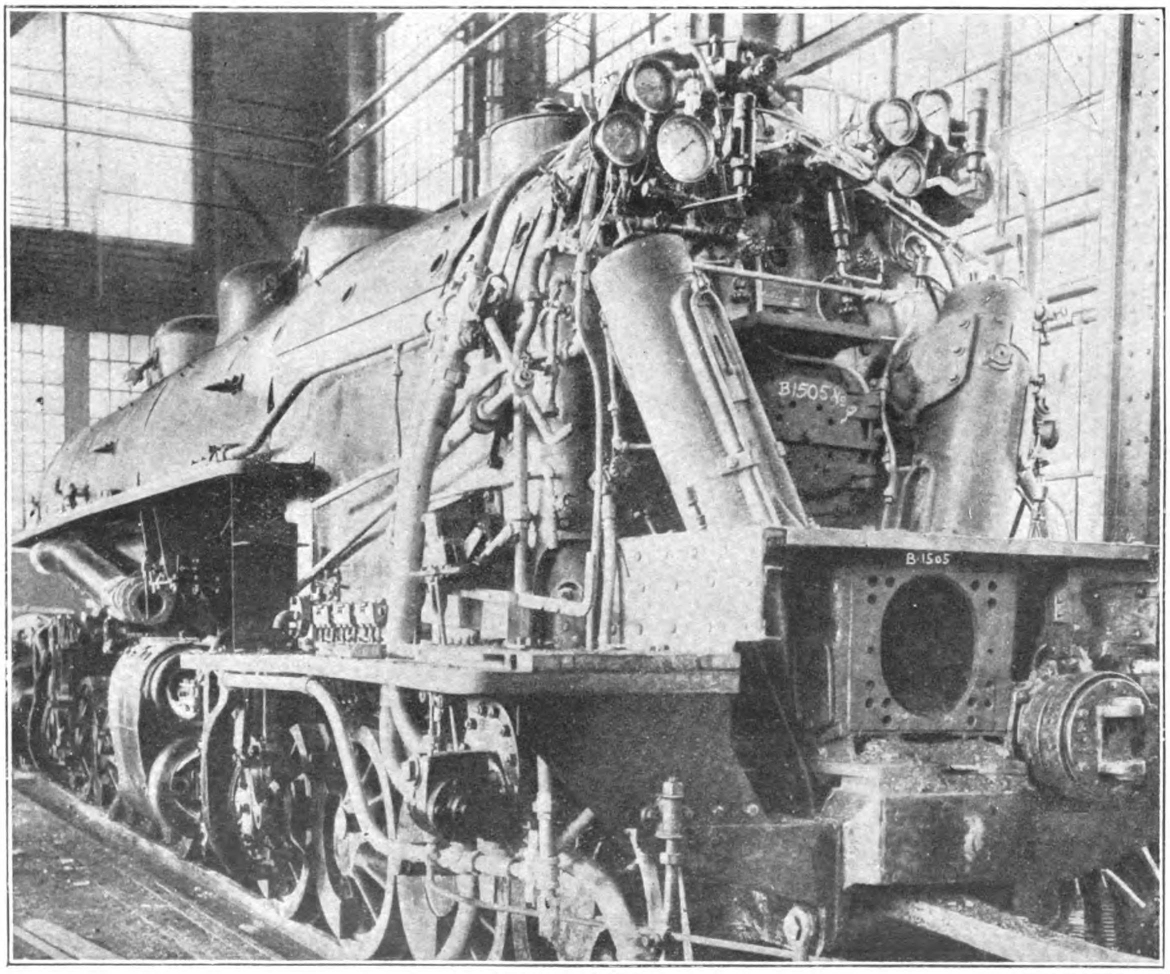
In giving a review such as this it is also of importance to draw attention to matters which compare less favourably with those of institutions similar to that under discussion and we will now endeavour to draw a comparison between the lines and services of the State Railways of Java and those of the neighboring countries such as the Federated Malay States and Siam. It should of course be understood that the following criticism is offered in the best spirits, and only for the reason that we are convinced that our criticism bears a decidedly constructive character. As already mentioned the State Railways are second to none as regards extensiveness in this part of the world but as regards service there are a few points in which they compare less favourably with the railway systems of their neighbors.

The first and foremost question is one of night trains. In Java and the islands of the Outer Possessions no night trains are run and although this question has from time to time been discussed in the local press no steps have been taken to introduce this manner of travelling, which on certain routes would undoubtedly be welcomed with open arms. Many reasons have been preferred for the non-adoption of night trains none of which however seem to present unsurmountable difficulties, for what is possible in the Federated Malay States is surely also possible in Java. Let us review the objections which have been raised and it will then be seen that they appear much more formidable on paper than they really are. In the first place it is suggested that native drivers are not to be trusted upon night duty as there is always the possibility of their falling asleep on the footplate ! Thus endangering the safety of the passengers but this is in my humble opinion a very weak argument for why should a native driver in Java be more susceptible to such irregularities than an Indian or Malay driver in the Federated Malay States or a Siamese driver in Siam ?

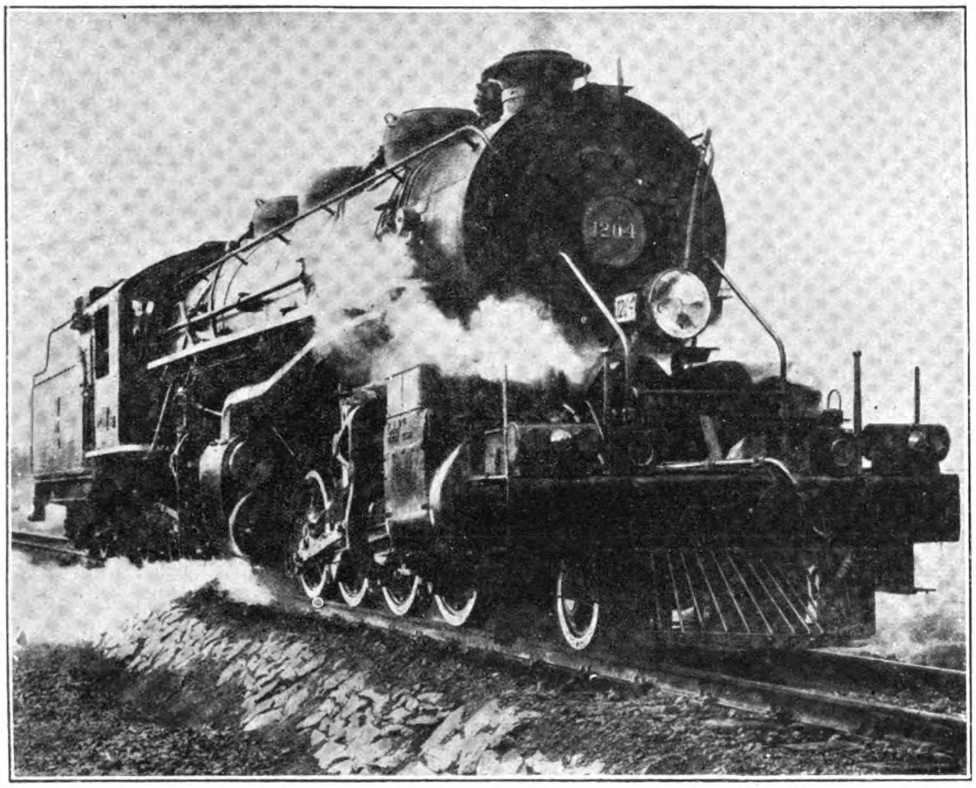
The express trains between Penang and Kuala Lumpur and Singapore are often driven by Indian drivers and such difficulties as suggested above are apparently not met with there. A second reason is one of expenditure : it is declared that the arrangements which would have to be made for the running of night trains such as additional line watchers, signal and station staff, would increase the costs of exploitation to such an extent as to make their running unprofitable. Here again the obvious answer to this argument is that if it is possible in the F.M.S. why not in Java ? It speaks for itself that an estimate would have to be made of the extra expenses involved and these taken into account in the fixing of the fares. A further argument against their adoption is that of landslides which would probably not be observed owing to the darkness with the result that a train would run the risk of dashing to destruction. Whilst there is something to be said in favour of this argument, as landslides are more frequent in this country than in the Federated Malay States owing to the volcanic nature of the soil, it must not be forgotten that several of the express trains which are running every day frequently finish the latter part of their jurney in darkness so that there would appear to be just as much risk then as when running the whole night through and in any case precautions could be taken where by this risk would be reduced to a minimum.

No, it seems to us that the real reason for their non-adoption lies in quite another direction. The Hollander is by nature adverse to night travelling and looks upon this manner of getting about as an abnormality and even in Holland, in the centre of the busy Continental traffic, night trains, with the exception of the International trains are unknown.

This is a peculiarity of the Dutchman and just as sons take after their fathers, so do colonies take after their mother countries. There is little doubt, however, that once this prejudice was overcome he would soon realise the



Automatic 1 D and D Locomotive



1 D and D Mountain Railway Mallet Locomotive

advantages of travelling by night and would become just as great an agitator for the adoption of this great boon to the business man, as his neighbors in the Federated Malay States. Let us for a moment review the advantages which a night service would bring to Java. In the first place the long discussed one-day-service between Batavia and Sourabaya and vice versa would be solved. The business man to whom in this country "time is money," just as much as in any other land, would be able to board the night express in Batavia at say 6 p.m. and arrive at his destination, Sourabaya, at noon the following day a saving on the present manner of travelling of 12 hours of daylight! Comfortable "sleepers" could be provided so that the drawback of the loss of a night's sleep would be done away with whilst at the same time the inconvenience of having to stay overnight in a hotel, as is now the case, would be a thing of the past. The distance could be covered at a comfortable speed where by a considerable saving in running costs could be made which in turn would reduce the extra expenditure already mentioned, and one of the real inconveniences attached to travelling in Java i.e. the early departure of the trains, would be obviated—a no small blessing. This is a matter of severe criticism on the part of both residents and visitors and one can quite imagine the indignation of a tourist on hearing that his train is timed to depart at the ungodly hour of 5.30 a.m. It is only quite recently that a correspondent of the Straits Times christened Java "The Land of Early Trains," a title rather apt to scare intending visitors! It would hardly be correct to say that travelling by train in a tropical country is a pleasure, far from it, for although everything has been done to make the journey as comfortable as possible the fact remains that travelling in a tropical climate in the heat of the day has many disadvantages. Heat, dust, sparks and cinders all go towards marring the delights of a railway journey but if the same journey was made in the cool of the night the disadvantages would be reduced to the minimum. Yes, night trains would without a doubt, be a boon to the travelling public in Java but one wonders how long it will be before the powers that be realise the advantages to be gained by their introduction.

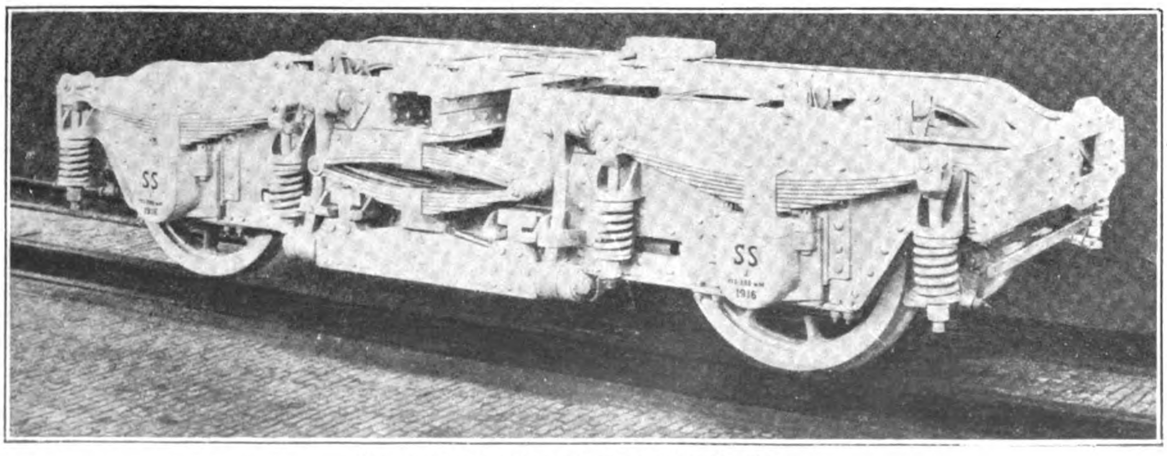
Another point in which the Java Railways compare less favourably with those of the Federated Malay States is the matter of carriages. Those who have travelled on the long distance lines in Java know only too well the inconvenience caused by the excessive heat and the system on which the carriages are built does not tend to provide the maximum of comfort so desirable when one is compelled to spend the whole day in the train, and in this connection the authorities would do well to study the construction of the F.M.S. Railways which, instead of being divided into compartments as is the case with the express trains in Java, consist of one long carriage without any divisions, so that there is always a current of air circulating through the vehicle with the result that travelling there is much cooler and thus more comfortable.

The question of dress when travelling by train in the tropics is also an important item but as this does not fall within the scope of this article I will confine myself to the remark that if travellers in Java, and I refer more particularly to the Dutch residents, were to dress more freely and less conventionally they would soon come to the conclusion that after all the maxim "comfort first" can be followed without any loss to their dignity.

The system of being able to purchase tickets for the intended journey in the office of the hotel in which one is staying is also a great convenience, doing away with the necessity of having to rush to the booking office at the last moment and the possibility of losing one's train.

These are a few of the points of difference which compare less favourably—for the rest Java's Railways can hold their own with those of other countries in the neighborhood and should these suggestions ever be adopted than Java will be able to boast of a railway service which is second to none in all respects.

We have now gone at considerable length to point out the shortcomings of the railways in this island, but let us now in all fairness make mention of a matter in which they are far ahead of their neighbours over the water—the electrification of the system. The jubilee of the State Railways marked an eventful epoch in their history for it was on this day that the electrified section of the line Tandjong Priok—Meester Cornelis was brought into operation. It is hardly necessary to mention that this was a redletter day, for it brought with it not only a vast improvement in the present communications but it was the first milestone on the road to much bigger things, i.e. the electrification of the whole railway net in Java. The question of electrifying the existing lines has been under consideration for several years but the financial circumstances would not allow of a start being made until quite recently and even now the change over from steam to electricity has to



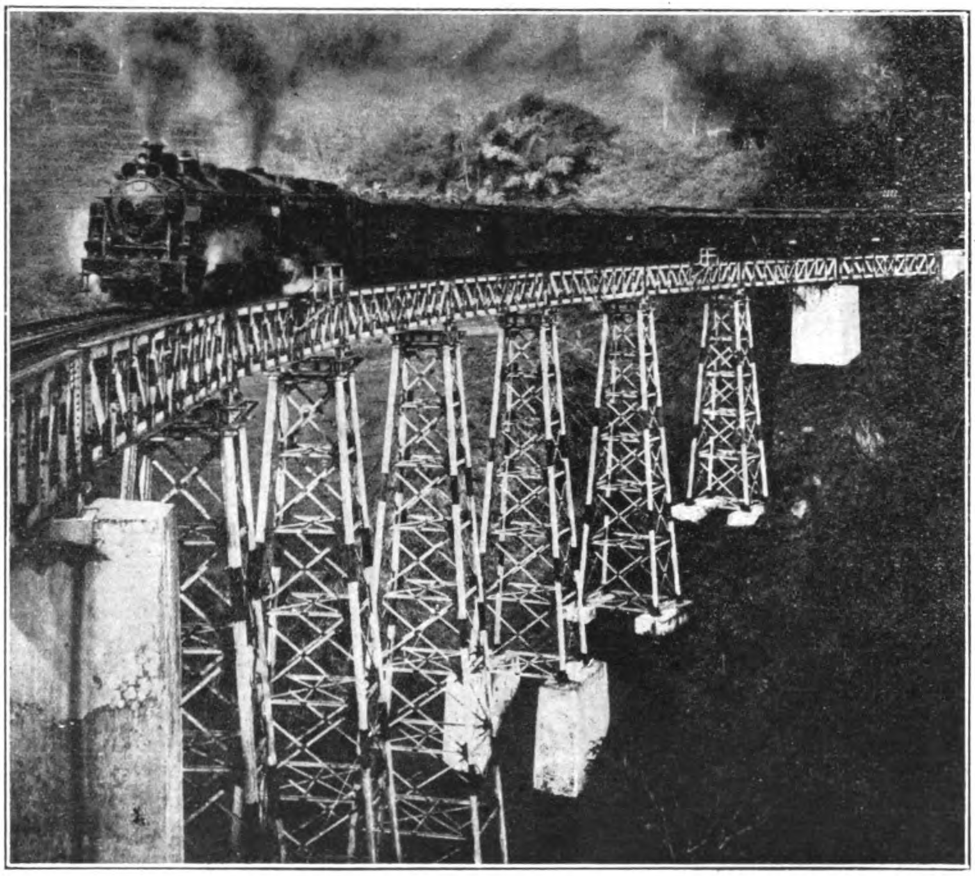
Coach Truck with springs outside the frame

be made by degrees, the opening of the above mentioned line marking the commencement of these operations. It was only natural that, with the introduction of electric railways in Europe and America, the suggestion of electrifying the system in Java should be made and this suggestion was given serious consideration by those in authority with the ultimate result mentioned above.

What a revolution in so short a period. From bullock carts to magnificent electric trains and that in fifty years! It was the success of the Chicago-Milwaukee Railway, the first railway to be electrified on a large scale which decided the question of the electrification of the Java railways: this and the electrification of main lines in other countries proved that electric trains could be run even more economically than steam trains especially in mountainous country. However, owing to the war the plans had to be postponed for owing to the fact that Java produces no coal it was realized that in time of war an enemy country could cut off these supplies necessary for the generation of electricity and with one stroke dislocate the whole railway traffic.

In a report published in 1917 it was shown how this could be avoided. Why should not the enormous water in Java, producing millions of horsepower per day, be harnessed and used for the generation of current for the railways and eventually for the lighting of the towns? The proposition was to build two water-power stations and to bring the current generated there by means of high tension cable to Tandjong Priok: to electrify the lines in Batavia, the line to Buitenzorg and eventually to Soekaboemi and also the main line as far as Tjikampek. These propositions, logical and economical as they were, were welcomed in all circles and it was not long before they were accepted by the Minister for the Colonies and Parliament in Holland. The building of the water-power station was commenced in 1919, one being erected at Tjitatih and the other at Tjianten, now known as the Oebroeg and Kratjak Stations, but owing to the unfavourable conditions which set in in 1921 it was found necessary to curtail the original program considerably and the work on the Kratjak Station was suspended whilst the electrification of the system was confined to the net in and around Batavia. The work on the line to Buitenzorg has had to be postoned until better times but the local lines in Batavia are nearing completion whilst, as already mentioned the line Tandjong Priok-Meester Cornelis has been in operation since April this year.

That the introduction of the electric system has proved a success is shown by the manner in which the new trains are patronised both by Europeans and natives who are only too anxious to take advantage of the faster and more frequent service provided. Let us hope that communication by electric train between Tandjong Priok and Weltevreden will soon be established whereby the present idiotic necessity of having to travel from Tandjong Priok to Weltevreden by motor car (owing to the infrequent train service) will be obviated. Result—increased revenue for the railways and a no small saving to the public. Java is the pioneer of the electric railway in South East Asia—let us hope that she will always hold the lead which she has obtained.



Railway Bridge on the Preanger Line near Melangbong

An article such as this would be incomplete if the financial results were not reviewed and although this may prove to be some what "dry" to some readers it is in any case interesting to note the development of the Java Railways from a financial point of view.

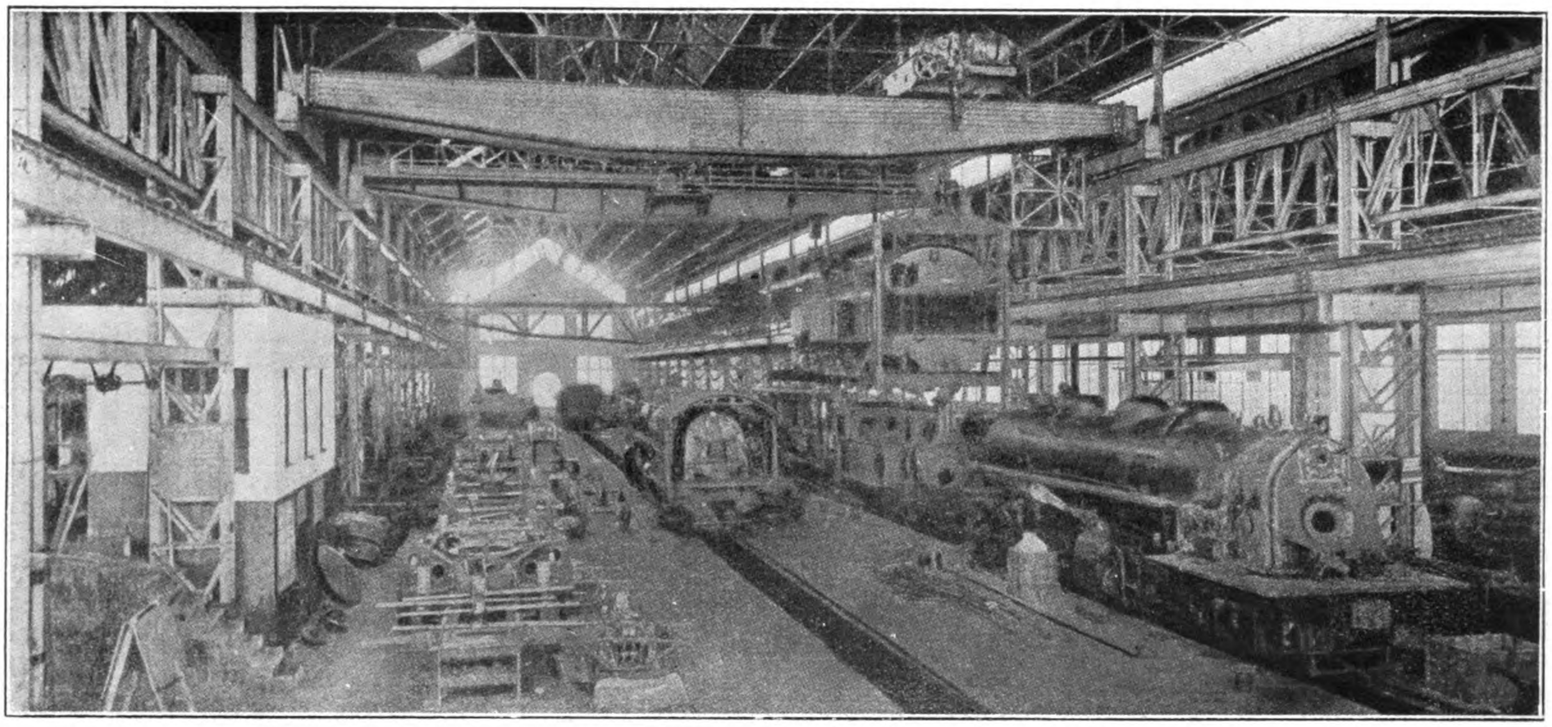
It has never been the intention of the East Indian Government to turn the State Railways into a gold mine for their own benefit, the sole object of their having taken the initiative, at the time when private capital was not forthcoming, being the solution of the urgent question of transport on the island. Thus the first steps were taken solely in the interests of the welfare of the country and without any thoughts as to possible profit, and on the whole the results are not disappointing. If we examine the results of the various lines separately we shall see that whilst some show a substantial profit others are working at a loss: among the latter may be mentioned the Acheen tram, the Palembang Line and the Lampong Line in Sumatra.

The gross receipts whow a gradual increase from the date of the introduction of the railways until 1922 when a considerable decrease was felt. On the other hand the costs of exploitation increased by leaps and bounds during and after the war years as a result of the rise in the prices of materials and consequently the margin available for renewals, maintenance repairs and depreciation became considerably reduced. The highest receipts registered since the inovation of the railway were registered in 1921 when they amounted to more than 80,000,000 guilders but in this year the costs of exploitation were also the highest ever experienced. The highest balance of gross receipts over exploitations costs was in 1924 when a balance of 23,452,006 guilders was available of which approximately 4,000,000 guilders were carried forward to the repairs, maintenance and depreciations accounts.

If the results of the profitable and the non-profitable lines are considered as a whole it will be seen that the rate of interest earned, calculated over the whole capital involved, has varied in the last fifty years between 0.8 per cent the lowest figure being registered in 1922 and the highest in 1924. If we consider only those lines which are operated at a profit, and these form two-thirds of the whole system, we obtain naturally even more favorable figures. In the most unfavorable year, 1922, the interest amounted to 1.2 per cent. whilst for 1924 figure was 5.2 per cent.

A few notes on the organisation of the State Railways in general are not out of place and I will commence with the workshop as these stand in direct relation to the general development of the railways and as such their growth has been just as remarkable as that of the railways themselves.

Much has been done during the last fifteen years towards the development of the workshops with the result that at the present time the State Railways possess an organization which compares favourably in all respects with similar institutions in Europe and America. It speaks for itself that such an organization influences the financial results of the railway industry to no small extent, in as much as repairs can be quickly and economically carried out, a matter of no small importance where delay in delivery means heavy losses to the branch concerned.



Locomotive Repair Shop at the Manggarai Workshops

At the present time the State Railways in Java possess four large modern workshops, i.e. one at Manggarai (close to Batavia), one at Bandoeng, one at Madioen and one at Sourabaya. With the exception of that at Sourabaya these workshops are equipped for the reception of both locomotives and coaches and, in addition to repairs and maintenance, the construction of coaches also forms part of their activities. The machinery installed in the above mentioned workshops is all electrically driven and in addition there are two smaller workshops at Djember and Poerworedjo. Statistics show that on an average 11 per cent. of the total number of locomotives in service are under repair, the figures for coaches and trucks are 8 per cent and 4 per cent. respectively which under the circumstances must be regarded as satisfactory.

As regards fuel it is of interest to note that all locomotives in service on the Java lines burn local coal and wood with the exception of two American mountain engines which make use of petroleum residue.

Owing to the fact that the government coal mines have been able to deliver this article at prices below those demanded for foreign coals, it has been found possible to keep the fuel expenditure at a comparatively low level. The estimated value of the fuel used on the railways in Java is 8,000,00 guilders per annum.

That the State Railways places service above everything is shown by the fact that locomotives from all the principal machinery manufacturing countries have been tested and thus we see engines from British, American, Dutch and Swiss factories in service on the various lines in Java. In the same manner we see that no less than 13 countries have participated in the manufacture of the new electric locomotives and coaches—truly cosmopolitan rolling stock !

It is gratifying to see that the State Railways consider efficiency above the question of giving the preference to home industry and, by giving foreign concerns the opportunity of competing for the delivery of material, places itself in the position of being able to select the most suitable and efficient material. Supporting home industries is in itself an excellent proposition but in many cases it is adopted at the cost of the efficiency of the industry itself and in this respect the State Railways are broad minded enough to realise the advantage to be obtained by open competition.

To conclude these few notes on the organization it may be mentioned that at the present day more than 398,000 employees are in their service of which of course the greater majority are natives. When we consider that in 1878 this figure was somewhere in the region of 250 we have again a speaking example of the development of the railways in Java.

That only one strike of any importance has been experienced speaks well for the spirit of their staff and employees in general and the fact that a considerable number of the strikers were reinstated after they had been discharged has no doubt done much to strengthen the relations between employer and employees.

This short review of the State Railways in Java and the Outer Possessions gives some idea of the development and future of this industry and it may be presumed that the spirit of the pioneers of this great asset to the welfare of the Netherlands East Indies is still alive to-day in the persons responsible for its further development. The State Railways of the Netherlands East Indies have a wonderful future in front of them and there is no reason why they should not eventually rise to a position second to none in all respects.

(The writer wishes to acknowledge the " Jubileumboek van de Staatsspoor-en Tramwegen in Nederlandsch Indië" as the source of the statistics mentioned in this article.)

China Stock and Share Handbook

COMPILED AND PUBLISHED BY C. R. MAGUIRE, SHANGHAI, 1925. PRICE $6.00

An index filing cabinet is an essential part of every well ordered business office and an index of the financial details of the various companies with which he has dealings is essential to the man interested in Bonds, Stocks, Shares and Exchange. Such an index has been given publicity in the reproduction of the "China Stock and Share Handbook," which is a welcome revival by its former compiler whose absence at the war brought its publication to a temporary stop. The "China Stock and Share Handbook" always proved a useful and popular compendium of financial information, but the present edition will prove even more useful and popular than any of its predecessors.

It will prove to those who have an interest in the commercial, industrial and banking development of China the enormous strides the country has made and is making in these directions.

Each company dealt with has its financial position shown in tabulated form covering a period of years, so that its status as a public investment and furture possibilities becomes simplified to the person looking for sound investments. The Handbook is more for the guidance of the investor than for the mere speculator and should, therefore, prove a fund of information to those who want to carefully invest their small savings. It will prove of great utility to Chinese and Foreign investors alike, having returns of a large number of important Chinese undertakings and Chinese Government bonds and securities.

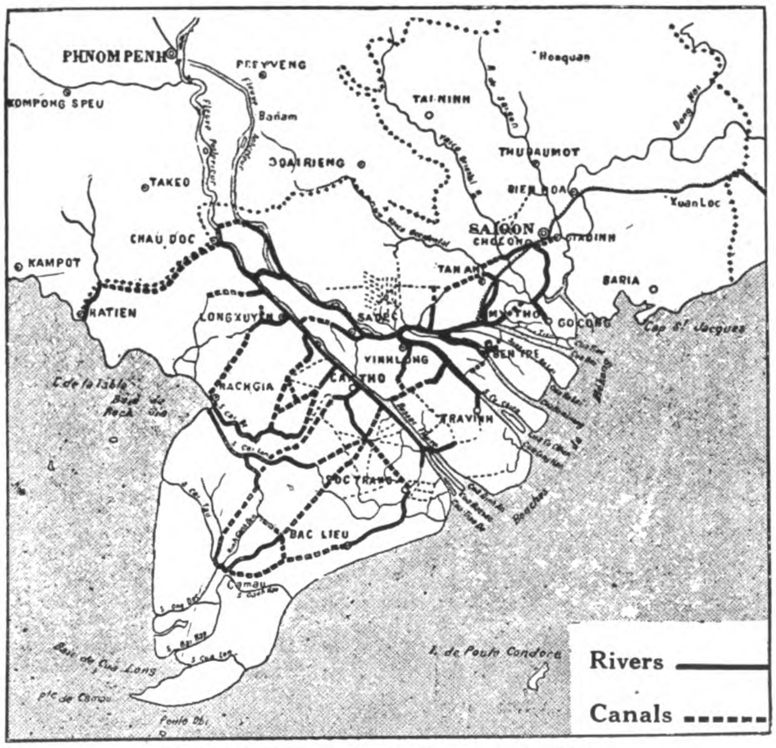
Economic Development of French Indo-China

By Ernest Roume, Former Governor General of French Indo-China

IN HIS masterful outline given at the inauguration of this series of lectures on the French Colonies, Mr. Albert Sarraut (former Minister of Colonies), speaking of France's civilizing mission, put side by side interest and duty of all colonizing nations, as concerns large scale development of production, and consequently wealth, of the colonies in their charge. The duty is not only to themselves, but in a greater measure, to the native populations for whose well being they are responsible ; and in a still superior measure to humanity at large, the needs of which are ever growing—and who, if these moral obligations were neglected, would finally question the legitimacy of the mandate, so willingly accepted at first.

Nothing is more true. Those times are past, when a country could with impunity neglect the economic development of its colonies and leave their latent riches dormant. To-day, in cases of that kind, even the best established diplomatic titles would not be sufficient to safeguard colonies of that category ; for sooner or later an avenging Nemesis would emerge, sister to the one who wrested Cuba, Porto Rico and the Philippines from their possessors. Without doubt, economic development of the material resources of a colony is not the only object worthy of attainment, but it makes conditions for all other progress, whether social, intellectual or moral. For, below a certain minimum of well-being, and if subsistence is precarious and aleatory, it would be in vain to try development of instruction and even effective sanitary improvement.

Hence, from every point of view, growth of production (and consequent wealth of a colony), is the fundamental touchstone of success or failure of the colonizing power; and it is in the light of these preliminary observations, that we shall examine France's economic achievements in Indo-China. In order to appreciate them with logic and justice, it seems best to recall in what condition we found this country at the time of our intervention. To do this we do not have to descend very far into the corridors of time, for the occupation of Cochin-China was achieved in 1867 while Cambodia accepted, or rather solicited our Protectorate ; but it was only in 1889, that Annam and Tonking came within the French Indo-Chinese Union ; though still in 1892, one of the first governors general, M. de Lanessan, could see from his residence on the right bank of the Red River, in Hanoi, the flames of the fires kindled on the left bank by the infamous " Black Flag" who still held the greatest part of the upper and midlands, to the Chinese frontiers.



Navigable Waterways in French Indo-China

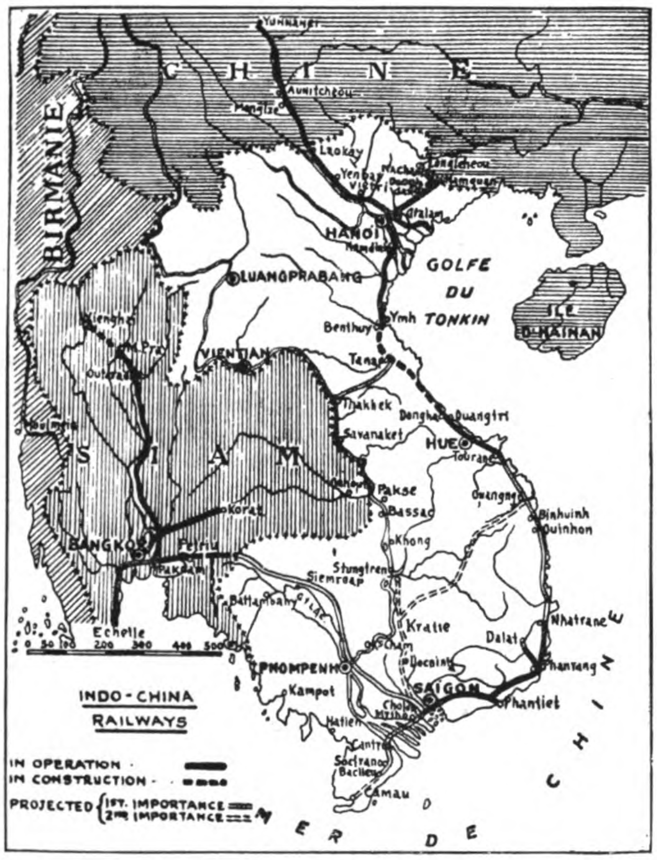
What then did we find, from an economic point of view ? A country in a state of lethargy, retired within itself, having no relations with the rest of the world except with a few nearby Chinese ports, a country exclusively agricultural, rice the basis of alimentation, being the main product. The map shows you, that French Indo-China has the outline of a gigantic capital "S," the open curves occupied by the deltas of her great beneficent rivers, the Red River and the Mekong, connected by the Annamese Mountain chain, 900 kilometers long, leaving on the Annam coast just enough room for a few lateral valleys, but in the west, approaching the Mekong River in the form of vast plateaus, called the Laos. The Annamese describe this letter "S" in a more picturesque and descriptive way : they compare it to the long stick of bamboo they carry, from each end of which is supended a basket of rice.

It is impossible, no census having been taken before that epoch, to give the number of inhabitants at the time of our establishment ; but though bigger now, population was already then concentrated in the delta of Tonking and in North Annam.

Along the 2,500 kilometers of coastline, there was not one well equipped port ; just simple shelters, often precarious, for sailing vessels of small tonnage. There were no roads, only trails for pack animals ; to offset this there were many navigable waterways, making possible the circulation of numerous junks. On account of these limited means of transportation, provinces out of reach of these water routes were exposed to famine, when the rice harvest was insufficient. I have myself witnessed calamities of this kind, as late as 1898, at Hué, the Capital City of the kingdom of Annam. This was before the railway, now connecting the port of Tourane with Hué, had been constructed. In 1898 those two cities were connected only by a difficult trail via the pass of " Nuages " and accessible only to pack animals, and in spite of all possible efforts the means of re-victualling were cruelly insufficient. For a long time we have not witnessed in Europe—outside of Russia—the horrible fact of a starving population, and thanks to French enterprise, Indo-China will not pass through this experience again. But even outside of these extreme famine cases, we found the people undernourished and consequently not very strong. This has been greatly corrected and improved. The way matters stood, there could, naturally be no question of considerable exterior commerce, so during the first few years of our occupations, this commerce consisted mainly of importing merchandise necessary for the upkeep of the troops and functionaries. And now I have arrived at my starting point : how has the very mediocre economic situation of Indo-China improved under French rule ?

Rice and Other Cereals

I have already indicated that rice is the basis of agriculture in Indo-China ; it is in fact more important for that country than wheat is for us. The nature of the soil, especially in the great deltas of the Red River and the Mekong, the atmospherical conditions, greatly favor this cereal, not only in Indo-China, but also in Siam and Burma. It is a national cultivation, placed under



invocation of the earth protecting genii ; and even now the Emperor of Annam in person celebrates the " Feast of Tillage." A native song quoted by M. de Tessan in his very interesting book " Asia Awakened," says " How could man exist without his ricefield ! The buffalo has grass, man has rice." It is certain we do not have to teach the Annamese people how to cultivate rice. They have done it for centuries, and their irrigation works are remarkable, considering their limited means of action. And nevertheless, what a vigorous impulsion we have been able to give to the extension of this cultivation, thanks to methodical application of hydraulic agricultural works, having the threefold objects of : first, fight, against inundation ; second, drainage of low lands ; third, irrigation of high lands. In Tonking, the works for strengthening the Annamese dikes, begun fifteen years ago, are almost finished ; and frequent breaks devastating the Tonkin provinces are now a thing of the past.

In Cochin-China, openings of great canals, draining the low lands and serving navigation have been taking place now for over forty years. Since 1893, when the " Societe des Dragages de Cochin-Chine" used powerful mechanical means, 520 kilometers of large canals and over 2,000 kilometers of medium large canals have been due ; 120 million cubic meters — more than was necessary for the Suez Canal— have been dredged, at an expense of about 100 million francs (gold). Irrigation of the high lands, presenting more technical difficulties, were undertaken later, after thorough study and investigation in Java and British India. It was found that from 6 to 700,000 hectares could be irrigated by both gravity and pumping. The first part of these works, 120,000 hectares, is completed, and it is estimated that it will take ten years to complete all of the planned irrigation works and twenty years for draining the 50,000 hectares in Tonkin, and the 600,000 in Cochin-China.

Now for the Results

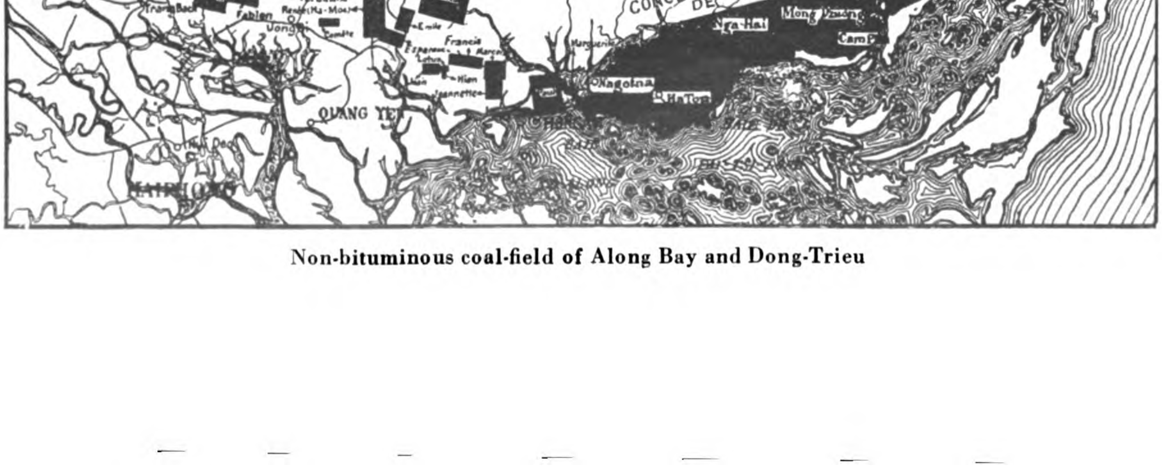
In Cochin-China, from 1879 to 1923, in 44 years, the area of rice fields grew from less than 400,000 hectares, to over 1,900,000, i. e. almost multiplied by five, rice exports passed from 250,000 to 1,200,000 tons, and the population of Cochin-China from one million and a half to 3,900,000. The total rice production of French Indo-China yearly is not less than from seven to eight million tons, four to five of which are for local consumption, four to five hundred thousand for seed, about 200,000 for distillation, and the remainder, two or two and a half million for export. Among the export items of 1923, rice alone represents a value of 652 million francs, i. e., more than half of Indo-China's total exports. To-day, the rice production of French Indo-China is considered equal, if not superior, to that of Burma, the latter having had until lately, first place in the world's markets. And when the works mentioned above are completed, adding more than one million hectares to the two million already under cultivation, what a magnificent perspective will be open to our beautiful Indo-China Colony. But out efforts do not stop at quantity production, but concern themselves also with improvement in quality. Thus the " Societe des Distilleries de l'Indo-Chine " is efficaciously cooperating with the government, by successfully using in its plants, mechanical devices for sorting the " paddy ' thus lessening cost of manipulation.

Other Cereals

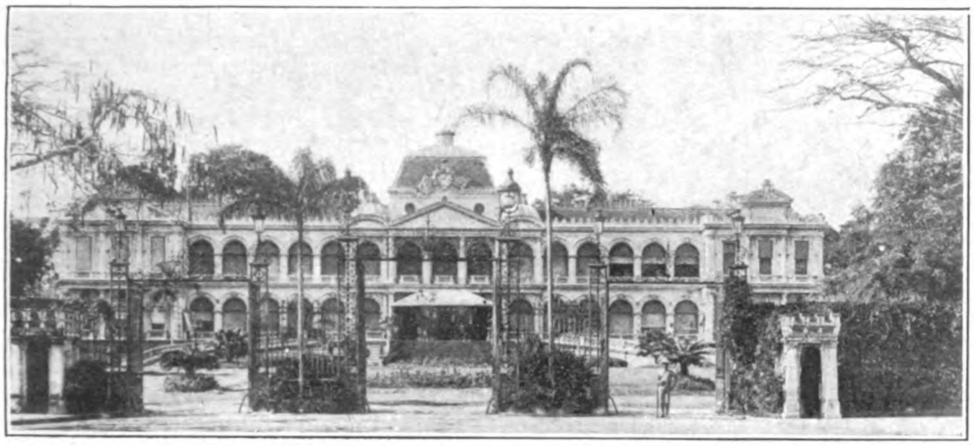
Outside of rice, Indo-China produces—under very favorable conditions—maize (corn) which also has an important place in native alimentation, and even in export, especially to France. Twenty-five years ago, maize, as an export item, was insignificant, but in 1905, the quantity exported suddenly jumped from a few hundred tons to sixteen thousand tons, increasing from year to year, reaching 133,000 tons in 1913. The war interrupting, this record has not as yet been repeated, the last yearly statistics showing 62,000 tons. This went almost exclusively to France, which is the more interesting when one knows that she imports yearly several hundred thousands of tons of maize, and therefore could easily buy more of this product from her own colony to mutual benefit.

Sericulture

Another agricultural asset of French Indo-China of local and French interest is mulberry-tree planting and consequent sericulture. The mulberry tree grows everywhere in Indo-China, even in the poorest soil ; and silkworm raising and the spinning and weaving of silk are occupations well adapted to native character and greatly followed in Annam, Tonkin and Cambodia. But before our intervention, production was mediocre, both in quantity and quality, and barely sufficing for local needs. Under the steady guidance of French technicians, merchants and administrative



Non-bituminous coal-field of Along Bay and Dong-Trieu



The Palace of the Governor General of Indo-China

agents—particularly Lyonese—the silk industry is undergoing marvelous transformation.

Rubber

The agricultural products I have mentioned so far, have existed from time immemorial. All we had to do, was to extend and perfect them. This is not the case concerning rubber, which was originally introduced there by us, and at a comparatively recent date, since it was in 1906 only, that this industry became somewhat important. The initiative was altogether private, and due to the great success of rubber planting in the neighboring countries of Indo-China, in Malaysia, the Dutch Indies, and Ceylon, where climatic conditions are similar to those in our colony. These initiatives were happily seconded by the administrative powers, by liberal concessionary terms on the one hand, and efficacious financial aid on the other hand, by way of loans granted the "Banque de l'Indo-Chine," guaranteed by the colony, when the infant industry struggled against heavy odds, resulting from the war. These difficulties have happily been overcome, and rubber production is flourishing to-day. In the eastern part of Cochin-China, and in Cambodia alone, there are 250 plantations, from small ones of 100 hectares or less, exploited by individuals, many of whom are natives to big plantations of several thousand hectares, belonging to corporations, and provided with perfect and modern equipment. Rubber cultivation being a new industry in Indo-China, it had the advantage of being able to profit by the example of her neighbors, thus avoiding costly experimenting, and beginning with right methods and modern equipment.

Add to this that French Indo-China possesses the ideal soil for this cultivation, her now famous gray and red soil, especially in Cochin-China, and Cambodia, and you will understand that rubber-planting there has a great future in store. Already in 1923, French Indo-China exported nearly 6,000 tons of rubber, valued at twenty-eight million francs, three-fourths of which went to French markets, reducing thus—though much too little as yet—the heavy tribute paid by France to foreign production. But the sum will be ever progressing, for a full yield of the present trees will not be had before 1926, when the quantity will be at least 10,000 tons. This too, will be quickly surpassed, because new plantations are being created all the time, and the day will dawn, when French rubber consumption will be completely supplied by her Indo-Chinese colony. This result will certainly be hastened, if tariff advantages—no matter how slight—will be granted.

Sugar—Spices

The fertile soil of our Far Eastern colony can supply the world with many other products, such as sugar, vegetable oils, cotton, flax, ramie, agave, jute, tobacco, coffee, tea, cinnamon, pepper, though most all of these are far from properly developed. The best developed of these is that of pepper, in the regions on the Gulf of Siam as far as Cochin-China and Cambodia. It is a little known fact, that nearly all the pepper consumed in France, originates in this region. Out of a total production of about 31,000 quintals, valued at fourteen and a half millions of francs 30,000 go to France. Indo-China is situated in natural sugar cane zones and within proximity of the region where sugar cane planting has acquired great importance and perfection: Java, Philippines, Borneo. Of course, our natives have planted sugar cane from time immemorial, but using primitive means. The native mills register from one to two tons of sugar to a hectare of cane, while La Martinique registers six ; Java, ten ; and Honolulu more than twenty. You will see that there is much to be done. Sugar cane planting has to become rational, and already several corporations have been formed in Cochin-China and Annam, with this object in view. Modern refineries are in course of construction. The movement is in progress.

Vegetable Oils, Coffee, Tea

Everybody recognizes the primary importance of oil production. Every day discovers new sources and new uses. Within fifteen or twenty years the world's markets of fats and oils will dictate to and regulate those of carburants, and Indo-China will have an advantageous place in those markets. The oil palm, best producer of industrial oils, has been successfully introduced in Indo-China: while the cocoanut palm is indigenous to this country, and plantations of it can, with little cost, be extended into the immense areas of the alluvions of the Cochin-China delta and in fact this work has been commenced. Ricine grows everywhere, above all in Tonkin. During the war, for needs of national defense, mostly for aeronautics, 3,000 tons of this grain has been sent to France. The coffee plant, after much experimentation, has been acclimated, Tonkin again giving best results. Indo-China could produce great quantities of tea. A big corporation has been organized for creating vast tea plantations in South Annam and others are following this example.

Tobacco

Tests made by the "Commission Interministerielle" of tobacco originating in Indo-China, demonstrate that certain kinds, notably from Tonkin and Annam, fulfill the requirements of the "Regie" (French Government Monopoly of Tobacco). The Minister of Finances proposes to send to the colony, a Commission, to buy for the government, as was done with Madagascar. On the other hand, a French Company, purporting rational cultivation and marketing of Indo-China tobacco, has been incorporated recently.

Textiles

Among the textile plants, cotton is necessarily attracting the greatest attention, on account of an impending scarcity of this raw material, greatly feared by the European cotton industry. Therefore it is good to know that cotton grows readily in all parts of Indo-China, but particularly in Cambodia on the banks called "chamcars" and like those of the Nile alternately inundated and drained off—of the great Mekong river. But native production is rudimentary and it will take much experimentation—a thing that is true of all tropical cultivation. This problem cannot be properly solved by the "Colons." A well constituted scientific Agronomic service alone can do this satisfactorily. And here truth obliges me to state, that in our Indo-China, this service is not as good as it should be, while in Java, Malaysia and Ceylon, it is powerfully organized. To be efficacious, these services should be autonomous, sufficiently financed, created with the collaboration of the Colonial governments and interested Colons, but independent of administrative and financial fluctuations. In this respect, we have a perfect model before our eyes in the admirable Colonial Pasteur Institutes rendering such great service, both scientific and practical, concerning maladies and infections—human, animal and vegetable—because their organization satisfies conditions of stability and continuity without which there would be only confusion and little result.

Fisheries

An efficient point of view is happily found in French Indo-, China's Oceanographic Service of Fisheries, which, truly scientific is connected with the laboratory of M. Gruvel, Professor at the Museum of Natural History, in Paris, and who for the last twenty years has devoted his studies and work to the research and rational exploitation of the ichthyological wealth of our colonies.

The 2,500 kilometers of French Indo-China coastline, and the great rivers and lakes, are indeed very rich in fish of all kinds. The Annamese are not only tillers of the soil, but fishermen, and fish adds to their principal food of rice, the necessary azotes. Though their fishing equipment is altogether rudimentary and insufficient, nevertheless and because of the very richness of their waters, they export yearly great quantities of dried and salt fish, and shrimps to China, representing about a hundred million francs.

Forestry

The service of Forestry also is most efficient. The great Indo-Chinese forests, covering considerable areas in the mountainous regions had been neglected before our coming. We are re-constituting them methodically—and more than two million hectares have been put in reserve, and protected from depredations and fires. These forests contain from 700 to 800 kinds of wood ranging from those for building purposes to the finest of cabinet woods.

Industries—Coal and Other Minerals

Less than 20 years ago, a summary resumé, like the present one, regarding the economic resources of Indo-China, might have been closed here. Indeed Indo-China was a quasi-exclusively agricultural country, and offered nothing but a restricted industry, limited by the satisfaction of the elementary domestic needs.

It is no more so : Now-a-days this country has embarked on the great industrial eddy, which sweeps away and transforms our planet, and the characteristics of which I wish to indicate here, as far as they concern our subject.

Tonkin is essentially the center of the industrial power of Indo-China : it is here indeed, that are found the constituent elements of the industrial production, coal, ore deposits, and manual labour.

First of all, coal ; it is chiefly anthracite, the formation of which spreads over a length of more than 100 kilometers, parallel to the north shore of Tonkin, where it rises to the level of the sea. It is an excellent fuel that burns without smoke and leaves no waste. By mixing it with Japanese soft coal (charbon gras) for which they now begin to substitute Tonkin soft coal, some agglomerations are obtained, by merely adding, through distillation, some black rosin or some coke.

The powerful and very prosperous Company of the Tonkin Collieries operates, at Hongay, the strata that are nearest to the sea, most of which are in the open ; out of nearly one million tons' yield, about two-thirds are exported.

Some other important Companies have undertaken the exploitation of several concessions in the same region, so that a rapid development of the production is assured. But there is not only anthracite, in the Tonkin, there is also, very luckily, soft coal, with 23% of volatile matter, which is an excellent coke-coal ; and this is all the more interesting, because these mines—and the Phan-Me mine particularly—are in a region where are to be found rich deposits of iron ore, so that you can judge at once of the perspectives that are opening up, and which are being studied very closely as regards iron metallurgy.

Zinc

The foregoing regards the future—perhaps a near future ; for the present, it is zinc which constitutes the principal mineral wealth exploited in Tonkin. There are, in fact, in Upper Tonkin, three rich mines of zinc calamine (native carbonate of zinc) from which were exported in 1923 about 33,000 tons of ore, valued at 23,000,000 of francs.

But—and this is what defines most clearly the new state of industrial evolution into which Indo-China has just entered—they are no longer content with the export of ore, but are shortly to treat this ore in Tonkin where a foundry or smelting plant has been erected near Haiphong, by the " Mines and Metallurgic Company," which is itself a branch of a large French metallurgic enterprise.

Besides this, Tonkin possesses two very important groups of tin mines, the one situated in Upper Tonkin, the other in Laos besides in Tonkin, there are deposits of lead, with notable silver quantities, which have in times past been actively exploited by the natives, and which are again actively prospected ; there are also deposits of auriferous quartz and of graphite.

This rapid enumeration, though too summary a resumé of the report presented last year to the Industrial Institute of Northern France by General Inspector of the Lantenois mines, ex-Chief of the Indo-China Mines Service, will suffice, however, to give an idea of the importance and of the variety of the mines of our colony.

But how many more resources does she not contain ! Both in Tonkin and in Cambodge are deposits of phosphates, the working of which have already been begun and are giving rise to the greatest expectations ; calcareous deposits of great aboundance, deposits of china or porcelain clay, treated as fireproof clay, and used for the ceramic art.

One of the most important and prosperous industries of Indo-China is that of the artificial Portland Cements, at Haiphong, which, besides supplying the needs of the colony, exports nearly 60,000 tons, and is buying machinery and preparing for a swift increase of production.

Close to Hué, the Company of hydraulic Limes of the Lang-Tho, is working some quarries of hydraulic lime stone, yielding 12,000 tons of hydraulic lime, cement blocks and divers ceramic and fireproof products.

Primal elements for the manufacture of glass are found both in Tonkin and Annam, and are of excellent quality, and the trade for this product is practically without limit, both in Indo-China and in all of the Far East ; this industry is therefore actively pursued now, and it will receive an added impetus by the establishment in Haiphong of a new and very important plant, that is being started by the Company of Glass-works of the Far East,

Lastly, the great Chemical Industry, the production of corrosive glass-wort or soda-ash, of chloride of lime and of hydrochloric acid, has just begun to develop at Haiphong, which is fast becoming the most powerful industrial center of Indo-China, and to hold a first-rank importance in the Orient.

This industry is feeding the manufacture of paper, which has at hand a very remarkable primal element in the bamboo, that is thriving here in great profusion ; this new industry is also developing at a quick pace.

I have already touched, while speaking of the rice, upon the textile plants, and generally on agricultural products, and industries based on these products ; of the imposing group of the Cholon and the Tonkin ricefields, of the great distilleries, of the spinning and weaving of both cotton and silk, of the manufactures and the treatment accorded to later and India-rubber, and of the manufacture of tobaccos in Hanoi. The limitation, necessarily restricted, of this Lecture, would hardly allow me to extend my remarks on this subject beyond the present scope and I can but wish that this summary and very incomplete review may leave with you a sufficiently clear perception of the industrial resources of Indo-China, and of what may shortly be expected of their full development.

Capital Invested

All this vast complexity of agricultural and industrial productions has been possible only thanks to the bringing into play of capital, the importance of whcih is daily growing. The Economic Agency of Indo-China has kindly given me regarding this subject some figures which—though they can be but approximate—I believe will prove interesting.

On December 31st, 1923, the nominal value of capital invested in Indo-China and quoted on the Paris Exchange, amounted to 1,208,640,000 francs and adding to this the amount of the local loan of 6,180,000 " piastres," which represents, at par of 10 francs per " piastre," 61,800,000 francs, we reach the total of 1,270,440,000 francs.

Taking into consideration, besides this, the capital invested in enterprises which are not belonging to this class of anonymous companies and some of which are very important, it is no exaggeration if we value at nearly two billion the nominal value of capital invested—by a majority of French people—in Indo-China up to the 31st December, 1923.

But it is particularly interesting to note that in the single year of 1924 to this sum has been added 328,000,000 francs, augmenting the capital of existing companies and for the formation of the new companies.

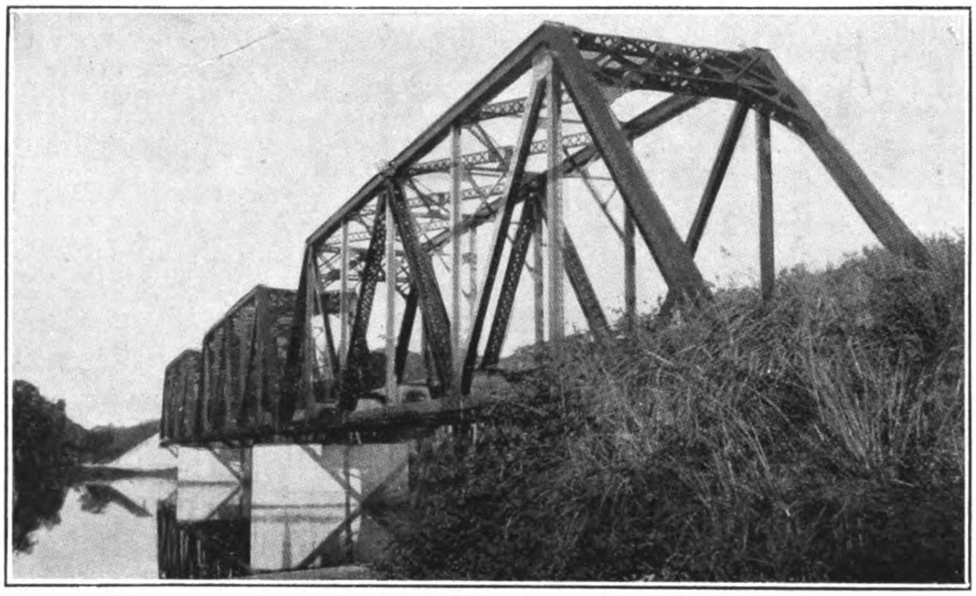
Moreover, we have not taken into consideration the increased value, often very considerable, of capital primarily invested ; but it is certain that the actual value of the capital invested in Indo-China would greatly exceed three billion.

It *is* a beginning, but it is *only* a beginning : these figures cannot be compared with the capital invested in the near-by foreign colonies ; it is necessary therefore that they should be substantially augmented if the integral value of Indo-China is to be reached, for to-day she has scarcely attained one-fourth of her rightful value.

The Manila Railroads

THE physical condition of the property of the Manila Railroad Company—roadbed, rolling stock, and structures—was never as good as it is at the present time. This statement is made not with a view to reflecting on former ownership or managements, but to draw attention to the fact that the investment of surplus earnings in permanent improvements and betterments and additions to rolling stock during the past three years has had its logical result. In confirmation of the above, it is pleasing to record that former President and General Manager Horace L. Higgins, after traveling over the entire system to inspect the property on behalf of the English bondholders a year ago October, remarked to the officials who accompanied him that he was extremely surprised and gratified at the most excellent and greatly improved condition in which he found the property and would so report to his principals, The Manila Railway Company (1906) Ltd., of London.

This improvement program is already beginning to have a favorable effect on operations. Raising the track level in various sections of the line, replacement of wooden pile trestles with permanent steel bridges, grade reduction and elimination of curves has tended and will tend toward greater operating economies and minimize the costly and vexatious interruptions to traffic caused by washouts during future rainy seasons. Furthermore, the added equipment units of greater capacity and strength have decreased equipment maintenance costs per car and conduced toward greater transportation efficiency.



Guinayangan River Bridge near Aloneros, Main Line South, Three 40-Meter Through Spans

Railway Location

During 1924 the location of the Main Line South from Km. 332, about 12 kilometers beyond the town of Ragay, Camarines Sur, to Km. 370. the end of the constructed line at Pamplona, a distance of 38 kilometers, was completed. This shows the total distance between the rail heads at Aloneros and Pamplona to be 108 kilometers.

In December, 1923, the investigation and survey for a railroad line from Tarlac, Tarlac, to San Jose, Nueva Ecija, a distance of 55 kilometers, by way of the towns of Victoria, Guimba, and Muñoz was authorized. A line along this route would serve two purposes :

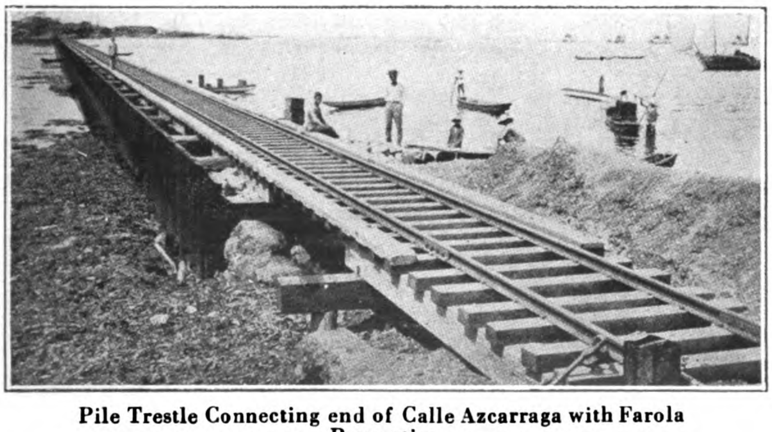
1. Direct railroad connection to the Main Line North at Tarlac for a well-populated, fertile region, producing a large tonnage of rice and sugar cane.
2. San Jose is the point where the new first-class highway known as the Santa Fe Road, running from San Jose northward into Nueva Vizcaya, begins. This road will eventually give ready access to the Cagayan Valley and motor traffic already developing will serve as a feeder to the railway line if constructed. San Jose itself is the center of an extensive rice-growing district now served by bull-cart and truck transportation to the town of Cabanatuan. At San Jose a modern Government irrigation system, known as the Talavera System, at present serving an area of approximately 5,000 hectares, is nearing completion. An additional area of 3,000 hectares will be served by the next planting season.

The survey of this line was made during 1924 on a maximum grade of four-tenths of 1 per cent. This line could be economically constructed as the erection of long and expensive bridges would be avoided.

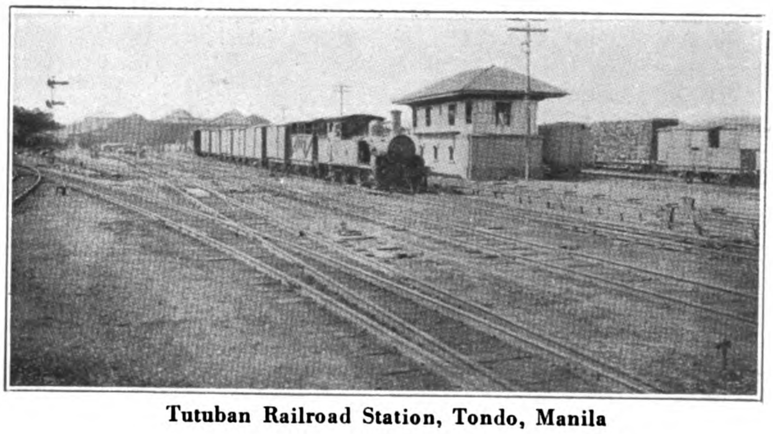
Railway Construction

That portion of the Main Line South between Calle Herran, Paco (Km. 9.620), and a point between Balagbag and Sucat (Km. 22.550), had been giving considerable trouble and causing uneconomical operation in former years on account of frequency of washouts, steep grades, sharp curves, and inadequate siding facilities at Culiculi and Balagbag. Extensive construction work was necessary, which has been practically completed during the past year. This work may be apportioned roughly to three main divisions :

1. From Km. 9.620, beginning at Calle Herran just south



Pile Trestle Connecting end of Calle Azcarraga with Farola Properties



Tutuban Railroad Station, Tondo, Manila

of Paco Station, to Km. 13,500 at Culi-culi station, the raising of the grade an average of 2-ft. above the former level.

2. From Culi-culi to Km. 21, three kilometers south of Balagbag station, the rectification of the grade by cutting down elevations and filling in depressions. This has been one of the most irregular pieces of track on the railroad and the grade reduction was absolutely necessary in order to facilitate economical operation, especially at Balagbag station which was on a high ridge, with inadequate sidings.
3. From Km. 21,100 to Km. 22,550, between Balagbag and Sucat, a new location of the line, which has straightened out a long reverse curve and reduced the grade. For this purpose it was necessary to acquire two kilometers additional right of way.

The maximum grade on this section has been reduced from 2 per cent. to 1 per cent., compensated, and heavy maintenance costs due to washouts during future rainy seasons will undoubtedly be avoided. It may be added that prior to the accomplishment of this work it was necessary to keep a helper engine continually available at Paco to assist heavy freight trains over the high ridge at Balagbag. The total cost for this work was estimated at £320,-000, but the amount actually expended on the project was approximately £250,000.

Maintenance of Way

During the year 1924 there were 121,619 ties used in the maintenance of operated lines, most of which were molave and the balance yacal. This is an increase of 20,793 over 1923.

All wooden bridges except those replaced by permanent structures were maintained in good condition. The maintenance of buildings was given special attention, the work in several cases being reconstruction and painting. (See previous comment regarding Maintenance of Way and Structures.)

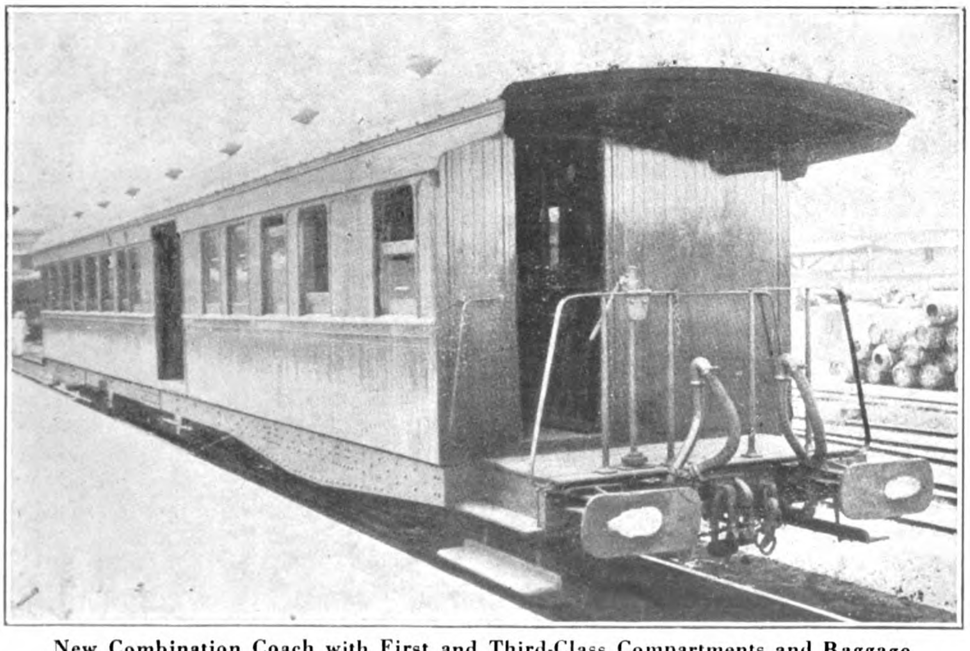
Additions and Betterments

The yard trackage at the following stations was increased as follows :

	Meters
Dau	650.00
Culi-culi	428,00
Bauang Sur	381.00
Manila Deposito	725.00
Sucat	384.00
Total	2,568.00

Industrial spurs were constructed as follows :

	Meters
Km. 112.253 Main Line South, Carabao Coconut Company	440.85
Km. 72.400 San Pablo Cut-Off, Calamba Sugar Estate ...	88.72
Km. 66.099 Batangas Line, Calamba Sugar Estate ...	94.00
Km. 74.038 San Pablo Cut-Off, Laguna Sugar Corporation	95.73
Km. 90.577 Batangas Line, Philippine Sugar Estates Development Company	92.45
Km. 40.375 Cabanatuan Line, Hermogenes Reyes ...	75.00
Total	886.75



New Combination Coach with First and Third-Class Compartments and Baggage Room Between. Length, 65 Feet, with 6-Wheel Trucks

Steel Bridges Constructed

Twelve (12) permanent steel bridges with concrete abutments were constructed to replace old wooden trestles at the following places :

Km. 70.45, Main Line North ...	One 7-foot I-Beam Girder.
Km. 63.22, Florida Blanca Branch ...	One 45-foot thru span.
Km. 63.62, Florida Blanca Branch ...	One 33-foot thru span.
Km. 65.90, Florida Blanca Branch ...	One 33-foot thru span.
Km. 84.24, Florida Blanca Branch ...	One 36-foot thru span.
Km. 34.35, Main Line South ...	One 16-meter thru span.
Km. 117.53, Main Line South ...	Five 15-foot I-Beam Girder.
Km. 117.84, Main Line South ...	One 100-foot thru span.
Km. 119.50, Main Line South ...	One 60-foot thru span.
Guinayangan River Bridge, Main Line South	Three 40-meter thru span.
Km. 71.98, Pagsanjan Branch ...	One 70-foot thru span.
Km. 134.400, Main Line South ...	One 50-foot thru span.

Other Construction

Wooden station buildings on concrete foundations were constructed at Tablante, Alacan, and Culi-culi.

At Hondagua two (2) industrial warehouses for depositing copra were built with corrugated galvanized iron sidings, wooden framing, and concrete foundations.

At Aloneros a bunkhouse was built for the train crews that sleep at Aloneros. Besides, the pump house was extended to accommodate the Delco Light Plant.

An outgoing freight platform was constructed at Manila.

At Calamba a reinforced concrete fence 940 meters long was constructed enclosing the whole yard.

A permanent galvanized iron pole telegraph line was constructed from Lucena to Siain, 67 kilometers in length.

An additional water crane was put in at San Fabian station.

An artesian well and permanent water tank was constructed at Calanutan station on the Tayug Branch.

An additional tract of land was purchased and an entrance road built at Santibañez terminal in Paco.

An additional tract of land of 12,300 square meters was purchased at Manila Terminal along Calle Dagupan and a reinforced concrete retaining wall and fence, 1,434 meters long was constructed on the Calle Dagupan side of the Terminal Yard. A wire fence with reinforced concrete posts 940 meters long was constructed between Calle Solis and the City Limits.

On the Cabanatuan Branch there were placed 16,193 ties as a capital charge thereby bringing the number of ties per kilometer up to standard.

Tondo Reclamation Work.—The Company was finally granted by the Government of the Philippine Islands a lease to the foreshore land on Manila Bay north of the Pasig River as described in its application No. 170 to the Director of Lands. The purpose in obtaining this lease was to secure foreshore rights so as (1) to permit of the construction of a pile trestle from the end of Calle Azcarraga to connect with the plants of the Atlantic, Gulf and Pacific Company and the Pacific Commercial Company near the mouth of the Pasig River and (2) to reclaim the area between this trestle and the bay front by dredging and filling, which area would then be utilized for yard space by the Company.

The first part of this construction has now been accomplished by the completion of a trestle 560 meters in length running from Calle Azcarraga across a portion of the bay to the plants of the companies above mentioned. Thirty thousand pesos of the cost of this trestle work was advanced by the Atlantic, Gulf and Pacific Company and the Pacific Commercial Company in equal amounts, with the understanding that they will be reimbursed by deductions from freight charges on future shipments made by them over the new line. The second part of the work will probably be completed during 1925.

This project was initiated in order to accomplish the following results :

1. Yard space fronting directly on the North Harbor of Manila Bay will permit the removal of the present coal yard at Pandacan to the new-filled area, producing a considerable saving in lighterage costs.

2. The securing of rail access to the plants of the Atlantic, Gulf and Pacific Company and the Pacific Commercial Company as mentioned above, producing additional revenues.

3. At present there is great congestion on the Murallon on account of the entirely inadequate facilities, causing great delays in handling of cars and consequent extra expense. The new trackage will permit more expenditions unloading of sugar shipped from the mills for export onto lighters and avoid the congestion referred to.

4. The necessary land will be provided for the layout of the proposed line to the South Harbor to connect with the piers.

The Manila Railroad Company has its head offices and central terminal in the City of Manila and operates 1,039.14 kilometers of lines in the Island of Luzon. It also owns nearly fifty kilometers of road now under construction. The company has two main lines—northern and southern. The northern line extends from Manila through the rich agricultural provinces of Central Luzon to Bauang Sur and Eastern Pangasinan. Spurs run from this line, east and west, reaching most of the important agricultural and industrial centers in the different provinces. The company contemplates the extension in the near future of its present branch-lines terminating at Cabanatuan, Nueva Ecija, to Aparri, the northernmost port of the Philippines. The proposed extension is to run through the provinces of Nueva Ecija, Nueva Vizcaya and the entire Cagayan Valley, famous for its tobacco products. The southern line extends from Manila to the town of Calawag in Tayabas Province, and runs through the Provinces of Rizal, Cavite, Laguna, Batangas, and Tayabas. A line twelve kilometers long is also being constructed so as to extend this southern terminal to Guinayangan. The company also owns two short lines in the Provinces of Camarines Sur and Albay, of which Legaspi is the head terminal. The main southern line will also be connected with the present line from Naga to Legaspi, and when all these new extensions are completed the lines of the company will extend from the northernmost parts of Luzon almost to its southernmost extremity.

Modern Machinery Gaining Popularity in Nanking

LIGHT machinery, such as sewing, hosiery-knitting and cotton-ginning machines, have been gainning popularity in recent years in Nanking. Although Nanking is not yet industrialized and although most of the industries have not yet advanced beyond the handicraft stage, these modern labor-saving devices, because of their cheapness and portability, are extensively used by those engaged in different kinds of domestic industry.

The iron cotton ginning machine has been in use in China for decades, but its advantages in speed and efficiency attracted little attention on the part of Nanking farmers until very recently. Ten or fifteen years ago, cotton growing was not so popular as it is now. Through the encouragement of the Nanking schools, the cotton area in the Nanking district has been rapidly extended in the past few years. For ginning raw cotton, Nanking farmers formerly used a type of crude wooden machine which had many disadvantages compared with the modern type. The old Chinese wooden gin had a very limited working capacity and the lint was not always free from pieces of broken seeds. The presence of such impurities greatly detracted from the value of the lint, which always commanded a lower price on the market than Shanghai or Nantungchow cotton, which is ginned by modern machinery. The cheapness of the modern iron ginning machine also recommends itself to the Nanking farmers. At present, most of the cotton farmers in Nanking suburbs and neighboring districts boast of having at least one iron ginning machine in each family. An iron machine turned out by the local foundries or iron works is sold at only $25-$26. Tung Tai Yung at Chi Hsiang Chieh, Nanking, is one of the well-known makers of such machines. Since the middle of May this year, over 300 cotton ginning machines have been sold by this establishment alone. Most of the old Chinese wooden ginning machines in Nanking have now been totally discarded.

Another modern device which has found favor among the Nanking hand-workers is the sewing machine. This machine is employed mostly by Nanking tailors and seamstresses. In Nanking tailor shops it is employed in making not only foreign-style clothing, but also Chinese clothing and articles like curtains, hat bands etc. There are three classes of seamstresses who make a living by means of this machine. A well-to-do seamstress generally keeps a small establishment employing two or three hands and owning a few sewing machines. She does sewing work on a piece work basis. These establishments also sell odds and ends as a side line. The less prosperous seamstresses keep stalls in the corners or any other spare space of general stores. In this case, the seamstress has only one machine and no assistant. Those who have domestic duties to attend to generally do sewing work at home. The principal clients of these seamstresses consist of shoe and hat makers and tailor shops which do not own sewing machines themselves.

Two types of sewing machines are used in Nanking, one worked by a handle and the other by a treadle. For ordinary sewing work, the hand-power type is quite sufficient, but the foot-power machine has a far greater speed. Owing to the high cost of living and the depreciation of the copper currency, in which the seamstresses are paid, the charge per piece has advanced considerably during the past two or three years. For sewing a pair of uppers on children's shoes 12-13 coppers is now charged instead of 6 coppers as formerly. The charge for sewing an ordinary Chinese coat was 60-70 cash two or three years ago but has advanced to 10 cents, small money. A much higher charge is made for sewing foreign or semi-foreign style clothing. The daily takings of a Nanking seamstress who devotes her time entirely to the work are estimated at between 1,500 cash and a dollar. The advantage of using the sewing machine has now been fully realised by the Nanking public. The machine not only saves labor and time but also turns out better work. Sewing machine stitches are always more uniform than those made by hand. Between 800 and 900 seamstresses in Nanking are earning their living by this occupation.

The introduction of the hosiery-knitting machine into Nanking has given employment to large numbers of women and girls and greatly improved the economic conditions of the poorer classes. Any one who wishes to engage himself or herself in this occupation must learn the work for one or two months under an expert knitter. During this period of apprenticeship, the beginner not only learns how to knit but also acquires a rudimentary knowledge of how to repair and overhaul the machine. The Nanking Vocational Training School for Girls also teaches hosiery knitting to its pupils. Nanking hosiery knitters either hire themselves to the hosiery knitting establishments on a daily wage basis or do the work at home on their own account. The cheapness of the knitting machine makes it available to most of the Nanking knitters. If the knitter works at home, his output can be sold to either the hosiery knitting establishments or the outfitters and dealers, who sell such articles. If the knitter is enterprising enough, he may employ a man to bring his products directly to the consumer by peddling in the streets. In this case, he can reap more handsome profits. There are only a few well organised hosiery knitting works in Nanking, but a great deal of the work is done by women in their homes. It is estimated that about 700 women in Nanking are engaged in hosiery knitting.

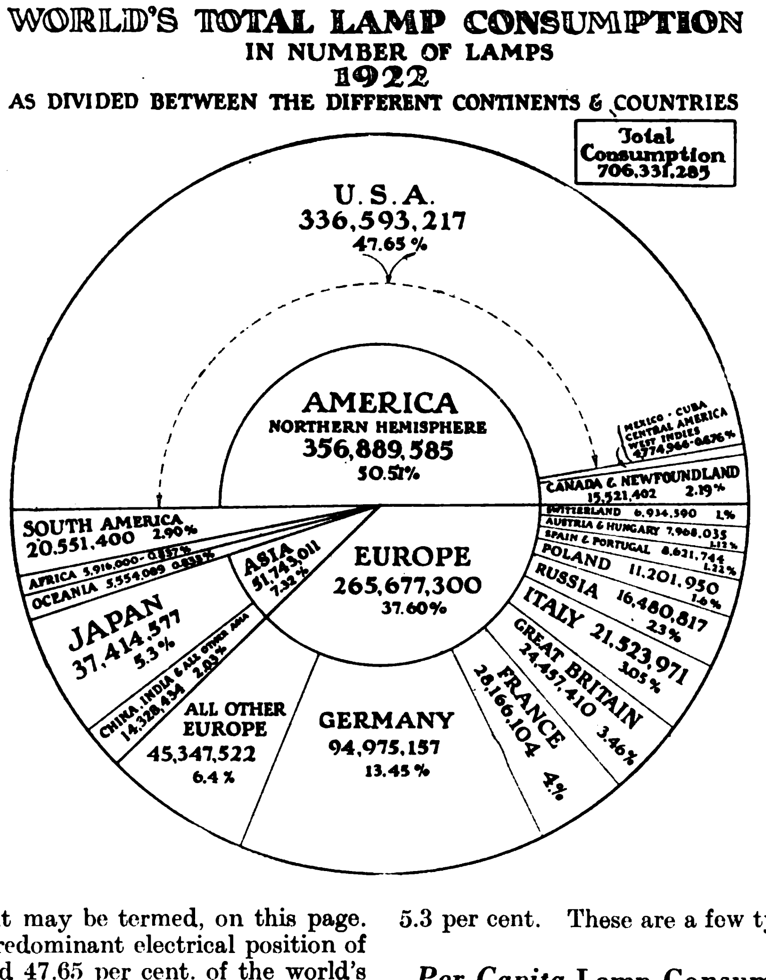
The Electric Incandescent Lamp Business of the World

Francis W. Willcox, General Electric Company

THERE is probably no better index of the electrical development of any country than the consumption of electric lamps in that country. Certainly there is no better measure of a country's *electric lighting* development than the number or value of electric lamps used each year. This has become increasingly apparent with the growth of the electric industry, owing to the almost universal adoption of the incandescent electric lamp. The growth of electric services is rooted in and woven about the development and use of the incandescent electric lamp. It is not too much to say that the lamp is the dominant device and the most potent part of the electric industry as well as the most universally used electric appliance. A review of the world's lamp business for any year should therefore prove interesting and valuable as giving a picture of the relative electrical industrial development of the various countries and areas of the world. A comparison of lamp consumption by years will also show the relative growth of the electric industry in each country.

From a census of the total world's lamp business covering the year 1922, it has been found that the total *production* of lamps (which is also the apparent consumption) amounts to 706,331,000 lamps of all sizes, large and miniature. This is 0.42 lamp each for all the inhabitants of the world, or 0.023 lamp for all of those in areas outside of the United States. It equals 6.2 cents expended by every person a year for lamps, or 5.1 cents per person outside the United States. In the United States there is an apparent average for each person of 3 lamps per year used and 70 cents per year spent for lamps. Of this number some 545,741,000 were the so-called "large" lamps employed in standard lighting service and the remainder, amounting to some 160,590,000, were of the miniature type, as used in the automobile and flashlight, and lamps operating chiefly from batteries.

The division of the world's lamp consumption between countries is clearly shown in the circular chart, or "lamp pie" as it may be termed, on this page. This chart definitely reveals the predominant electrical position of the United States, which consumed 47.65 per cent. of the world's total lamp consumption. This is greater than the whole of Europe, including Great Britain, which consumed altogether only 37.63 per cent. of the world's consumption. Germany forms the largest part (over one-third) of Europe, but the United States consumption is over 3½ times that of Germany. North America, including the United States, Canada, Mexico, Central America, Cuba and the West Indies, takes 50.3 per cent. of the world's consumption, so that with Europe, practically 88 per cent. of the world's consumption is accounted for, leaving only 12 per cent. for the remainder of the world. This 12 per cent. part is sub-divided as shown into 7 per cent. for Asia (of which Japan takes 5.3 per cent.); 2.92 per cent. for all South America; 1.05 per cent. for Oceania including Australia; and 0.86 per cent. for Africa.



Growth in Lamp Consumption in the Past Decade

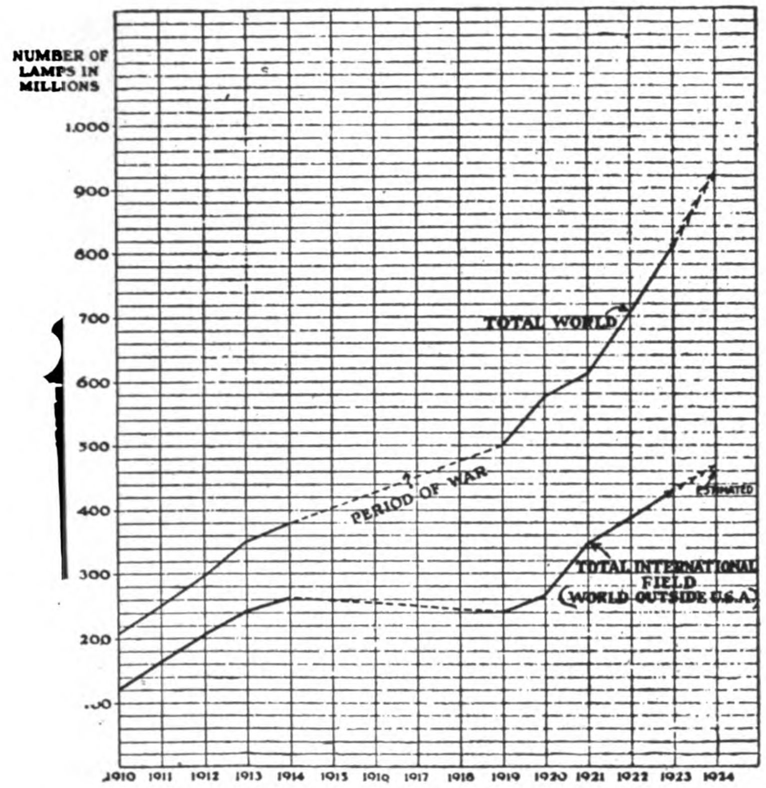
In 1911 a census of the world's lamp production gave an apparent total consumption of 251,503.00. In eleven years then, there has been an increase in annual consumption of 454,828,000 lamps, or over 180 per cent. total growth, or about 6 per cent. growth per year. During the decade, in part of which the World War was waged, the world's annual lamp consumption has grown at an average rate of 41,348,000 lamps per year.

In the same time the lamp consumption of the United States has shown the amazing increase of 250,573,000 lamps, or nearly 300 per cent., a rate of 11 per cent. growth each year. The remainder of the world outside of the United States has increased 196,261,000 lamps in these eleven years, or 113 per cent., a rate of about 5 per cent. growth per year.

Electric lighting in the United States has therefore apparently grown at more than double the rate of the remainder of the world in the past decade. In 1911 the United States consumed 35 per cent. of the world's total lamp consumption, while in 1922 the United States portion had advanced to 47.65 per cent. Europe in 1911 consumed 55 per cent. of the world's total as compared with 36.7 in 1922. Great Britain in 1911 consumed 8 per cent. as compared with 3¼ per cent. in 1922. Germany in 1911 took 12½ per cent. as compared with 13¼ per cent. in 1922. Japan in 1911 took 1¼ per cent. of the world's total and in 1922 she consumed 5.3 per cent. These are a few typical examples.

Per Capita Lamp Consumption of Leading Countries

The table below gives the percentage increase in total lamp consumption and in lamp consumption *per capita*, for the principal countries and areas of the world. It shows extremes of growth from that of Great Britain of only 23 per cent. to that of 405 per cent. for Japan, while intermediate positions are occupied by Germany, with a growth of 200 per cent., and the United States with an increase of 291 per cent.



Increase of annual lamp consumption for the principal countries and areas of the world, in periods of 11 years—1911 to 1922.

Countries and Areas	Per Cent. Increase in Number of Lamps Consumed	Per Cent. Increase in Per Capita Consumption
Belgium...	68	60
France	70	67
Germany	200	220
Great Britain	23	17.6
Italy	95	60
Netherlands	170	93
Spain and Portugal	40	14
Sweden	97	81
Switzerland	56	49
Total for Europe ...	96	49
Japan	405	114
United States	291	227
Total for World outside the United States ...	113	
Total for the world	180	

The best basis for consumption between countries is undoubtedly the annual per capita consumption. These are shown in the following diagram for various countries and areas. Comparing these values with those for 1911, we have the percentage changes shown in the third column of the above table.

The annual per capita consumption of lamps for 1922 in most of the countries is less than one lamp. The exceptions are notable and include the United States, Germany, Canada, Switzerland, Norway and Sweden. The last four countries have large water power resources, while the United States and Germany are countries having great industrial development. The comparatively low consumption for Great Britain is due to its having relatively few houses wired and to its firmly entrenched gas service.

Per Capita Consumption

The high *per capita* lamp consumption for the United States is the result of the intensive electric lighting development work on the part of electrical manufacturers, central stations, and the electrical trade generally in the United States for the past ten years or more. Such work has been ably assisted and co-ordinated under the National Electric Light Association, the Society for Electrical Development, and the Illuminating Engineering Society.

The present United States figure of over three lamps *per capita* is only a recent achievement and is several fold greater than what it was in 1910. It has been accomplished only as a result of unremitting endeavor and large expenditures of money and effort in the extension of electric service and the promotion of more and better lighting. A striking example of such activities is the Children's Home Lighting contest held at the end of 1924 on which and in connection with which the manufacturers, central stations, and electrical trade in general expended several million dollars, the original promotion and development fund alone approximating half a million dollars.

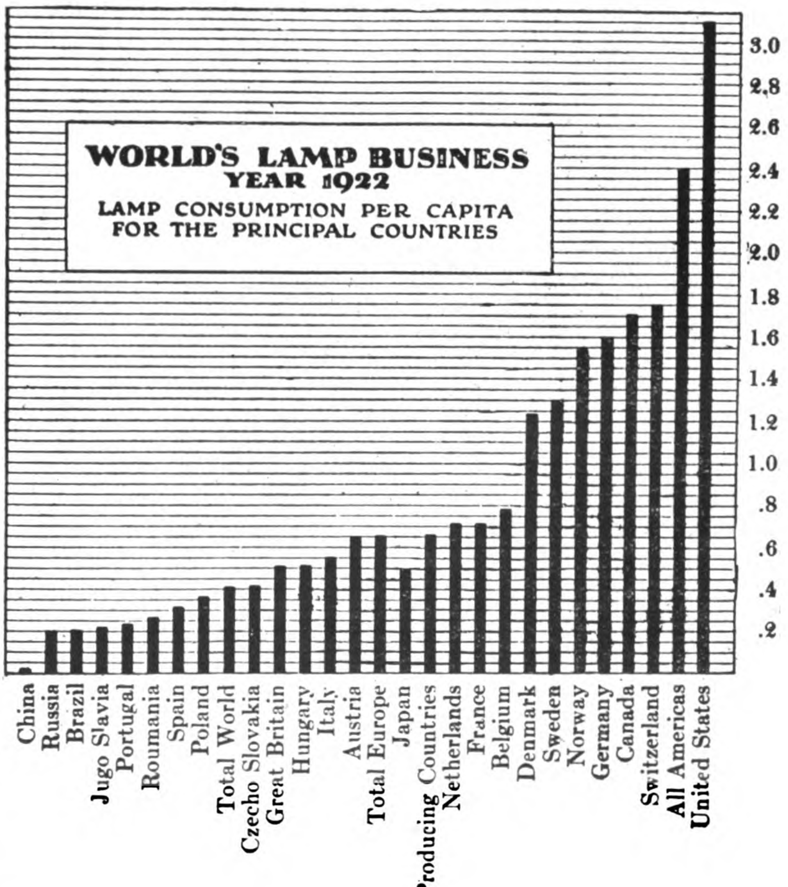
The results secured in lamp consumption for the United States may well serve to stimulate the electrical industry in other countries to promote electrical development.

World Possibilities in Electrical Lamp Use and Consumption

It is an interesting speculation to consider what might be achieved were the lamp consumption of the leading countries of the world raised to the 1922 per capita figure for the United States or even to one-half this figure.

It would mean for European countries alone an increase from the present total of 257,342,000 lamps to the enormous total of 1,170, 000,000. For Great Britain alone it would raise the existing total consumption of 24,457,000 to a total of 142,000,000 lamps. Taking the whole world, after excluding the United States, and leaving out such countries as Asia (except Japan), and central Africa, with their enormous masses of population unserved with electric light, we would find that just raising the lamp consumption to one lamp per head (one-third of the consumption ratio of the United States) would give a total consumption of over 681,000,000 lamps or about twice the existing demand. If the consumption were raised to two lamps per head of population (two-thirds of the United States consumption ratio), this would give a total lamp consumption of over one and a third billion lamps or about four-fold increase on the present consumption. Such a lamp demand at an average price of the equivalent of 30 cents each would give a value corresponding to $409,000,000 at two lamps *per capita*.

We can expand this idea still further on the basis that a lamp consumed each year means, on an average, at least two sockets and lamps installed. We can then readily visualize what these enlarged lamp consumptions of 681,000,000 and 1,363,000,000 lamps per year



would mean in kilowatt-hour demand on central stations, and in the sale of such things as sockets, switches, wire, lighting fixtures, and other appliances, of meters, transformers, cable, conduits, and of the generating apparatus required.

A lamp consumption of 1,363,000,000 would represent about two and three-quarter billion sockets and lamps installed, and this at an average of only 50 watts per lamp gives an installed lamp capacity of 136,000,000,000 watts or 136,000,000 kilowatts. With an average use per lamp of 500 hours per annum, the annual kilowatt-hour consumption for lighting would total 68,000,000,000, representing, at the equivalent of 5 cents per kilowatt-hour, an annual revenge corresponding to nearly three and a half billions of dollars.

It has been conservatively estimated that every lamp or lamp socket newly installed calls on the average for an investment in sockets, lighting appliances, meters, cable, distribution equipment, and generating apparatus of about nine dollars for every dollar expended in lamps.

Assuming that the lamp costs represent an average of 30 cents each, then the total investment cost for the lamps, lighting fixtures and appliances, and distribution and generating equipment would be the equivalent of about three dollars per lamp. Taking his figure, our enlarged lamp consumption at a ratio of a lamps *per capita*, which calls for a 1,363,000,000 lamp and socket installation, would represent a purchase and investment equivalent to $4,089,000,000 of electric appliances and apparatus, including lamps.

Such is the tremendous return that waits the electric industry of the world as the result of the development in those countries (outside of the United States and the undeveloped world areas of India, China, Africa, etc.), of an electric lamp consumption of two lamps per head of population or less than two-thirds of the figure already obtained in the United States.

Trend of the World's Lamp Consumption

The trend of the world's lamp consumption is interestingly shown by the curve below. It predicates a total world's lamp consumption in 1924 of over nine hundred million lamps. The comparison trend curve excluding the United States is shown on the same diagram and indicates a consumption in 1924 of about half of that of the whole world.

20-ton Clear-Ice Plant at Kyoto

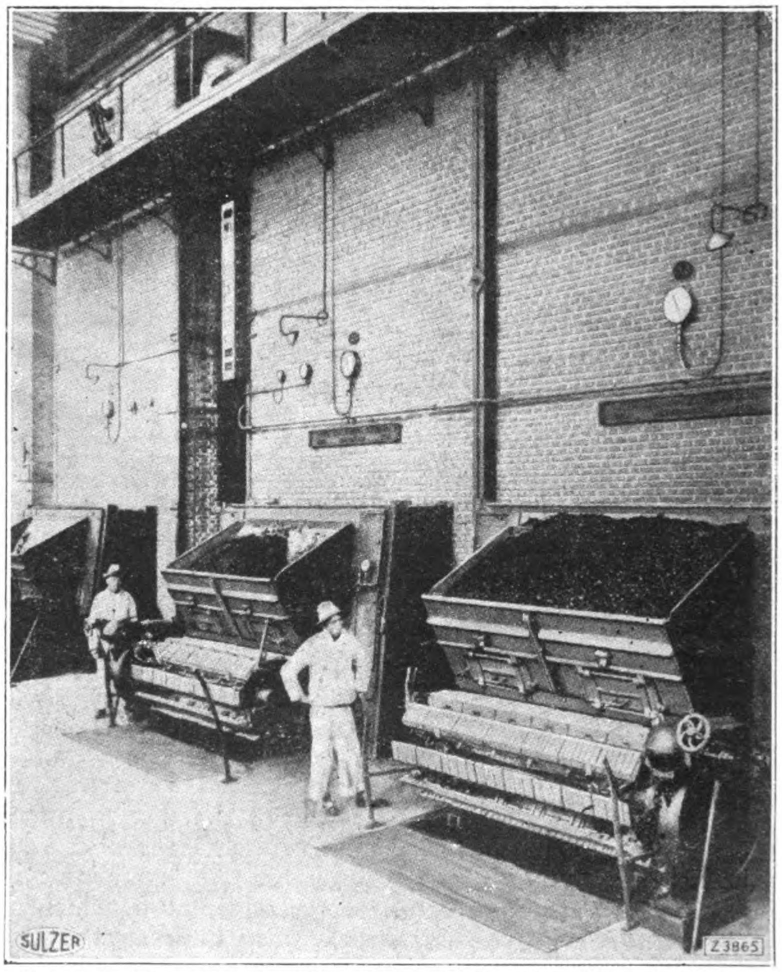
For the Ryumon Hyoshitsu, Kyoto, a company possessing a large number of ice factories distributed throughout the whole of Japan, a clear-ice plant has been supplied by Sulzer Brothers,

20 ton Ice Plant for Ryomun Hyoshitsu, Kyoto (Japan), two 300 lbs. Ice Cans being placed in Tipping Device.

designed to produce 20 tons of ice daily. The cold is generated by Sulzer ammonia compressor with a rated capacity of 480,000 h. Th. u. per hour, belt driven from a 65-h.p. electric motor. The ice tank is fitted with mechanism for agitating the brine and contains 384 cells for 300-lb. ice blocks. The water with which the cells are filled is taken from the city mains, whilst the cooling-water for the trickling condenser is raised from an artesian well 330-500-ft. deep and delivered to the condenser by a Sulzer centrifugal pump. The ice made in winter and early spring is kept in store house with a capacity of 1000 tons, erected alongside the machine room.

Sulzer Upright Water-Tube Boiler Plant in China

The Nikka Boshoku Kaisha, an important firm of cotton spinners in Shanghai, has put in service in their Pootung Factory, Shanghai, a boiler plant for supplying the steam required by the electric power station. The plant consists of three Sulzer upright water-tube boilers, each of 2,700 sq. ft. heating surface and built for a working pressure of 215-lb. per sq. in. The superheaters fitted to the boilers can be cut out of service altogether or used at various adjustable temperatures making it possible to superheat the steam up to abt. 660 deg. Fahr. The stokers are travelling



Sulzer upright water-tube boilers in a spinning mill at Shanghai, China

stokers of the Underfeed Stoker Company's type working with forced draught. Each of the boilers can evaporate 14,500 to 15,500-lb. of water per hour in normal service, and 19,000 to 21,000-lb. per hour when forced. Chinese or Japanese coal is used as fuel. In addition to the boilers and their accessories, Sulzer Brothers supplied all the steam and water piping and the necessary auxiliary machinery, such as high-pressure centrifugal feed-pumps and forced-draught fans.

In a report dated March 5, 1924, the engineer of the factory says that, as this was the first Sulzer upright water-tube boiler in Shanghai, he was anxious as to whether he would get good results or not; but now he is much satisfied to find a much better economy than guaranteed and no difficulty in handling even with Chinese labor.

Iron in the Philippines

By Warren D. Smith

THERE were nearly 20,000 metric tons of iron ore mined in 1919. The production for 1920 fell considerably below this, amounting to only 116 tons. The reason foi the decreased production is that the Calambayanga deposits, which previous to 1920 had been mined by Japanese interests, lay idle. The specific reasons for the cessation of operations have not been learned, but it is to be presumed that the falling market and the wharfage tax (which is virtually an export tax) of 2 pesos per ton made the mining of this ore prohibitive. At the present time the only production is in the Angat district, Bulacan Province, where 83 metric tons of pig iron were made during 1920 from the high-grade hematite of that region. The production is entirely in the hands of Filipinos who are using the very crude, but very cheap, methods of the Chinese. The product is of such high grade, owing to the excellence of the ore and the use of charcoal, that plowshares cast from this material are prized above even imported steel plows. Pratt and Dalburg, who made a thorough study of this region in 1912, estimated its probable iron-ore reserve at 1,200,000 tons.

On Dahikan Bay, Surigao Province, Mindanao, there is what appears to be an enormous deposit of lateritic iron ore, which in many ways resembles the Cuban deposits at Nipe Bay. Pratt and Lednicky, who surveyed the Surigao deposits in 1915, estimated the iron-ore reserve in this field to be 500,000,000 tons. This deposit was made a Government reservation by an executive order of the Governor General in 1915, and it is this which the recently created National Iron Company intends to exploit. If the deposit is worked, the logical place for the smelting operations is Cebu Island, as the only good seam of coking coal known in the Island is in Cebu, and the rule the world over is that iron goes to coal. Cebu has other advantages to recommend it as a smelting point; namely, it has the largest supply of labor and it is favorably situated, geographically and commercially.

The importance of iron in the present stage of civilization needs no emphasis here. In the Philippines this need has only lately begun to be felt; it came with the quickening and revolutionizing of the industrial life of the Archipelago. Until 1898, when the aspect of things in general changed, agriculture was the chief industry of the Filipinos and it will continue to be; but manufacturing, as the natural outgrowth of a modernized mode of life and of improved agricultural practice, is on the increase.

As is generally known, iron metal does not, except under rare and special circumstances, exist in the natural state in the earth. Practically the only natural metallic iron is in the form of meteorites. As these are relatively few in the Philippines, as elsewhere, it becomes necessary to turn to the compounds of iron for a supply, of which apparently there is great abundance. The important Philippine iron minerals are hematite (Fe_2O_3), magnetite (Fe_3O_4), and limonite ($2\ Fe_2O_3.3\ H_2O$). These three minerals make up the bulk of the iron-ore deposits in the Philippines. They are generally bedded or blanket deposits, though magnetite is found in some fields in the form of veins.

The principal deposits are the Angat deposits, Bulacan Province, and the eastern cordillera, Luzon; the Mambulao deposits, Camarines Norte Province, Luzon; and the Surigao deposits, northeastern Mindanao.

For the geologic discussion of this subject I have drawn freely upon the work of McCaskey, Adams, Pratt, and Dalburg, especially. Elicano has contributed the metallurgical discussion.

The Angat deposits.—These deposits were first investigated and mapped in 1903 by McCaskey. Dalburg and Pratt say:

The Bulacan iron-ore region lies in the foothills of the eastern cordillera about 15 kilometers east of the towns of Angat and San Miguel, Bulacan Province. The region has its major extension in a northeast direction. Numerous isolated outcrops are found for a distance of 20 kilometers along this line, over a width of about 2 kilometers, and two small outcrops occur to the east of this general belt.

The ores are found near the contact of the igneous rocks, both holocrystalline deep-seated rocks (granites) and intrusives and extrusives which form the cordillera, with the sedimentaries lying more or less tilted on its western flank. The strike of the sedimentary formation is roughly parallel to the line of contact with the igneous rocks. The upper beds are tuffs, clays, and sands of Pleistocene to Recent age, while the lower part of the series is made up of the shales, sandstones, and arkoses which Smith assigns to the Miocene and Oligocene. The limestone horizons which have been noted generally in the Tertiary rocks are identified in this series, and at several places there is an apparent association of the ore deposits and the lower limestone (Miocene).

The ores are essentially hematite and magnetite. These minerals occur as intimate mixtures in all proportions from pure magnetite to pure hematite, although hematite is more commonly encountered. The ores are usually fine grained and massive, but the hematite is sometimes "micaceous." The hematite ores are hard and dense, while the magnetite and the typical hematite magnetite ores are softer. Quartz is prominent in most of the ore; it generally occurs filling interstices between the iron minerals, but considerable vein quartz carrying only minor quantities of crystalline hematite and magnetite is to be observed. Great bowlders and blocks of iron-stained quartz mask the immediate neighborhood of the ore bodies. The quartz in these bowlders is evidently the product of the replacement of other rocks by silica. The walls of the shallow pits from which the iron ore is mined are in many instances a soft, dark green rock, which consists largely of hornblendic mineral, sometimes fibrous, but usually massive. It is probable that this rock is in some degree analogous to the complex silicates which are characteristic of some of the Scandinavian iron ores and to which the name "skarn" has been applied by the Swedish geologists. The association of the ore with this wall rock is so general that the native miners recognize the latter as *camisa de bacal* (cloak of the iron ore). Pyrite is characteristic of the ores, and occurs in them as aggregates of fresh crystals or massive in veinlets. Chalcopyrite sometimes accompanies the pyrite, and cobalt has been detected in these sulphides.

Analyses show the ores smelted in the native industry to average 60 per cent. or more of metallic iron. The ore is hand picked for smelting, however, and since the miners are very clever at judging rich ore the smelting charges represent better than the average ore. Samples made up of spalls from many bowlders on the outcrops indicate that the larger ore bodies carry on an average from 50 to 55 per cent. of metallic iron. The typical ore is of Bessemer grade although in some of the ores the phosphorous content is about the usually prescribed limit; sulphur is generally low. In the purer ores the percentage of alumina (from 2 to 6 per cent.) is rather high in proportion to the silica (from 3 to 8 per cent). Alumina and silica are the principal slag-forming constituents of the ores.

Camaching.—The iron-ore deposit in the locality called Camaching at the head of Balaong River lies about 20 kilometers north-northeast of Angat. Camaching is the northernmost of the iron-ore properties in the Angat district and is also the most difficulty accessible property. There is displayed at Camaching, however, a tonnage of iron ore greater than that of all the other properties combined.

Magnetite is the principal ore mineral, but is intimately mixed with black massive hematite.

Montamorong.—Montamorong lies about 7 kilometers south-southwest of Camaching. It is nearer the western edge of the cordilera than Camaching, and is, consequently, more accessible. The ore deposit at Montamorong occurs at the eastern edge of the granite area on the contact between the granite and extrusive rocks—flows and tuffs. Numerous dikes of a dark-colored holocrystalline rock made up principally of plagioclase feldspar and pyroxene cut both she granite and the extrusives in the vicinity of the ore body. The ore body has the appearance of a vein with much-altered and not sharply defined walls. A shallow pit which has been opened on the outcrop reveals the presence of a fault parallel to the apparent strike of the vein (north 60° west) with a downthrow of about 1 meter to the northeast. The vein pitches to the northeast at an angle of 45° at the site of the pit, but it is doubtful if the strike and pitch, as noted, are constant. The workable ore in the vein has an estimated thickness of from 1 to 2 meters, and the outcrop can be followed for 50 meters.

The ore is a soft massive hematite with a considerable quantity of magnetite.

Hison.—The original Hison concession, the demarcation for which was performed in 1816, apparently centered around the middle one of three outcrops which occur about 3 kilometers south southeast of Montamorong.

These outcrops lie along the eastern border of the granite area. Immediately east of the Hison outcrop is a narrow belt of sedimentary rocks, consisting of limestone, shales, clays, and fine-granied clastic rocks. The limestone is most prominent, and persists southward beyond the Santa Lutgarda outcrop. The beds strike north 20° east, and dip eastward at an angle of 60°. As at Montamorong the periphery of the granite is cut by dikes which appear to penetrate the sedimentaries as well. Although detailed relationships cannot be determined, in a general way the Hison ore deposit occurs between a basement of granite and overlying sedimentaries and is associated with the dike rocks.

At Hison and Santa Lutgarda the ore is identical; at the surface, a massive hard black ore consisting of both hematite and magnetite, while in the shallow pits which have been opened the ore encountered becomes softer and consists almost exclusively of magnetite. Smelting charges carry 65 per cent. of metallic iron. Gangue minerals are quartz, pyrite, and the minerals of the characteristic green rock which is found in and near the walls.

At the Constancia outcrop the ore is similar, but carries less quartz and a larger proportion of the green wall rock, which here is lighter than usual in color and decidedly fibrous. The Constancia ore is principally magnetite with subordinate black hematite. It is soft, and is marked by nests and veinlets of pyrite. Here, as elsewhere, the pyrite is most prominent near the walls of the deposit.

In the bowlders which mark these outcrops, several thousand tons of ore are available. The width of the ore exposed in the outcrops varies from 6 to 15 meters, but it cannot be assumed that the deposit is continuous between outcrops.

Santol.—Two mining claims located by American prospectors cover the base of Mount Santol along Santol Creek about 3 kilometers south-southwest of Hison. No outcrops of ore in place are to be seen, but the claims are strewn with large hematite-magnetite bowlders aggregating undoubtedly several thousand tons of ore.

The inevitable and intimate association of the ores with vein quartz and the character of this association suggest that the ore minerals, hematite and magnetite, were deposited together from solutions presumably of more or less deep-seated origin. Part of the pyrite occupies cracks in the original ore and must, therefore, be secondary, but pyrite and rarely chalcopyrite also occur in intimate mixture with the ore minerals apparently as original constituents of the ore. Much of the ore appears to be a product of replacement; specimens showing the replacement of limestone, fragmental rocks, felsites, and holocrystalline rocks by ore have been noted. The green wall rocks, which have been cited as comparable with the "skarn" of the Norwegian iron-ore deposits, are believed to be an alteration product resulting from the action of the ore-depositing solutions.

The principal ore deposits occur near contact between sedimentary and older igneous rocks, both deep seated and effusive. The strike of the contact between the igneous rocks and the sedimentaries, which is in general paralle to the strike of the sedimentary rocks, is also the strike of the larger ore bodies. The possible conclusion from this fact that the ore has resulted from contact phenomena between the two types of rocks is not tenable, however, because the igneous rocks are not intrusive, but constitute a preexisting basement.

From the foregoing discussion it will appear that a minimum of 1,000,000 tons of iron ore is probably available in this field. This approximation is made in the absence of any direct information as to the persistence of the ore with depth, and is therefore not to be accepted as a reliable estimate. If the deposit is purely superficial, as it may well be, so far as the evidence from exploration is concerned, then the estimate is too large. From the geology of the deposits as presented in this paper, however, it may be argued that the persistence of the ore to a reasonable depth is probable, and if the ores do persist in depth a great deal more than 1,000,000 tons should be in reserve in this field.

Other observers have suggested that the Bulacan iron ores have resulted from the alteration of pyrite and other iron-bearing minerals by surface waters. Such an alteration would be most complete at the surface; therefore, the ore might be expected to become more pyritiferous with depth and to be unfit for use when the unchanged sulphides were reached. A deep seated origin, such as is suggested in the foregoing discussion, with the pyrite secondary or at most contemporaneous in origin with the ore minerals, would mean more constancy in character with depth and a more or less uniform distribution of pyrite.

It would not be difficult nor expensive to explore the Bulacan iron-ore deposits by core drilling and thus to determine their character and extent beneath the surface.

My own opinion of these deposits of the eastern cordillera is that they are largely of superficial origin, and core drilling must absolutely precede any large-scale operations. I am the person alluded to by Pratt as having a different opinion as to the origin of these deposits, but owing to Pratt's longer study of these, I would not here press my own ideas.

The Lanatin iron deposits.—I have never visited these, but suspect they are a continuation of those just described, as the axis of the folding in the eastern cordillera, if projected, would pass through the three localities Bosoboso, San Isidro, and Santa Inez. Of these Adams says:

In visiting the Lanatin deposits the writer journeyed by the way of Bosoboso, past the deserted settlements of San Jose, San Isidro, and Santa Inez. At Santa Inez there are small bowlders of iron ore in the river, and the remains of the abutments of a suspension bridge are in part constructed of bowlders of iron ore. Bowlders of iron ore, some of which are from 2 to 3 meters in diameter, are encountered about one hour's walk up the river in the bed of the stream. The mountain to the west of the river was evidently the source of these masses. The lower slope of the mountain was ascended along the bed of a stream which empties into the river just above the bowlders. The country rock exposed by erosion is an andesite containing numerous small specks of pyrite, and in some places bunches of pyrite were found in sheer zones. The larger masses of pyrite were partially altered to hematite. In places there is a small amount of chalcopyrite present and the alteration has given rise to a coating of the blue and green copper carbonates. The copper ores have been prospected lately, but have not been found in encouraging quantities. On the wall of the ravine, a face of rock was seen which showed a considerable amount of iron ore, coating and replacing the country rock. This has somewhat the appearance of a dyke running up the mountain, although there is no proof that it is, since the dense vegetation obscures the formation excepting in the walls and bed of the ravine. Near the top of the hill there is an outcrop of iron ore. The summit of the hill is capped by a heavy bed of limestone such as is frequently met with in the eastern cordillera. In descending, exposures of a metamorphosed fine-grained clastic rock were seen in the bed of the ravine to the south of the one which was followed in ascending. This rock contains specks of pyrite, but no bowlders of hematite were seen. A simple and sufficient explanation of the origin of the iron ore is that it has been derived from the pyrite which is found disseminated in the country rock and occurring as masses in the sheer zones. It is probable that the mineralization is a result of contact phenomena resulting from the intrusion of the andesite in the sedimentary formation.

The amount of iron ore is sufficient to supply a small furnace operating as a local industry, and utilizing charcoal in smelting, but there is at present no exposure of an ore body which would warrant the establishment of a large furnace.

It should be remarked here that the prospectors who examined this locality report another iron deposit somewhat more promising at a distance of a long day's march in the rugged and very little known country to the northeast.

Iron deposits near Santa Inez.—A deposit of iron which has never been worked occurs a short distance to the north of Santa Maria, in the valley of the Santa Maria River which enters the northeast arm of Bay Lake. The position of this deposit is shown on d'Almonte's map of Luzon, and to the south of it there is indicated an outcrop of coal. From inquiry it was learned, that neither the coal nor the iron is of sufficient importance to warrant special investigation.

The Camarines deposits.—The Camarines iron deposits are three in number and are in the following localities: Calambayanga Island, a small island on the west side of the entrance to Mambulao Bay, Camarines Norte; on the long narrow neck of mainland on the west side of Mambulao Bay; and near the barrio of Batobalani near the head of Paracale River, a few kilometers southeast of Mambulao.

I have visited all of these deposits recently (1920) and have had opportunity to confirm the surveys made there by Pratt in 1915, and, rather than recast what that author has written, I will include excerpts from his reports made about that time. Subsequent work makes it appear that not so much ore will be found available here as Pratt thought at that time to be likely. Only the judicious use of the core drill will absolutely prove these deposits. It should be pointed out, in justice to Pratt, however, that he gave no estimate of probable tonnage other than is contained in the statement that "the ore in sight is undoubtedly to be estimated in hundreds of thousands of tons but the total quantity of ore available is undetermined."

Excerpts from Pratt's paper are as follows:

The ore body on Calambayanga Island appears to be irregular in shape, but to conform more or less closely to the strike and dip of the sedimentary beds in which it occurs. It outcrops on the western part of the island and is roughly oval or lens-shaped in plan. Ore of exactly the same character is encountered on the mainland to the south, where exposures are seen at intervals for a distance of at least 2 kilometers (1.2 miles) inland. A small island south-southwest of Calambayanga Island and considerably to the west of a line between it and the outcrops on the mainland is composed wholly of iron ore of the same character. Again, at Bato-balani, 12 kilometers (7.5 miles) southeast of Calambayanga Island and still near the line of contact between the sedimentaries and the older igneous rocks, iron ore similar in character to the Calambayanga ore is found.

At each of these places the outcrops are marked by great blocks of black ore, angular in form and with pitted, irregular surfaces. These blocks have been designated as bowlders by several observers, but the term bowlder conveys a wrong impression, inasmuch as the masses of ore at the outcrops show no evidence of having been transported, but have the appearance of disintegration products in place. They vary in size up to masses of many ton's weight. At the prominent outcrops they occur to the exclusion of all other rocks, but elsewhere they are isolated from each other and are embedded in yellow, residual clay.

Only the Calambayanga ore body has been examined closely by me. The western half of the island is strewn with blocks of ore. The northeastern part is made up of sedimentary rocks, principally sandstones, or fine-grained clastics, shales, and conglomerates. At the northern extremity of the island the beds strike north 20° east and dip 45° to the west, but toward the south, along the east coast, the strike changes gradually until it is north 60° west with the dip to the south. A bed of crystalline limestone outcrops in the sedimentaries halfway along the eastern coast, and some of the other sedimentary beds are calcareous. Minor outcrops of stratified rocks are found on the eastern coast, but here the strike is north 60° west, and tuffs, agglomerates, and fragmental rocks predominate over other types. These volcanic rocks are less indurated than the sedimentaries on the eastern shore of the island, and there is a consequent suggestion that they belong to a separate younger formation.

Extending north-northwest into the mass of the island from the southeastern point is a great outstanding body of quartz, a lode or vein, with a width of possibly 100 meters. This quartz is mineralized and contains numerous veinlets of iron ore. A shallow pit has been sunk in the quartz near the centre of the island, and a sample taken from the wall of this pit showed upon assay a trace of gold. The sedimentary rocks to the east are highly silicified near the contact with the quartz.

The outcrop of the quartz becomes concealed toward the north-northwest by a mantle of clay, but on the northwest shore, approximately at the point where the quartz should reappear, if it continued so far, there is encountered a dike of dark-colored gabbro between agglomeratic tuff and sedimentaries. This dike is vertical and strikes north 60° west. A small vein of quartz carrying unaltered fresh pyrite was observed in it. Under the microscope the dike rock is seen to be holocrystalline and to consist principally of plagioclase feldspar and pyroxene. The feldspar predominates and occurs in large

lath-shaped crystals with a parallel arrangement. The pyroxene appears to be much decomposed, and associated with it throughout the section is magnetite in considerable abundance.

Along the western and northern shore line of the island the blocks of iron ore are present in great abundance and lie one upon another with no intervening foreign material. Farther up the slopes, however, and at the summit of the island the blocks are scattered over the surface, embedded in residual clay.

Fanning studied the ore on the mainland; he traced the outcrop of the ore for a total distance of 3 kilometers (including the outcrop on the island ?) The width as revealed to him by occasional outcrops in place varied up to 15 meters. Sedimentary rocks are found on the mainland, as on the island, and similarly are indurated, tilted at various angles, and pierced by dikes. Volcanic tuffs, agglomerates, and flows are prominent on the mainland and on the neighboring small islands.

At Bato-balani the iron ore occurs in large blocks scattered over the side of a hill. The ore is magnetite with some hematite and carries also fresh quartz and pyrite.

The iron ore on Calambayanga Island and on the adjacent mainland is almost pure hematite with only traces of magnetite. The hematite is massive or granular, and the ore is moderately soft and very porous, or vesicular. At places over the exposure a small proportion of pyrite in fresh crystals may be detected in the hematite, and likewise quartz is found sparingly in scattered grains or in veinlets. Copper stains were found in the slightly pyritiferous ore at two places, indicating that some chalcopyrite occurs with the pyrite.

The Bato-balani ore contains much more magnetite than the ore on Calambayanga Island; it is also harder and shows more pyrite and quartz, but otherwise the ores similar.

The observations set forth in this report have led to the conclusion that the ore on Calambayanga Island is related in origin to the quartz vein or lode with which it is associated. Veinlets of ore are found in the quartz, and quartz occurs sparingly in the ore. The processes which produced the body of quartz probably yielded under different local conditions the adjacent body of iron ore. Both types of mineralization probably resulted directly or indirectly from the intrusion of dikes into the sedimentary rocks near the contact with the older igneous base. Apparently there was some replacement of the wall rocks as well as the filling of cavities and fractures. Probably the limestone and the calcareous sediments were most susceptible of replacement in this manner. The dike of gabbro on the north-western shore of the island with its notable proportion of magnetite may be taken to represent a part of the intrusive rocks. The tuff and agglomerate on the shore of the island and on the neighboring islands and mainland are surface extrusions which may be related genetically to the dike rocks.

Rinne concluded that the Bato-balani ore had resulted from contact mineralization, probably at the contact of intrusive diorite and limestone. The Bato-balani and Calambayanga ore deposits prove upon examination to be very much alike except that magnetite is the predominant ore mineral at Bato-balani, whereas hematite predominates at Calambayanga. Probably the two deposits are related in origin, and certainly the observations recorded herewith on the Calambayanga deposit are evidence of a genesis similar to that suggested by Rinne for the ore at Bato-balani.

Certain general characteristics are common to the iron ore at Calambayanga, at Bato-balani, and in Bulacan Province: for example, the association of the ore with intrusive rocks in sedimentaries, especially limestones; the nature of the ore minerals; and the presence of quartz in the ore. In some of the Bulacan deposits the replacement of limestone by ore is clearly evident.

The Surigao deposits.—These deposits were discovered by H. F. Cameron, former district engineer in the Bureau of Public Works, Philippine Government, about 1912. They are situated near Dahikan Bay in the extreme northeast corner of Surigao Province, Mindanao Island. He was struck by the similarity to the Nipe Bay deposits of Cuba with which he was familiar. Samples analyzed by the Bureau of Science, which he had collected, confirmed his opinions about the value of the deposits, and, following his official report, the deposit was reserved by executive order pending a detailed examination. In the early part of 1915 Pratt (504) and Lednicky made a fairly detailed examination of the deposit; excerpts from their report will be found in the chapter on Regional Geology devoted to Mindanao and Sulu.

It is extremely probable that other, similar lateritic deposits will be found in the Philippines as in other parts of Malaysia. Only recently word has come that a large deposit, much like the Philippine, has been discovered in Celebes, just to the south of the Archipelago, and investigations by Dutch engineers with the view to its exploitation are under way.

In many other parts of the Philippine Islands there are considerable accumulations of magnetic sands which have been washed out of the igneous rocks, principally andesite and basalt, and subsequently concentrated on the beaches. In some places these deposits are so extensive as to lead one to consider them as possible sources of iron. In fact, some persons have made serious attempts to briquet and smelt the sands from the beaches of Manila Bay, in Bataan Province, but without success. In Cebu and other islands some specimens of specular hematite have been found, indicating possibilities to be investigated.

Iron Smelting in the Philippines

Dalburg and Pratt have the following to say regarding the primitive method of iron smelting used in the Philippines:

> Iron smelting in the Philippines between the years 1784 and 1797 appears from the scant description on the record to have accomplished first a reduction of the iron into balls (bolas) or pasty masses which must have been somewhat malleable since bolos and other implements were made from them. The first smelting was undoubtedly done under the guidance of Spaniards, and can scarcely be spoken of as a Filipino process.

The present-day process and practice have been described accurately and in detail by McCaskey and by Dalburg and Pratt, and have not changed materially within the last fifty or sixty years. An abstract is given in the following paragraphs.

The furnaces are cylindrical stacks from 2 to 2.5 meters in height and about 1.5 meters in exterior diameter. The upper part of the stack to a depth of 1.75 meters is hollow and constitutes the smelting crucible, which is shaped like an inverted truncated cone, circular at the top of the furnace, with a diameter of about 1 meter, and elliptical at the bottom or truncated section of the cone with about 0.5 and 0.2 meter as major and minor axes, respectively. A rectangular runner about 12 centimeters deep and 13 centimeters wide pierces the bottom of the crucible from front to back of the furnace. The back end of the runner admits a single tubular clay tuyèré, which is connected to the blowing apparatus and through which the blast enters the furnace. The front end of the runner, which is placed a little lower than the rear, serves as a tap hole for both iron and slag. A block of quartz-sandstone, locally called *batong-buga*, is set in the wall of the crucible over the tap hole just where the blast, entering through the tuyèré from the opposite side, will impinge upon it. The walls of the furnace are soft-burned brick made of clay and set in a mortar of the same clay, which is the residual resulting from the decomposition of the granite found in the region. The sides of the crucible and runner are lined with a mixture of clay and charcoal powder.

The blowing apparatus (*joncoy*) is a hollow log 35 centimeters in interior diameter and 3.5 meters long; it is fitted with a wooden piston which is edged with soft chicken feathers to prevent leakage of air around it. The piston rod is long enough to permit a full stroke when worked back and forth by hand. The blower is double acting, wooden tubes conducting the blast from valves at both ends of the displacement chamber to the tuyèré. In operation the blower lies almost horizontal, one end being raised slightly from the floor to facilitate the work of the operator.

The molds (*hormas*) are made of clay reënforced by rattan or wire. Each mold consists of a base, which is fixed rigidly to a frame or rack, and a removable cover, which is made securely fast to the base by a stick placed across the top of the molds with both ends tied to the rack. For convenience in pouring one end of the rack is raised so that the molds are inclined at an angle of about forty degrees.

The fuel used in smelting is charcoal, usually burned near the smelting plant. A charcoal kiln or an *inglesa* is a rectangular inclosure, the walls of which are made of bamboo poles; it is about 14 meters long, 4.5 meters wide and 4.5 meters high. The logs for charcoal are cut into lengths 1 meter shorter than the width of the kiln, and are corded up inside the kiln, leaving 0.5 meter space between the pile and the bamboo walls. Openings which run longitudinally along the floor of the kiln and up one end of the pile are provided for maintaining a draft. The space around the pile inside the walls is filled with fine charcoal waste and a cover of the same material is spread over the top. The fire is started at the lower end and gradually burns through the kiln, being retarded by the smothering effect of the charcoal cover. It requires anywhere from fifteen to thirty days to burn a kiln of 140 cubic meters of charcoal. The charcoal is obtained in unusually large pieces and is hard and strong, containing about 81 per cent. fixed carbon and about 3 per cent. ash.

To blow in a furnace, a slow fire is started in the crucible and allowed to burn for several hours, then charcoal is added until the crucible is filled and a light blast is applied. About twenty-four hours after the fire is kindled the blast is increased and a small quantity of ore together with more charcoal is charged at the top of the furnace. Increasingly larger charges are added at intervals until the operation is normal and the furnace is in full blast. Afterwards ore and charcoal are charged together at intervals of from one to five hours depending on the rate at which the iron comes down.

The average charge consists of 43 kilograms of charcoal and 25 kilograms of ore. The ore is broken into pieces with a maximum dimeter of about 2 centimeters. When the furnace is working normally, iron is tapped off every three or four hours.

As no flux is added to the charges, the clay lining of the crucible is quickly attacked and eaten away by the charcoal ash, so the smelting continues only as long as the furnace works well or until no more iron can be brought down, ordinarily for a period of from twelve to fifteen days. When siliceous ores are smelted the life of a furnace reaches to more than twenty-five days. The average capacity of furnaces is from 200 to 400 kilograms of metallic iron per day, all of which is made into plowpoints and plowshares. The castings produced are uniformly a white fine-grained iron, which is low in silicon, extraordinarily hard, and contains very little graphitic carbon. This should be expected with a furnace of such a short smelting column and with such a blowing equipment, capable of producing only a comparatively low temperature.

With the shortage of gray scrap and pig iron during the World War, greatly needed in local foundries, attention was directed to the possibility of producing gray iron from Philippine ores without entailing the expenditure of large capital. Improvement of the native practice was naturally suggested as a possible solution. After eliminating countless difficulties in the transaction, the Bureau of Science obtained the consent of Mr. Matias Fernando, a mine and smelting-plant owner of Angat, to carry out some experiments in his furnaces. The experiments were started by T. Dar Juan, F. Reyes, and myself with the introduction of a mechanical blower, which readily demonstrated its advantage over the hand blower bv a slight increase of temperature in the hearth, an increase of output and a decrease of fuel consumption. Further changes, however, were needed and it was planned to introduce some means of preheating the blast and some changes in the furnace design, but funds were not available to carry out the experiments to a successful termination.

Mr. M. E. Heacock has organized the Manila Iron & Steel Company and erected in Bataan a small blast furnace with practically modern equipment. This place was selected because of the extensive fuel supply available from the Bataan forest. On account of high cost of transportation during its organization, the company planned to utilize in the meantime the magnetite sand which is found naturally concentrated along Limay and Mariveles beach bordering Manila Bay. It is to be regretted, however, that the postwar crisis paralyzed the activities of this company, a consequence to be expected in organizations of this nature starting with very limited capital.

The National Iron Company was created by the Government to establish an iron and steel industry in the Philippines. Mr. A. S. Argüelles, chemist of the Bureau of Science, was able to secure from reputable metallurgists and metallurgical concerns in the United States valuable comments on many important points to be considered in the organization and establishment of an iron and steel industry in the Philippines. Up to this time, however, nothing is known of the probability of materialization of the project.

Although during the last twenty years the agricultural and manufacturing industries in the Philippines have increased considerably, mining has advanced very slowly. With the progress of the above industries the demand for iron and steel products has shown a material increase, amounting to several millions of pesos annually. There exist in the Islands proved commercial deposits of iron ores, which could and should be developed and exploited to counterbalance the great wealth going out of the country annually.

The exploitation of the iron deposits could be effected either by exporting the ores to a neighboring metallurgical plant, or by establishing a smelter in the Islands. Japan and China may be considered as possible principal markets for Philippine ores, with New Zealand and Australia coming next. The problem of metallic iron production in the Philippines might be solved in two ways: blast furnace and electric smelting. The first requires a considerable supply of suitable fuel that can be produced at a very reasonable price; the second, though requiring only about one-third as much fuel, needs a great supply of cheap electric energy.

Chemical and Physical Characteristics of Philippine Ores

The question might arise as to the suitability of the Philippine ores for smelting. In Table 40 are given the analyses of samples taken from the important Philippine deposits. For the sake of comparison analyses of some foreign ores are also given.

TABLE 40.—*Analyses of Philippine iron ore.*

Constituent.	Bulacan ore.	Calambayanga ore.	Surigao ore.	Mayari ore, Cuba.	Magnetite from Hongkong.	Hematite, Mesabi Range, Minnesota.
Hygroscopic water ...	0.25	—	13.50	—	—	12.27
Combined water ...	—	—	6.60	11.15	—	—
Silica (SiO_2)	5.02	1.02	1.04	2.26	1.20	6.80
Alumina Al_2O_3) ...	4.80	1.31	10.56	14.90	—	2.23
Ferric oxide (Fe_2O_3)	66.41	97.35	66.80	68.75	70.32	—
Ferrous oxide (FeO)	20.64	—	0.36	0.77	22.53	—
Lime (CaO)	0.35	—	—	—	0.60	0.32
Magnesia (MgO) ...	0.74	—	—	—	3.64	0.22
Manganese oxide (MnO)	0.24	0.11	—	—	1.48	—
Chromium oxide (Cr_2O_3)	—	—	1.15	1.89	—	—
Titanium oxide (TiO_2)	0.23	—	—	—	—	—
Nickel oxide (NiO) ...	—	—	None.	0.74	—	—
Phosphorus (P) ...	0.052	0.001	Trace.	—	0.004	0.062
Sulphur (S)	0.02	—	Trace.	—	0.11	0.07
Total iron (Fe) ...	62.54	64.14	54.29	48.65	66.75	58.83

The foregoing analyses show that the average iron contents of Philippine ores are well within the average smelting requirement. The ores from Bulacan and Calambayanga are much richer than those from Surigao, but the accessibility of the latter and the possibly lower mining cost are important points worthy of consideration. With the exception of a few samples, all are within the Bessemer limit as to phosphorus. Sulphur is variable, being high in some and low in other samples, but this element can be controlled by the furnace man.

It is important to note that alumina is high in proportion to silica, as compared with the iron ores most widely smelted elsewhere. This fact will perhaps require the production of high alumina slags, and will necessitate, besides the requisite amount of limestone, the increase of the silica in the ore by the addition of barren quartz.

In usual practice ores high in alumina are generally avoided due to the obscure rôle of alumina in the slags, but J. E. Johnson, jr., reports the successful experimental operation of a blast furnace, with perfectly satisfactory desulphurization, in which the alumina in the slag had been as high as 39.5 per cent. with silica as low as 21 per cent. on individual flushes and averaging for an entire day SiO_{22}, 24.7 per cent.; Al_2O_3, 36.0 per cent.; neutral substances (CaS, MnO, FeO, etc.), approximately 3.5 per cent.; and CaO, the remainder. Weld also states that, in connection with the high alumina and chromium content of the Mayari ores of Cuba, exhaustive studies and experiments on these ores have been carried out by the Pennsylvania Steel Company, and that it has been announced that all the difficulties have been solved, and steel rails of more than usual excellence, due doubtless to the nickel content, manufactured from them. It might, therefore, be conclusively stated that the special high alumina characteristic of Philippine iron ores does not exclude them from being smelted successfully. It may be superfluous to state that the character of the Surigao ores, except for the absence of nickel, is similar to that of the Mayari ores.

Titanium is present in some of the Bulacan ores but in quantities that would not affect the operation of a blast furnace or the grade of the iron produced.

The ores of Bulacan Province consist of magnetite and hematite in intimate mixture, but of varying proportion. Both minerals are usually massive, although some specular hematite is sometimes encountered. The Calambayanga ore is almost pure hematite with only traces of magnetite. The hematite is massive or granular, and the ore is moderately soft and very porous or vesicular. Therefore, from the peculiarities above described, the formation of fines in more or less considerable quantity might be expected, and these must receive preliminary treatment before being charged into a furnace. There are several processes of agglomerating ore fines, already known, involving the use or non-use of heat. It remains only for the operator to adopt the one that is most suitable and most economical in conjunction with the smelting-plant equipment.

The Surigao ore offers an entirely different problem. It is principally ferruginous clay, but contains also an abundance of small, round pellets of hydrous iron oxides, as well as fragments or crusts of the parent rock, much altered, porous, and iron stained,

but which maintain their original form. The ore is soft and very spongy, or mealy. In utilizing this ore, sintering or nodulizing is necessary, and some means of separating the intermixed fragments of country or other barren rocks will have to be provided.

Mining Costs

The present exploitation of the Bulacan deposits does not develop them at all; nor has the work done on the Calambayanga revealed much as to the character of the deposit, which cannot be accurately determined owing to obscure geologic relations. It is, therefore, dangerous to advance at present any tentative estimate on the mining cost until more exploratory and development work has been done. Pratt and Dalburg noted that the walls of the ore bodies in Bulacan Province are invariably soft; similar conditions are found in Calambayanga. Such conditions require a great deal of underground timbering, a very expensive item to add to mining costs in the Philippines. The Surigao deposit has been more or less thoroughly studied, and its mode of occurrence makes its mining less problematic than that of the former two; an estimate of the cost could be fairly calculated after it has been decided what kind of excavating and transportation equipment shall be used.

Unless a smelter is built near the mines, the transportation of the ores from the mines to a place from which shipping can be made either to local or to foreign smelters is a problem that must be solved by the prospective operator.

The Bulacan deposits are isolated in a mountainous region, 50 kilometers or more from a railroad line. The Surigao and Calambayanga deposits are near to points that can be developed into good harbors, but the sharp relief offered by the regions will require considerable expenditure, especially as they are subject to the sudden formation of large streams during the rainy season. Aërial cable transportation will probably be the most convenient.

Labor is scarce in all three districts, as most of the people are engaged in agriculture and cannot be depended upon for continuous work in the mines. The timber supply in the districts is not abundant, either for fuel or for construction.

Fuel Supply

Deposits of coking coal suitable for blast-furnace use are found in Cebu and in Sibuguey, Mindanao. Exploitation has been started in these fields, but only on a small scale. Development of the coking seams is not very extensive and the probable available quantity is still unknown. It will take several years to place either one of the districts on a producing basis capable of supplying continuously a blast-furnace plant.

For a charcoal supply the extensive forests of Zambales, Bataan, Tayabas, Mindoro, Negros, and Mindanao might be pointed out. It will, however, be necessary to keep up the reforestation of the area selected, in order to insure future supply. To this end the use of ipil-ipil (*Leucaena glauca* Benth.) may be suggested, the wood from which makes a strong and hard charcoal.

Semianthracite is also being mined at Sibuguey, but like the other fields is still inadequately developed. This may be counted upon as a possible source of fuel supply for blast-furnace smelting.

Flux Supply

On account of the low silica content of Philippine iron ores, silica flux might be needed besides limestone. A good supply of both limestone and silica can be found near some of the ore deposits, all of which could be transported together with the ore. There exists, besides, a good supply of limestone and siliceous tuff near the coal mines of Cebu.

Power Supply

Power can be either steam or hydro-electric. For the use of the former the locations of fuel supply have already been mentioned; for hydro-electric development the following are possibilities: Agus River draining the inexhaustible reservoir of Lake Lanao, in Mindanao; Angat River in Bulacan Province; and Agno River in Pangasinan Province. A report on the power possibilities of Agus River has been submitted by Chas. Bradshaw, formerly of the Bureau of Public Works, and is in the files of that bureau. Seven possible power sites are mentioned, with heads varying from 160 to 400 feet, and the total available power is about 300,000 electric horse power, at a cost, estimated on prewar conditions, of from 40 to 90 pesos per electric horse power installed. General C. de las Heras, in a paper read before the Manila Merchants' Association in May, 1912, described several ways of developing hydraulic power in Angat River, and he estimated that 11,400 electric horse power could be developed at a cost of about 4,500,000 pesos. The Bureau of Public Works has at present under study the possibility of developing Agno River, which is said to be capable of furnishing 1,000,000 horse power.

Smelting Process

It has been mentioned before that either blast furnace or electric smelting could be adopted for the production of metallic iron. Granting that there is an abundance of good iron ore and fuel and a possibility of developing cheap hydro-electric energy, the commercial success of either process will depend on the possibility of continuous operation. It has been pointed out that Japan, China, New Zealand and Australia are possible markets for Philippine ores; the same may be said in connection with marketing the pig and other iron products. The advisability, however, of counting upon these countries indefinitely as markets for Philippine iron is not commercially sound, because all of them have already started in the iron industry themselves, and Japan and China have, each and together, extensive programs for developing the iron deposits on the Asiatic Continent. To be conservative, therefore, it would be advisable to depend only upon home consumption in the estimation of smelting-plant capacities.

The total imports of iron and steel and their various manufactures amounted to 37,575,421 pesos in 1920, 38,621,929 pesos in 1919, 22,464,508 pesos in 1918, and 10,023,155 pesos in 1917.

TABLE 41.—*Showing the most important iron and steel products imported into the Philippine Islands during 1920 and their quantities and values.*

Article.	Quantity. *Kilos.*	Value. *Pesos.*
Pig iron ...	2,149,201	170,385
Bar iron ...	524,320	107,549
Bars or rods of steel ...	14,486,984	2,842,005
Railroad materials ...	22,451,041	3,196,580
Corrugated roofing ...	4,324,336	1,741,230
All other sheets and plates ...	3,470,774	984,748
Structural iron and steel ...	7,138,851	1,711,891
Wires and cables ...	2,578,901	1,133,125
Nails, spikes, and tacks ...	2,402,863	682,071
Needles, nuts, bolts, washers, rivets, screws, and tools ...	—	3,239,926
Pipes and fittings ...	4,387,395	1,602,384
Total ...	63,914,666	17,411,894

It will be noticed that the local demand for pig iron is very small, and any project for establishing a smelting plant will have to be developed along the lines of greater demand. Were the capacity of a plant based on the total iron imported, it would require a daily output of about 200 metric tons of iron, operating 350 days in a year. The operating cost of a blast furnace of this capacity is not very economical, being comparatively higher than a furnace of two-or three-fold capacity. With a more conservative figure, say 100 metric tons or less per day, the disadvantage of a blast-furnace plant will become more apparent.

The increasing use of electric furnaces for production of steel of different kinds, and the adaptability of such furnaces to electric ore smelting make their use more convenient and perhaps more economical than the operation of blast furnaces, especially when a very small daily capacity is to be considered. Of course, the development of hydro-electric power will entail considerable initial capital; yet, bearing in mind the amount of capital to be invested to develop and to keep up the exploitation of a fuel supply in order to insure continuous operation of a blast furnace, the advantages will still be in favor of the electric furnace; primarily, because the amount of capital to be invested in the development of a hydro-electric plant can be fixed, or closely estimated, while the capital needed in the exploitation of coal will vary greatly according to conditions that can only be determined after considerable development work; second, because the price of electric energy can be calculated from the start, while the mining costs of coal will depend on labor and underground conditions, which are very variable factors; and, third, because the extent of the Philippine coking coal supply is not yet definitely known, while the hydraulic power resources have already been studied. Another point worthy of consideration is the fact that, if Agno River is developed, not only the iron industry will be benefited but also the gold mining of Benguet, the manufacturing industries of Manila and, incidentally, the agriculture of the intervening provinces.

The Technical Fair in Leipzig

13 large exhibition halls—A " street of nations " planned

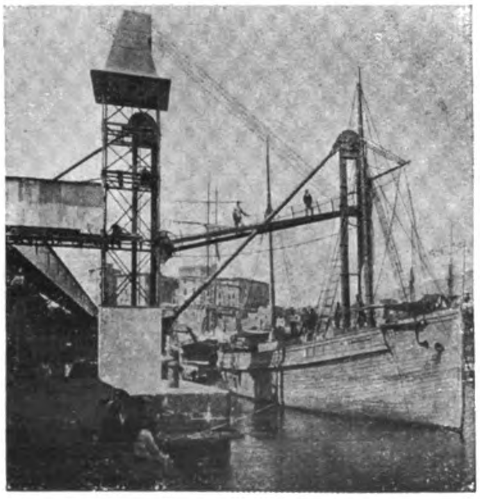
WE may maintain without all exaggeration that the Leipzig Technical Fair, famed far beyond the German frontiers, is in its own way perfectly unique. Only he who has actually seen this Fair with his own eyes and experienced it can have any real conception of the *importance* and *extent* of this enormous Fair. An opportunity of attending it is offered *twice a year*, in Spring and Autumn. As the Technical Fair is absolutely *international,* all countries naturally take a lively interest in it. Non-German states regularly send their agents, either to exhibit the Products of their country or to make favourable purchases. The advantages of such a visit are n t to be underestimated. The visitor has the chance of transacting business in one place, in the shortest time, with the minimum of expenditure and the maximum of comfort. He also gets a comprehensive idea of the latest technical achievements. Imposing character of the Technical Fair is evident in its *interior arrangement*—everything within the range of technics raw materials, semi-manufactures, and ready-made goods, *all the technical branches of industry* are represented—and also in its *external construction.* 13 mighty halls, among them the machine-tool hall with an exhibition and traffic space of 21,000 square metres, cover part of the area which is traversed by broad roads and adorned by beautiful gardens. The Leipzig Technical Fair, which already occupies a surface of 360,000 square metres, goes on steadily developing. Among other projects a " street of nations " is planned, where non-German states can exhibit collectively in halls of their own the products of their own country, other halls are also planned to supplement those already standing. The official statistics as to the number of visitors show what intense interest is taken on all sides in this world-market place. No fewer than 180,000 interested visitors attended the last Leipzig Spring Fair. Of these 18,000 were foreigners. There were 14,000 exhibiting firms. So Leipzig has become more and more the point of attention and the meeting-place of exhibitors and buyers from every civilized country. The approaching *Technical Spring Fair of 1926*, which has been still further improved, is sure to be thronged by visitors. It will last from *February 28 till March 10.*

BUHLER BROTHERS

Engineering Works and Foundries

UZWIL (SWITZERLAND)

Established 1860 **Employees abt. 2,000**



Moulin Feola & Jeandeau Drydock Crane in Action

SPECIALITIES:

- PortlandCement Works
- Brick and Tile Making Plants
- Chocolate and Cocoa-Factories
- Breweries and Malteries
- Powder and Celluloid-Presses
- Crushing and Breaking Machinery
- Silico-Calcareous Brick Works
- Paste-Goods Factories
- Briquetting Plants
- Rice-Mills
- Roller Mills for Soap and Paint Manufacture
- "Duplex" Newspaper Printing Presses
- Conveying Plants of every kind

For particulars apply to the

Far Eastern Office: BUHLER BROTHERS

P. O. Box 227 HARBIN (Manchuria), Kitaiskaya Street 59

SULZER BROTHERS

SHANGHAI ENGINEERING OFFICE
4 AVENUE EDWARD VII

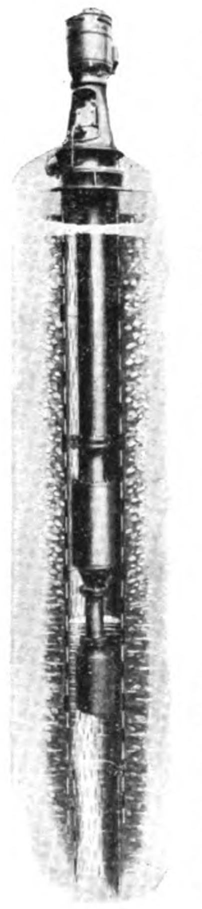
蘇爾壽穿空式唧筒適於深井中吸取流質之用

蘇爾壽工程事務所

上海愛多亞路四號

本公司常備目錄供給各界

垂詢工程事務亦易誠酬答



Suitable for raising water, oil, brine from deep boreholes and wells.

These pumps are designed for Boreholes from 4 to 36" and depths to 500-ft. and more.

Delivery head above surface may be chosen as high as required.

Suitable for any kind of drive.

Sulzer Centrifugal Borehole Pumps

are of simple design, proved reliability and low running costs

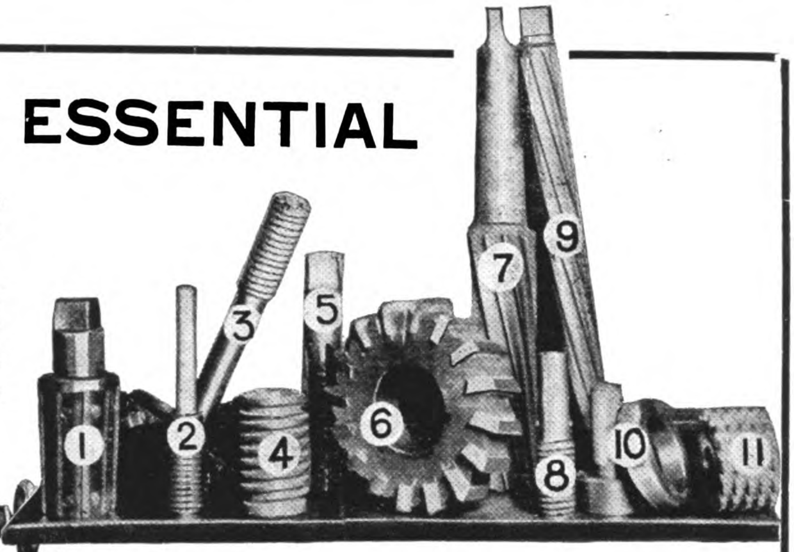
Other products of our factories

Uniflow Steam Engines, Upright Water-tube Boilers, High and Lowlift Centrifugal Pumps, Fan and Ventilators for all purposes, Fire Engines, Stationary and Marine Diesel Engines, Airless Injection Diesel Engines, Ice and Refrigerating Plants, Maag Gears and Maag Gear Planing Machines.

WINTERTHUR. SWITZERLAND.

WHERE QUALITY IS ESSENTIAL

In the tool room where work of the highest quality and closest accuracy is demanded the **"American" Tool Room Lathe** has become a great favorite. In no other lathe are the qualifications for tool room service more highly developed than in the "American." The accuracy of "American" Lathes is absolutely guaranteed.



SEND FOR OUR TOOL ROOM LATHE BULLETIN

AMERICAN

A UNIVERSAL TOOL ROOM LATHE

The **"American" Tool Room Lathe** will handle a wide variety of rotary cutters, taps, reamers, end mills, hollow mills, dies, etc. The "American" is completely universal and will handle as great a variety, if not greater, than any lathe built.

Agents: Andersen, Meyer & Co., Ltd., Shanghai and Manchuria
Horne Co., Ltd., 36 Kawaguchi-cho, Nishi-ku, Osaka, Japan
H. P. Gregory & Co., Sydney & Melbourne
Pacific Commercial Co., Manila, P.I.
Honolulu Iron Works, Honolulu, H.I.

THE AMERICAN TOOL WORKS COMPANY

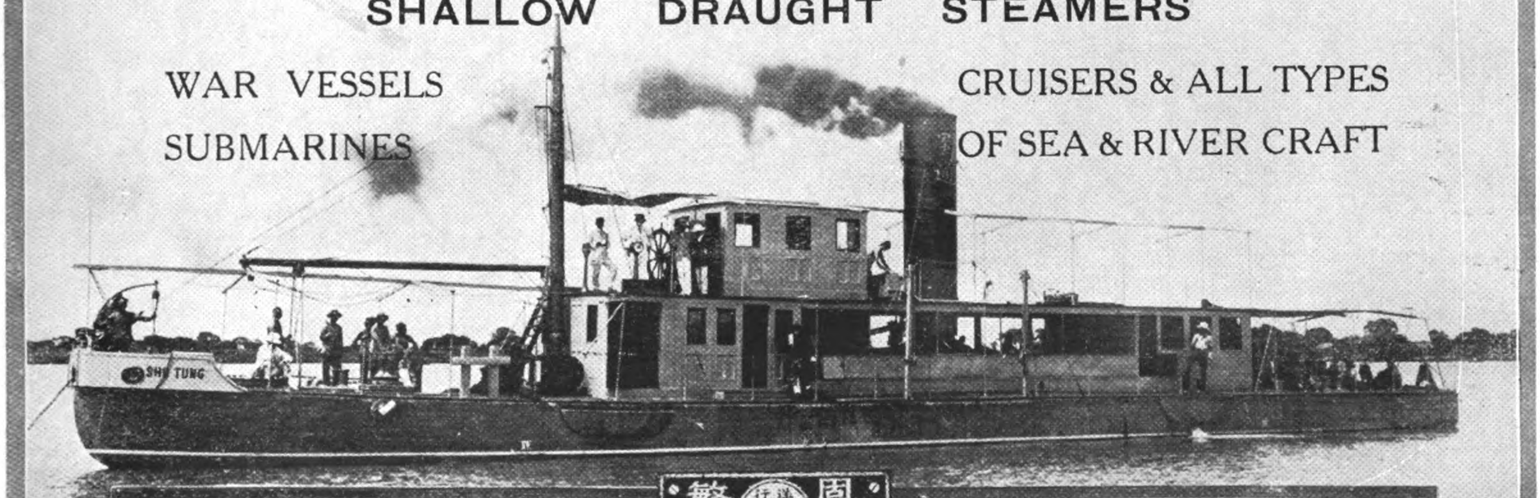
Lathes CINCINNATI, U.S.A. Shapers-Radials

THORNYCROFT

SHALLOW DRAUGHT STEAMERS

WAR VESSELS
SUBMARINES

CRUISERS & ALL TYPES
OF SEA & RIVER CRAFT



All types of River and Ocean Craft
Steam or Motor propelled. Stern Wheel or Tunnel Stern

Motor Boats to 40 knots
Water Tube Boilers
Marine Engines

Cargo Steamers to 5,000 tons.
Steam Turbines
Oil Fuel Gear

Marine Motors for Petrol or Paraffin
Stationary Oil Engines for Electric Lighting, Pumping and Power Plants

JOHN I. THORNYCROFT & CO., LTD.
Robert Dollar Building
3, Canton Road, Shanghai
London, S.W. 1, England. Works: Southampton

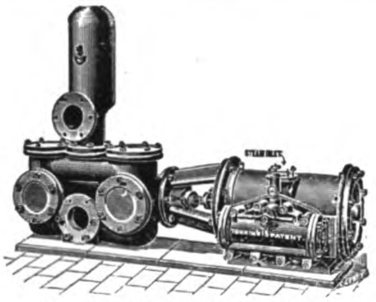
Silks, Crepes, Brocades, Cotton Cloths

SILK AND COTTON YARNS, NOILS, etc.

OUR EXPORT DEPARTMENT
IS REPRESENTED IN ALL THE IMPORTANT COMMERCIAL CENTERS OF THE WORLD AND CAN FURNISH PROMPTLY FULL INFORMATION AND QUOTATIONS REGARDING THE LARGE VARIETY OF TEXTILES MADE IN OUR MILLS

KANEGAFUCHI SPINNING COMPANY, LIMITED

HIGASHI-SHIRIIKE, KOBE, JAPAN



STEAM PUMP for General Purposes

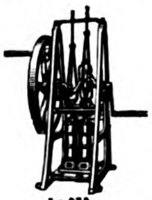
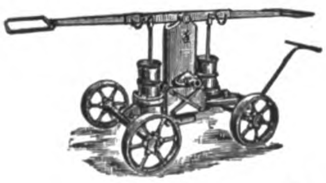


Fig.228.

Fig.160.

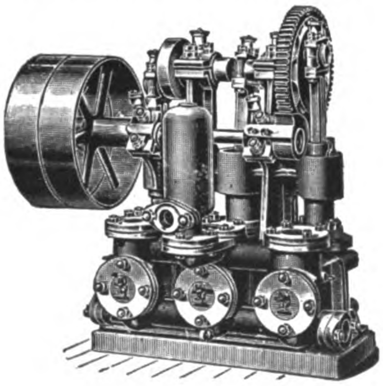


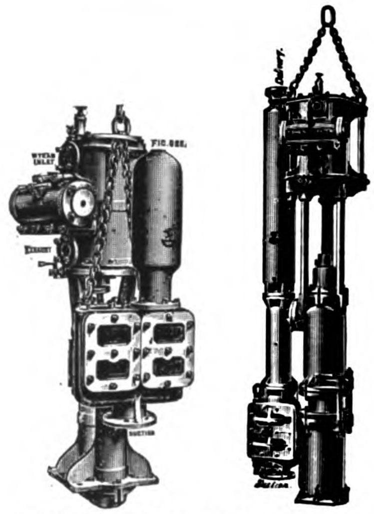
WE MANUFACTURE

PUMPS

FOR EVERY PURPOSE

To be worked by HAND, STEAM, BELT, WIND, WATER or ELECTRIC POWER





SINKING PUMPS for COLLIERIES, MINES, Etc.

Fig.191.

Fig.185.

Write for "Eastern" List.

JOSEPH EVANS & SONS

(WOLVERHAMPTON) LTD,

CULWELL WORKS,

WOLVERHAMPTON, ENGLAND.

Agents for China:

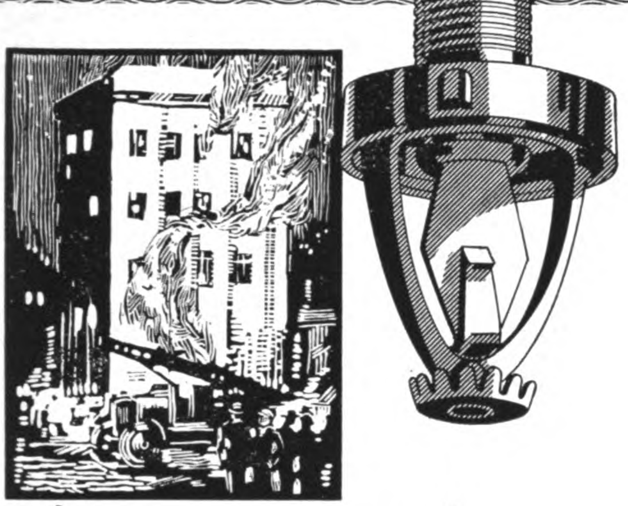
J. WHITTALL & CO., LTD.

16 Victoria Terrace, Tientsin

Stocks Kept in Tientsin

26, Hsi Tang Tze Hutung, Peking

FIRE! FIRE! FIRE! FIRE! FIRE!



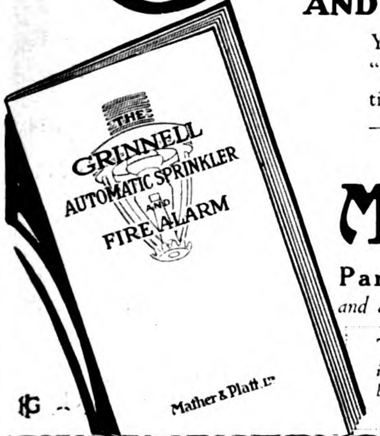
Are you insured against loss of business during rebuilding?

FIRE uncontrolled—see how it gains headway—eating into the place above—spreading to right and to left—in ecstatic destruction of, perhaps, *your* property.

No, you are not covered by a Fire Insurance Policy! No policy can restore lost prestige, loss of time during rebuilding, or loss of valued papers and indexed information.

The obviously sensible way to prevent heavy losses through fire is to extinguish it in its early stage—when it is a small, one man job. You cannot have a man at every likely danger spot during day and night! No, but you can let the "Grinnell" serve the same purpose. It starts when the fire starts—and in a few seconds there is no fire!

GRINNELL
AUTOMATIC SPRINKLER AND FIRE ALARM



You cannot write too soon for "Grinnell" information. Procrastination may mean conflagration—with its attendant losses and inconvenience.

Mather & Platt *Limited*
Park Works, Manchester
and at 14, Great Smith St., London, S.W.1

THIS BOOKLET
is sent immediately upon request. Your business postcard is sufficient.

FIRE! FIRE! FIRE! FIRE! FIRE!

Agents in China: LIDDELL BROS. & CO., LTD.
SHANGHAI, TIENTSIN AND HANKOW.
Representative: Mr. F. Fletcher, 47 Szechuen, Road, Shanghai
Representative in Japan: Mr. W. Frith, 7 Goko-dori, 4-chome, Kobe

WILLIAMS
SUPERIOR DROP-FORGED TOOLS

WILLIAMS' SUPERIOR DROP-FORGED WRENCHES

We make and carry them, Little and Big, Straight and Bent, Thin and Thick; 40 patterns, in about 1,000 sizes, with openings from $\frac{3}{16}$th to $7\frac{5}{8}$ inches:

Something Standard for all requirements that can be standardized:

Something that is Superior because our methods and process from material buying, on up to the completed tool, enable us to incorporate in our wrenches the experience gained in nearly half a century in quantity production of goods of the highest grade for many purposes.

Specify "Williams' Wrenches" and get Superior quality.

Ask for Wrench Book.

J. H. WILLIAMS & CO.

"The Wrench People."

Export Office:	*London Representative:*	*General Offices:*
21 State Street, New York, U.S.A.	**BENJ. WHITTAKER, LTD., Aldwych House, Aldwych, London, W.C.2.**	**Buffalo, N.Y., U.S.A.**

Cable Address:
" IWASAKISAL-
TOKYO "

Code Used:
A. 1., A.B.C. 5th, Western
Union, Bentley's Complete
Phrase

MITSUBISHI SHOJI KAISHA, LTD.

(MITSUBISHI TRADING CO., LTD.)

Capital, fully paid-up - - - Y. 15,000,000

Head Office:

MARUNOUCHI, TOKYO.

Importers and Exporters, Manufacturers, Commission Merchants, Brokers, Ship Owners.

EXPORTING:

Coal, Copper and all Other Descriptions of Metals, Minerals and Cereals, Chemicals, Oil, Paper, Glass, Canned Fish, Silk Goods, and General Oriental Products and Merchandise

IMPORTING:

Iron, Steel, Machinery, Machine Tools, Chemicals, and General Merchandise

ANNUAL PRODUCTION:

Electrolytic Copper Ingots	20,000	Tons
Pig Iron	100,000	,,
Steel	50,000	,,
Coal	3,500,000	,,

COLLIERIES:

Takashima, Ochi, Yoshinotani, Kishidake, Namazuta, Shinnew, Hojo, Kanada, Kamiyamada, Ashibetsu, Bibai, O-Yubari, and Sakito

BRANCHES and AGENCIES:

Tokyo, Yokohama, Nagoya, Osaka, Kobe, Moji, Wakamatsu, Karatsu, Nagasaki, Otaru, Tsuruga, Kure, Muroran, Hakodate, Kushiro, Vladivostok, Dairen, Kirin, Harbin, Peking, Shanghai, Hankow, Hongkong, Canton, Tientsin, Tsingtao, Tsinan, Singapore, London, Paris, Lyon, Marseilles, Berlin, New York, Seattle

STEAMSHIP DEPARTMENT—KOBE

Fleet Owned	25,000	Tons Gross
Chartered Steamers	12,000	,, ,,

Regular and Irregular Routes between home ports and Chinese and South Sea Islands Ports, etc.

MIIKE COAL

The Finest Steaming and Bunker Coals of the Far East are mined from the famed Miike, Tagawa, Yamano Sunakawa and Kawakami Collieries operated by the

MITSUI

MINING COMPANY, LTD.

HEAD OFFICE:
No. 1 Surugacho, Nihonbashi Ku,
TOKYO, JAPAN

Capital - - Yen 100,000,000

Annual Coal Output is equal to one-quarter of Total Japanese Mines.

LEAD, SILVER, GOLD, ZINC, COPPER, SPELTER, SULPHUR, COKE, IRON, CHEMICALS and DYES

Are produced from the Company's, KAMIOKA, Lead, Silver and Zinc Mine; SANO, Copper and Zinc Mine; KUSHIKINO, Gold Mine; KONGO, Tungsten Mine; IWAONOBORI, Sulphur and Metal Mine; Zinc Plants, Coke, Dyestuffs and By-products Establishments in Miike.

Sole Agents for our Products:

MITSUI BUSSAN KAISHA, Ltd.

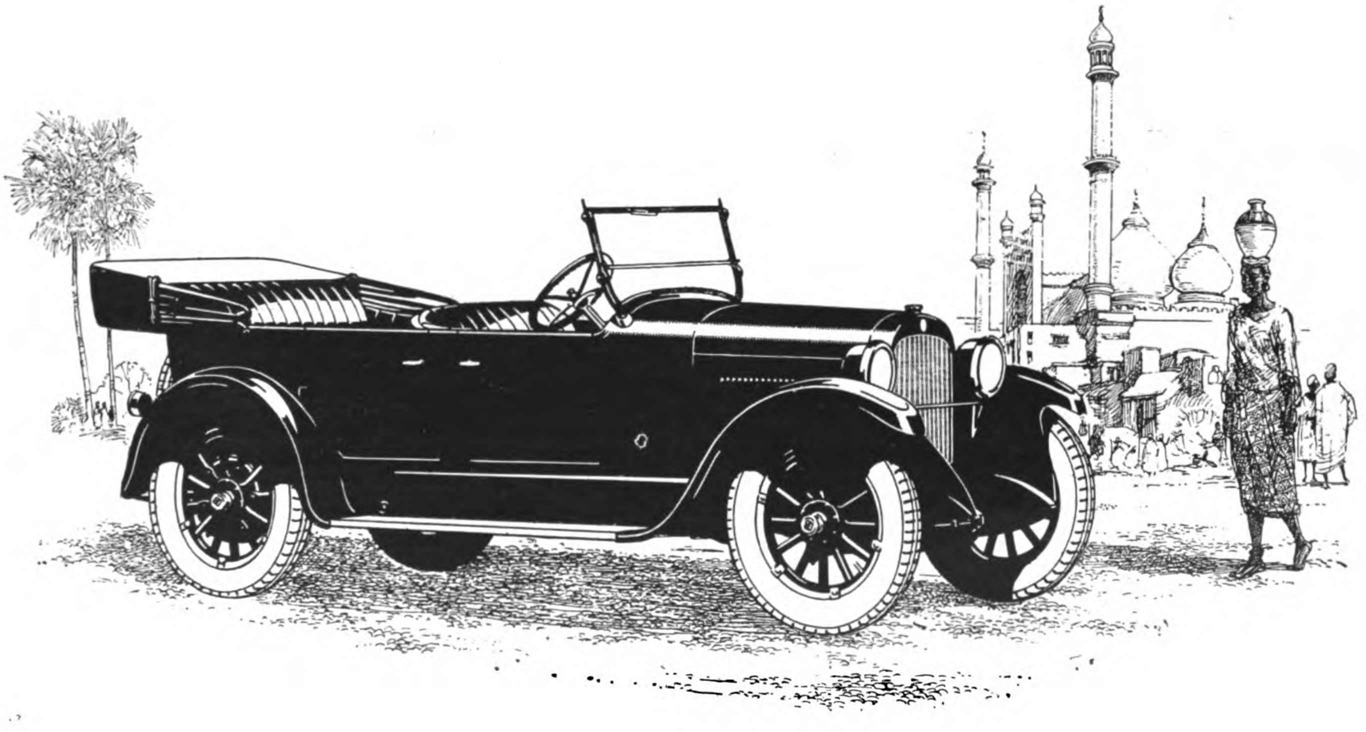
(MITSUI & Co., Ltd.)

Tokyo, London, New York, Shanghai, Hongkong, and other Principal Commercial Centres of the World.

DODGE BROTHERS
TOURING CAR

Almost invariably preferred by expeditions travelling into remote and unpopulated regions of the world.

It will travel any trail that offers motor car traction, and will do so with a minimum of attention.



China Motors, 125 Bubbling Well Road, Shanghai
Japan Automobile Co., Tameike, Akasaka, Tokio
E. W. Frazar & Co., 13 Rue de Paris, Tientsin
J. H. Morris, 21 Teide, Seoul, Korea

Central Motors Ltd., 172-6 Orchard Road, Singapore
Levy Hermanos, Inc., 536-70 Gandara, Manila
The Dragon Motor Car Co., Ltd., Hong Kong
N. V. Velodrome, Soerabaia

TRADE MARK

S

CABLE ADDRESS: "SUGAR," TOKYO
CODE: A.B.C. 5TH EDITION
Head Office:
Nippon Kogyo-Ginko Building,
Marunouchi, Tokyo

RAW SUGAR REFINED

THE JAPAN SUGAR CO., LTD.
(DAI NIPPON SEITO KABUSHIKI KAISHA)
CAPITAL: YEN 27,250,000; PAID-UP: YEN 20,062,000
RESERVE FUND: YEN 12,270,000

TRADE MARK

S

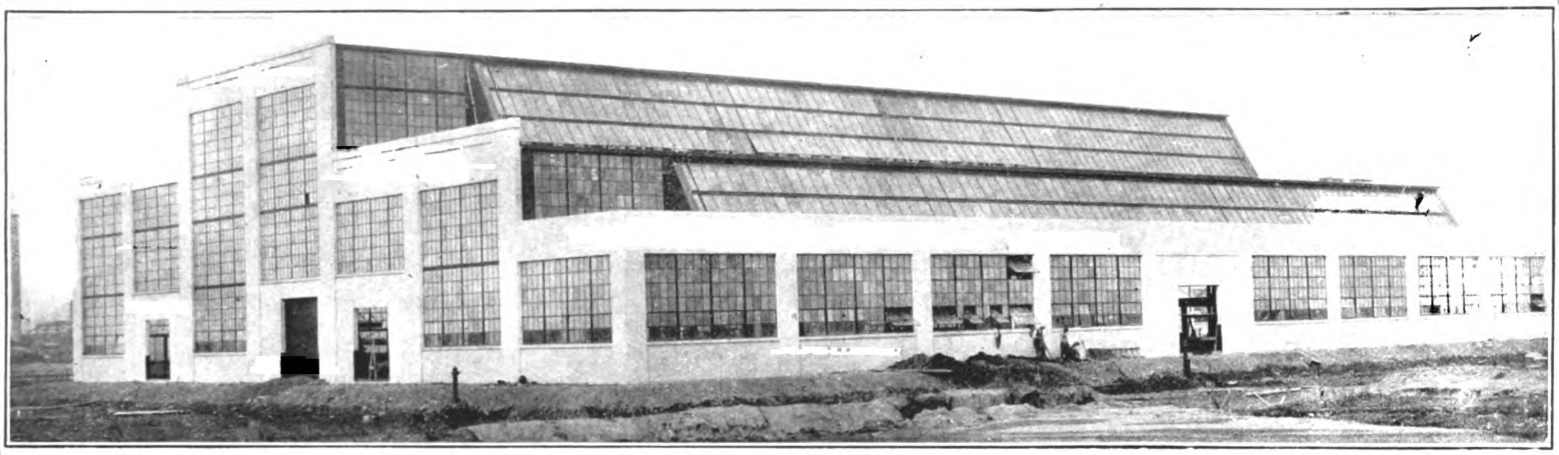
THE
MUNICIPAL ELECTRICITY DEPARTMENT
HAS RECEIVED DEMANDS FOR
ELECTRIC POWER
AMOUNTING TO
120,000 HORSE POWER
AND HAS GENERATING PLANT TO A CAPACITY OF
120,000 KILO-WATTS

DO YOU THINK
IT IS POSSIBLE TO MAKE YOUR OWN POWER AT A COST WHICH CAN COMPETE
WITH THE CHEAP RATES MADE AVAILABLE
BY THE OPERATION OF THIS VAST MODERN POWER PLANT?

ASK

THE CONSUMERS ENGINEER'S DEPARTMENT, 17, FOOCHOW ROAD, SHANGHAI
TELEPHONE FOR AN APPOINTMENT TO CENTRAL 283.

EVERYTHING ELECTRICAL



The Forge Shop of the New Plant of the Shibaura Engineering Works

COMPLETE POWER PLANTS AND SUB-STATIONS

DESIGNED AND EQUIPPED

GENERATORS, MOTORS, ROTARY CONVERTERS, CONDENSERS, TRANSFORMERS, SWITCH BOARDS, FANS, ETC.

THE SHIBAURA ENGINEERING WORKS, LTD.

HEAD OFFICE: 1 KANASUGI HAMACHO, SHIBA-KU, TOKYO

WORKS AT SHIBAURA, TOKYO AND TSURUMI, JAPAN

Catalogs, Specifications, Estimates Supplied on Application

EXPORT AGENTS:

THE MITSUI BUSSAN KAISHA, LTD.

S&F SALE & FRAZAR S&F

LIMITED

No. 1 Yayesucho, Kojimachi-Ku

TOKYO

Central Post Office Box No. 18

IMPORTS EXPORTS

Telegraphic Address: Since 1834 The Name "FRAZAR" For All Offices has been Connected

WITH

ORIENTAL TRADE

BRANCHES - - - - Yokohama, Kobe, Osaka, Kyoto, Moji, Hakodate, Nagoya, Keijo (Korea), Taihoku (Formosa) Mukden (Manchuria), Vladivostok (Siberia.)

AFFILIATED COMPANIES -
- FRAZAR & CO., 30 Church St., New York, and Paris, Seattle, San Francisco.
- FRAZAR TRUST CO., LTD., Tokyo and Yokohama.
- FRAZAR FOREIGN TRADE BUILDING CO., New York.

CORRESPONDENTS - -
- SALE & CO., 21 Old Broad St., London, E.C.
- F. G. SALE & SONS, 20 Bishops Gate, London, E.C.
- E. W. FRAZAR & CO., 5 Rue de Paris, Tientsin and Peking, Harbin, Mukden.

WORLD-WIDE CONNECTIONS
EXCLUSIVE AGENCIES IN ALL LINES
LARGE STOCKS

A FEW OF OUR AGENCIES

MOTORCARS, TRUCKS, TRACTORS, ETC. Ford Motor Co., Hupmobile Motor Car Corp Franklin Motor Car Co., Armstrong Siddeley Co., Ltd., Rolls Royce Co., Ltd., The White Co (Trucks), Splitdorf Electrical Co.
MACHINE TOOLS. Joseph T. Ryerson & Son, Giddings & Lewis Mfg. Co., Wm. Sellers & Co., Inc.
RAILWAY EQUIPMENT. Baldwin Locomotive Works, W. H. Miner, Griffin Wheel Co., Duff Mfg. Co.
AVIATION EQUIPMENT: Handley Page, Ltd.
BRITISH STEEL and STEEL PRODUCTS. Jonas and Colver, Ltd., Smith & Coventry, Ltd., Sheffield Twist Drill & Steel Co., Ltd., Chubb & Son's Lock & Safe Co., Ltd.
CANNING MACHINERY and EQUIPMENT. American Can Co., Adriance Machine Works, Anchor Cap & Closure Co., Burpee and Letson Ltd., Seeley Brothers.
CANNED SALMON and CRAB from Kamchatka.
Fairbanks Morse & Co. Stationary and Marine Engines. Motors, Pumps, Wind Mills, complete Power and Lighting Plants.
Chain Belt Co., "Rex" Concrete Mixers.
J. L. Mott Iron Works, Plumbing Fittings and Supplies.
Shepard Electric Crane & Hoist Co., Cranes and Hoists.
Armour & Co., Canned Meats and Fruits, Soaps, Toilet Articles.
The Carnation Milk Products Co., "Carnation Cream."
The Glidden Co., Paints, "Jap-a-lac" Auto Finishes, Cold Water Paints, Wood Stains.
The Duratex Co., "Duratex" Leather Substitute and Rubber Coated Top and Curtain Materials.
S. C. Johnson & Son, Floor Wax, Paste, Liquid, and Powder.
The Klein Manufacturing Co., Technical Paints "Metal Crete" Concrete Hardeners, Cement Coating.
The Tungsten Wire Works (Stockholm), Wires for Filaments.
The Victor Talking Machine Co., Machines and Records.
The Graphoscope Development Co., Projectors and Films.
The Victor Typewriter Co., Standard Typewriters.
The Corona Typewriter Co., Folding Typewriters.
The Rolex Watch Co., Ltd., "Rolex" Watches.
Simmons Hardware Co., "Keen Kutter" and "Oak Leaf" Brands of Tools and Cutlery.
The Gillette Safety Razor Co., "Gillete" Blades.

MANY OTHER EXCLUSIVE AGENCIES

ROAD, EXCAVATING, POWER HOUSE, REFRIGERATING MACHINERY: STEEL and IRON PRODUCTS: "Gould" STORAGE BATTERIES.
RADIO APPARATUS, HEATING EQUIPMENT, FERTILIZERS, SAWN TIMBER CHEMICALS.
OUR SERVICE also covers BONDS and INVESTMENTS, FIRE and MARINE INSURANCE, SHIPPING, STORING, CHARTER, SALE and PURCHASE of STEAMERS.

INQUIRIES SOLICITED - If we cannot Supply your Requirements from Stock, we will be pleased to Recommend Local Alternatives or Advise Regarding Imports.

SMOKE CAPSTAN

B-255 This advertisement is issued by the British-American Tobacco Co (China) Ltd

JAPANESE
TEXTILES
FOR EXPORT

Standard Printed and Dyed Cotton and Silk Fabrics

SHIRTINGS, PRINTS, DAMASKS, SHEETINGS, CRETONNES, TOWELING, DRILLS, FLANNELETTES, CREPES, ETC. ETC.

PONGEES, CREPES, BROCADES, SILKS, SATINS

FUJI GASSED SPINNING COMPANY, LIMITED

(FUJI GASU BOSEKI KABUSHIKI KAISHA)

Head Office:
GOCHOME, OSHIMA-MACHI
NEAR TOKYO
CABLE ADDRESS: "FUHO"

CAPITAL - Yen 38,000,000
OPERATING
450,000 Spindles and
1,775 Looms

Business Office:
SHICHOME, HAKOZAKI-CHO,
NIHONBASHI-KU,
TOKYO

TRIMO

The Tools for Hard Work

The all-steel wrench

They stand up under the strain of rough usage. Right materials—best design—every operating convenience—every feature of economy.

TRIMO users buy for long service.

The Monkey Wrench shown

has double the strength and durability of the ordinary monkey wrench. Unequalled for open work and general use. All steel (as shown) or with wood handle. Seven sizes.

Other tools having the

Quality TRIMO Mark

are the

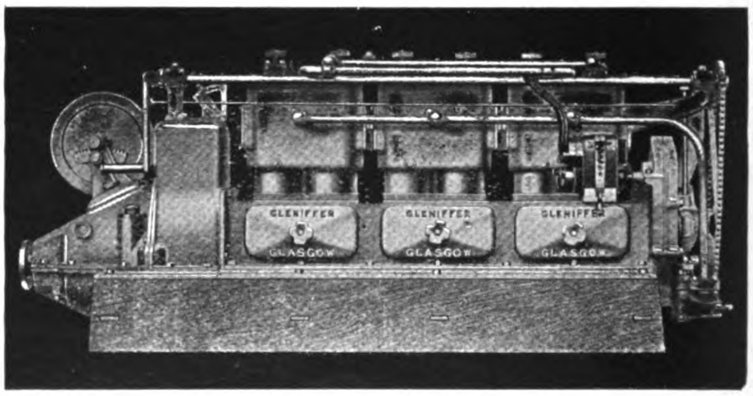
Pipe Wrench—Pipe Cutter
Chain Pipe Wrench

Can be had by calling on your dealer or by writing

TRIMONT MANUFACTURING CO.

ROXBURY (Boston), Mass., U. S. A.

GLENIFFER
MARINE MOTORS



36/42 H.P. Paraffin Engine and Reverse Gear

A sound British engineering job of compact and clean design.

All working parts entirely enclosed, thus ensuring silent and clean running.

Range of Models—12 to 90 H.P.

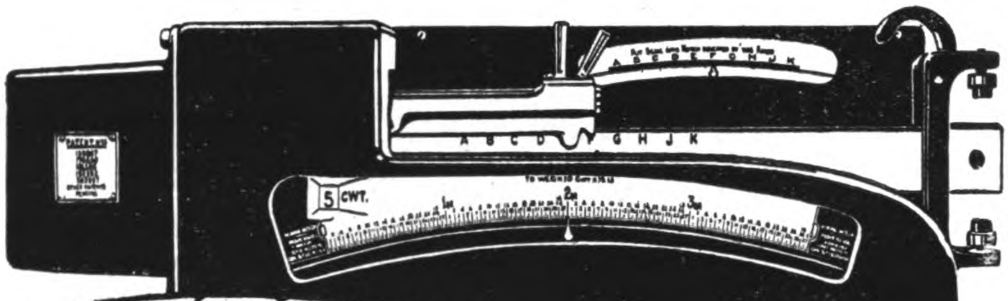
Agents: China and Hongkong—THE JARDINE ENGINEERING CORPORATION, LTD., at Shanghai and Hongkong.

F.M.S. & Straits Settlements—Ritchie & Bisset, 23-25 The Arcade, Singapore

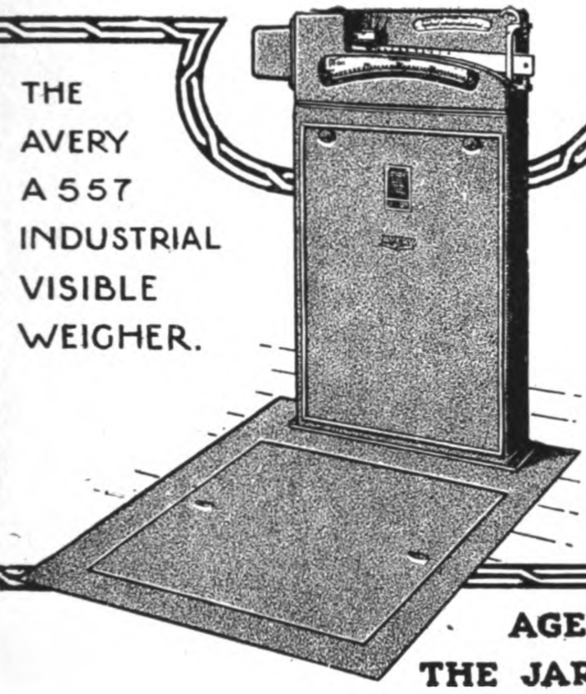
GLENIFFER MOTORS, LTD.,

ANNIESLAND, GLASGOW, SCOTLAND

MISTAKES POSITIVELY ELIMINATED.



THE AVERY A 557 INDUSTRIAL VISIBLE WEIGHER.



AVERY

ACCURATE AND RAPID VISIBLE WEIGHING

THE AVERY NO. A. 557 revolutionises weighing machines

Immediately the load is placed on the platform a selector automatically indicates to the operator the notch in the steelyard into which the poise should be placed.

The positioning of the poise automatically reveals, in large figures on the chart, the major portion of the load, the minor portion being indicated on the quadrant, which is graduated to 1-cwt. by ½-lb. divisions. If the poise is inadvertently placed in the wrong notch the pointer records no weight and signals to the operator how to correct the mistake.

Write for List 274 to Export Dept.

W. & T. AVERY, LTD.
SOHO FOUNDRY BIRMINGHAM

AGENTS FOR CHINA—
THE JARDINE ENG^R. CORPORATION L^TD SHANGHAI.

AD 1063

Edgar Allen
STAG BRAND

"Stag" Miners' Drill Steels

Have the same reputation in China as they have on the Rand and in Mines all over the world. Mine Managers know and trust them. Even where they are not actually used, their good quality is recognized. Stocks are held in most of the principal mining centres. Standardized quality prevents trouble to the consumer, each delivery giving the same results.

The Edgar Allen mark on drill steels means economy, reliability and efficiency.

Branch Office in Japan:
EDGAR ALLEN & CO., LTD.,
2 Mitsu Bishi Buildings,
1 Yaesu Cho, Kojimachi
Ku, Tokyo

Edgar Allen & Co. Ltd.
Imperial Steel Works
Sheffield

Agents in China:
The Jardine Engineering
Corporation, Ltd.
8a Yuen-Ming-Yuen Road, Shanghai
and at Hongkong, Tientsin,
Hankow, Peking, etc.

THE JARDINE ENGINEERING CORPORATION, LTD

Registered Office: 8a YUEN-MING-YUEN ROAD, SHANGHAI

Branches: Hongkong, Hankow, Tientsin, Peking, Harbin, Mukden and Taiyuanfu

ENGINEERING SUPPLIES AND MACHINERY

LARGE STOCKS CARRIED IN

SHANGHAI, HONGKONG, HANKOW, TIENTSIN

Including:—

MACHINE TOOLS OF EVERY DESCRIPTION,
STEAM ENGINES AND BOILERS,
GAS, GASOLINE AND OIL ENGINES,
PUMPS, TOOL STEELS, PULLEYS,
SHAFTING, BELTING, PAINTS,
"CHUBB" SAFES AND LOCKS,
"AVERY" WEIGHING MACHINES,
WIRE ROPES FOR ALL PURPOSES,
ELECTRIC LIGHTING SETS, MOTORS
AND ELECTRIC ACCESSORIES,
DIVING APPARATUS, Etc. Etc.

EXPERT STAFF IN SHANGHAI

CONTRACTORS

FOR THE SUPPLY OF

COTTON SPINNING AND WEAVING MACHINERY, FLOUR AND CORN MILLING MACHINERY, ELECTRIC LIGHT AND POWER PLANTS, INDUSTRIAL PLANTS FOR ALL PURPOSES

DESIGNERS AND BUILDERS OF MOTOR BOATS

ESTABLISHED 1835

HORSFALL & BICKHAM, LTD.

MANCHESTER, ENGLAND

MANUFACTURERS OF ALL KINDS OF

CARD CLOTHING

CARD WIRE, CARD CLOTH FOUNDATIONS
CARD GRINDING MACHINERY
AND

EMERY FILLETING (HORBICK BRAND)

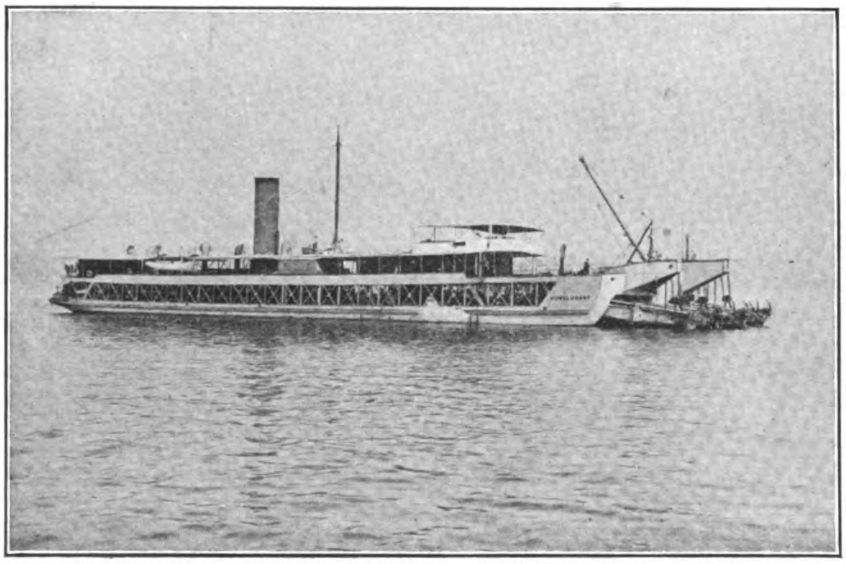
SOLE AGENTS IN CHINA:
THE JARDINE ENGINEERING CORPORATION LIMITED, SHANGHAI.
STOCKS CARRIED IN SHANGHAI AND TIENTSIN.

Wm. Simons & Co., Ltd., Renfrew

CONSTRUCTORS OF

Marine Dredging Plant of most Modern and Improved Types and of the Greatest Capacities.

Constructors of Barge Loading, "Simons" Reclamation, Canal and Suction Cutter Hopper Dredgers. Hopper and Barge Loading Bucket Dredgers. Alluvial Dredgers. Trailing Suction Dredgers.



Triple Screw Cutter Suction Discharging Dredgers *Ronaldshay* and *Cowley* Constructed for the Government of India.

Builders of Dipper and Drag Line Dredgers of Latest Type.

Propelling and Dumb Hopper Barges.

Replace Parts supplied or fitted to existing Dredgers.

Inventors and First Constructors of "Hopper" and "Sternwell" Dredgers and Elevating Deck Ferry Steamers.

Telegrams: "Simons" Renfrew.

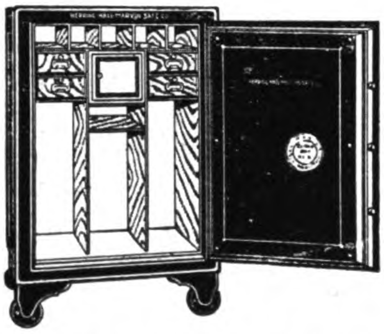
Established 1810

Head Office and Works: Renfrew, near Glasgow.

8a Yuen-Ming-Yuen Road Shanghai.

Agents in China:
THE JARDINE ENGINEERING CORPORATION, LTD.

and at Hongkong, Tientsin, Hankow, Peking, etc.



Unfailing Protection For Your Most Valued Possessions

HERRING-HALL-MARVIN

Safes and Bank Vaults

All sizes from the smallest Home Safe to the largest Bank Vaults, Key-Lock or Combination.

MUSTARD & COMPANY, LTD.

Sole Agents for China, Hongkong and Macao.

Shanghai, Tientsin, Hankow, Hongkong, Canton, Harbin.

The JANNEY-PENN Coupler

THE latest development of the Janney type of M. C. B. Coupling originally introduced and promoted by this company. This coupler has all the simplicity of the early type of the Janney coupler, and also has the up-to-date features of a "Lock-to-the-Lock," "Lock-Set," and a "Knuckle-Opener," and complies fully with all the requirements and recommendations of the M. C. B. Association of the U. S. A.

This coupler has the desirable feature of easy accessibility of parts, thus facilitating the making of repairs.

Furnished with various designs of rear end to suit different types of Draft Rigging.

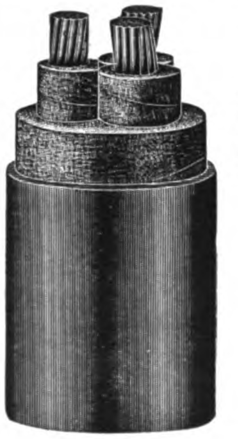
Manufactured exclusively by

THE McCONWAY & TORLEY CO.

Pittsburgh, Pa., U. S. A.

Cable Address—Torley, Pittsburgh

China Agents: The Robert Dollar Co., Tientsin, Hankow and Shanghai, China



YOUR every requirement of bare and insulated electric wires and cables and cable accessories can be satisfactorily met from the complete line of STANDARD Products. These products are guaranteed by over 43 years of successful service.

Standard Underground Cable Company

General Offices: Pittsburgh, Pa., U.S.A.

Agents for China:

Andersen Meyer & Co., Ltd., Shanghai

CHAMBERS, SCOTT & CO., LTD.

SPECIALISE IN

CRANES WINCHES

HOISTING & MACHINE TOOL PLANT

SHIPMENTS UNDERTAKEN

Cablegrams: "ENERGY"
Codes: Bentley, Marconi A.B.C. Western Union

MOTHERWELL, Nr. GLASGOW

Branch Offices : London and Liverpool

GOULDS

A Type for Every Service

Literature on Request

THE GOULDS MANUFACTURING COMPANY

Main Office and Works: SENECA FALLS, NEW YORK, U. S. A.
CABLE ADDRESS: "Glavis," Seneca Falls. CODES: Bentley's Lieber's, A. B. C. 6th and Western Union.

PUMPS

Special Machinery

for the manufacture of all Cement-Goods

as bricks of sand and slag, roofing tiles, hollow blocks

Moulds for cement-pipes, stair steps fence posts

HYDRAULIC AND MECHANICAL PRESSES

for the manufacture of cement plates of all kinds

Complete Plants manufacturing corrugated Asbestos-Sheets

Stone crushers, Sifting drums, Concrete mixers, cement colors L. C. M.

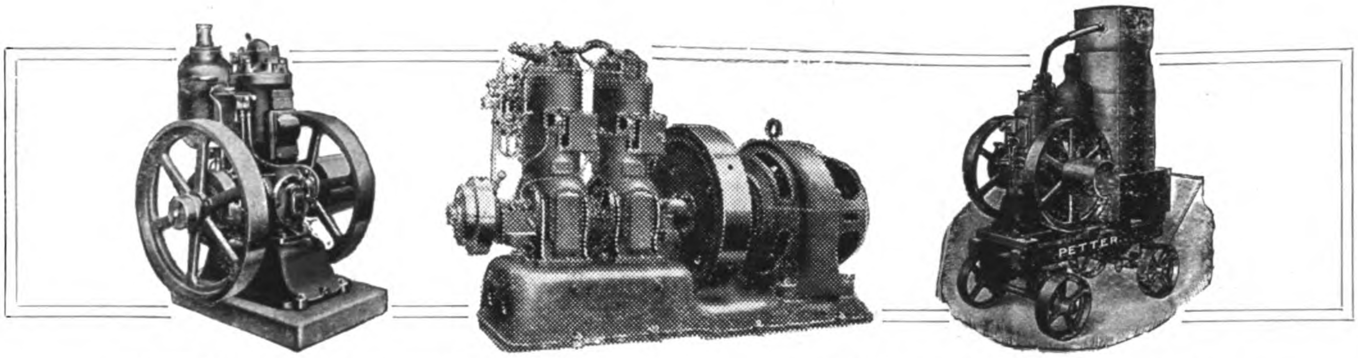
MACHINERY WORKS

DR. GASPARY & CO.

MARKRANSTADT NEAR LIEPZIG

Visit wanted. Catalogue No. 181 Gratis

Petter Oil Engines for all Purposes



PETTER 'S' TYPE ENGINES

Start and work on Crude Fuel Oil.
Self-contained. No Steam Boiler or Gas Plant. Great Saving in floor space and cost of foundations.
START FROM COLD without pre-heating.
Always ready for work.
For Factories, Electric Lighting, etc.
Sizes 5, 8, 12, 18, 24 and 36 H.P.

PETTER 'M' TYPE ENGINES

Start on Petrol—Work on Kerosene with Magneto Ignition.
Sizes 1½, 3 and 5 H.P. For Agricultural and general purposes.

THE PETTER-LIGHT ELECTRIC LIGHTING PLANTS

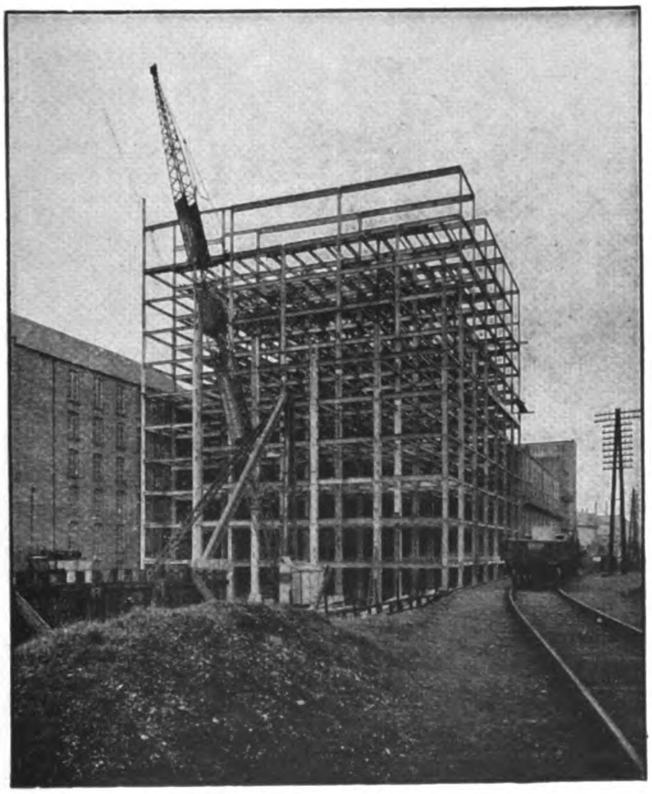
with Petter 'M' Type Engines are in use all over the World for Home, Shop, and Factory.

The Petter 'S' Type Marine Engines (Cold Starting) are Unrivalled for Fishing Boats and Small Vessels

For particulars of the larger size Engines up to 500 h.p. please write to Messrs Vickers-Pet ers Ltd., Ipswich

PETTERS LIMITED, OIL ENGINE WORKS, YEOVIL, ENGLAND

Information may be obtained from Rear-Admiral Yutani, c/o Mitsubishi Shoji Kaisha, Ltd., Marunouchi, Tokyo



3,000 Tons Steel Frame Building of ten floors. This type of construction is suitable for all kinds of factories, warehouses, and retail stores. Fire risks reduced to a minimum.

Redpath Brown Steelwork

IN constant demand at home and abroad for all classes of building and structural work—for Factories, Sheds, Warehouses, Bridges, Garages, Godowns, and Pithead Frames. State your requirements and we will supply designs and estimates. Enquiries from architects receive immediate and special attention. With our annual capacity of over 100,000 tons and stocks of steel in hand of 20,000 tons ready for fabrication we are in a position to proceed with the work at shortest notice.

AS Steel Merchants we are also ready to supply from stock, joists, channels, angles, flats, plates, bars, bolts and rivets.

REDPATH, BROWN & CO., LTD.

LONDON: 3, Laurence Pountney Hill, E.C.4.
EDINBURGH (Head Office): 2, St. Andrew Square.
GLASGOW: 19, Waterloo Street.
MANCHESTER: Trafford Park.
NEWCASTLE-ON-TYNE: Milburn House.
BIRMINGHAM: 47, Temple Row.
DUBLIN: 36, St. George's Quay.
BELFAST: 69, Scottish Provident Bldgs.

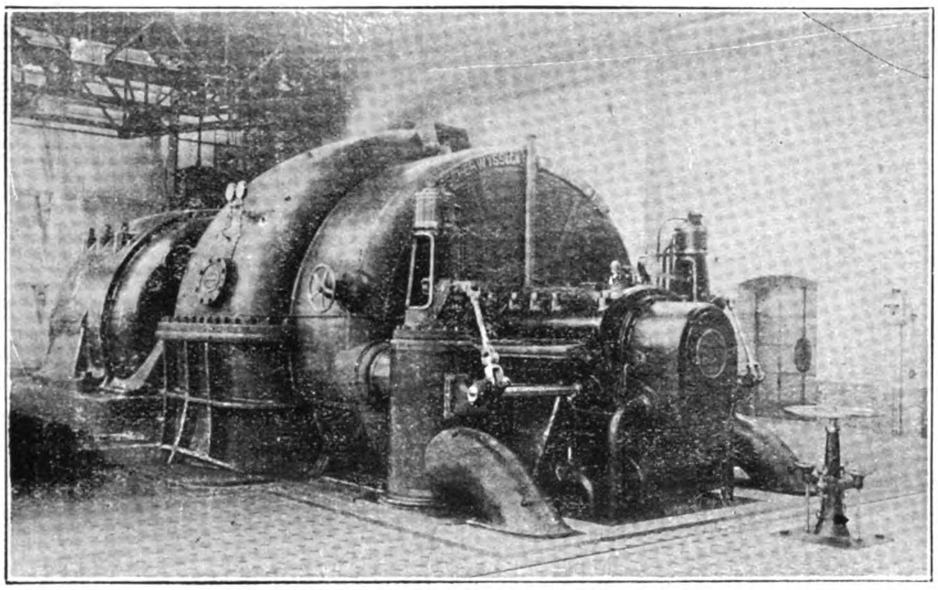
Cables: A.B.C. Sixth Edition, and Marconi International.

Japanese Representatives: Messrs. L. J. Healing & Co., Eiraku Buildings, Marunouchi, Tokyo.

ESCHER-WYSS & Co.

ENGINEERS AND CONTRACTORS

ZURICH, SWITZERLAND



30,000 K.W. Escher Wyss "Zoelly" Steam Turbogenerator

SPECIALITIES:

STEAM AND WATER TURBINES, STEAM BOILERS, SYSTEM GARBE, TURBO PUMPS AND COMPRESSORS, ICE- AND PAPER-MAKING MACHINERY

FAR EASTERN OFFICE

No 320-322-324 Marunouchi Building

TOKYO

LIFTS

FOR ALL PURPOSES

FITTED WITH WORLD-FAMED VEE WHEEL DRIVE

MANUFACTURED BY

SMITH MAJOR & STEVENS LTD.

LONDON AND ABBEY WORKS, NORTHAMPTON

ENGLAND

EASTERN AGENTS:

CALCUTTA: Messrs. JESSOP & CO., LTD., 93 CLIVE STREET

SHANGHAI: Messrs. SCOTT, HARDING & CO., 6 PEKING ROAD

SINGAPORE: Messrs. UNITED ENGINEERS, LTD. 5 BATTERY ROAD

JAPAN: Messrs. S. SAMUEL & CO., LTD. TOKYO

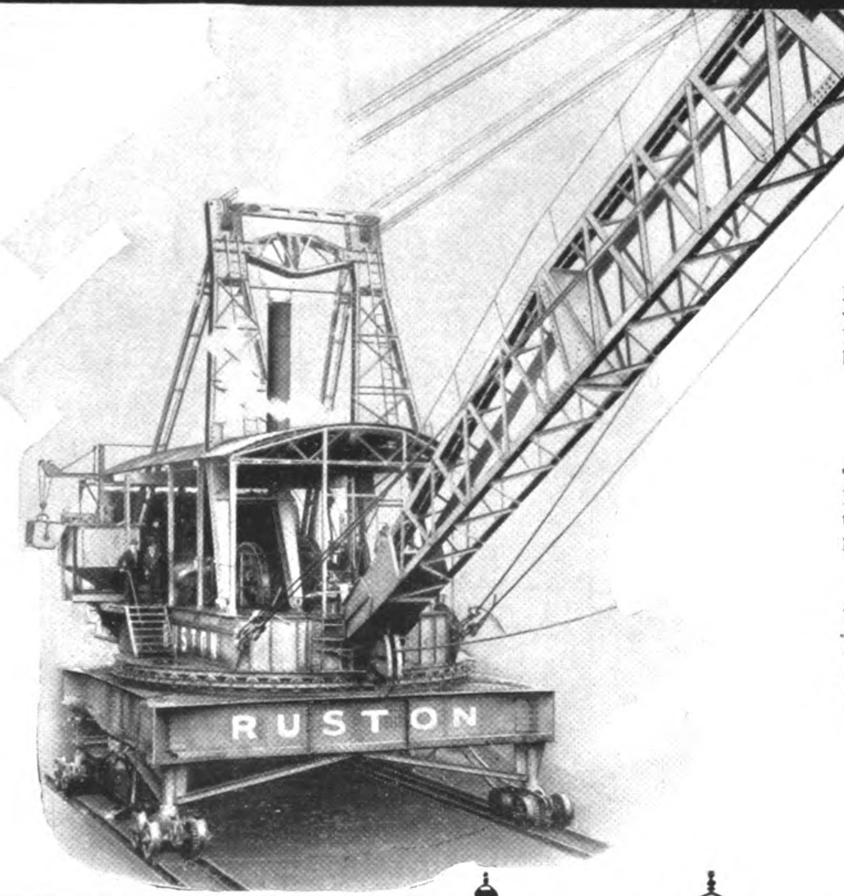
EXCLUSIVELY USED BY BRITISH ADMIRALTY ON ALL LATEST BATTLESHIPS.

RUSTON

EXCAVATORS AGAIN PREFERRED

AN EXTENSION OF THE

WORLD'S LARGEST ORDER FOR DRAGLINE EXCAVATORS



Ruston Dragline Excavators already supplied for work on the gigantic Irrigation Schemes on hand in India, have given such satisfaction that orders have been placed for

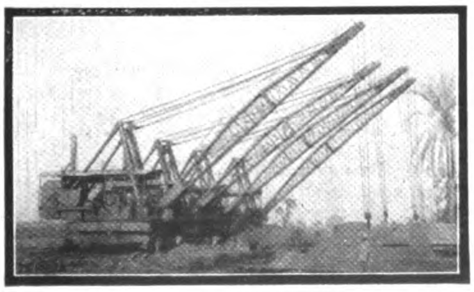
TWO FURTHER RUSTON DRAGLINE EXCAVATORS.

The exceptional manufacturing facilities of the Ruston Works is indicated by the time allowed for this contract. The two new machines are to be completed in SEVEN WEEKS from receipt of order.

All interested in Excavating Problems are invited to send for our Catalogue Illustrating a full range of Ruston Excavating Machinery—Crane Navvies, Shovels and Draglines—from 17 to 350 tons: Steam, Electric or Oil Driven.

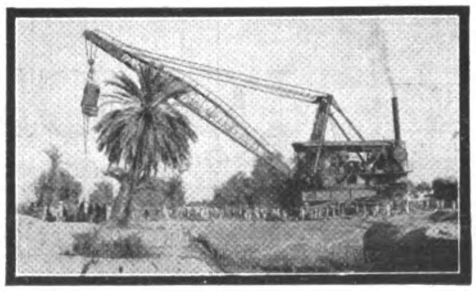
Agents:

MARTIN & CO., CALCUTTA
UNITED ENGINEERS, LTD., SINGAPORE, RANGOON, etc.
L. J. HEALING & CO., TOKYO, etc.
ARNHOLD & CO., LTD., SHANGHAI.



AT WORK IN INDIA

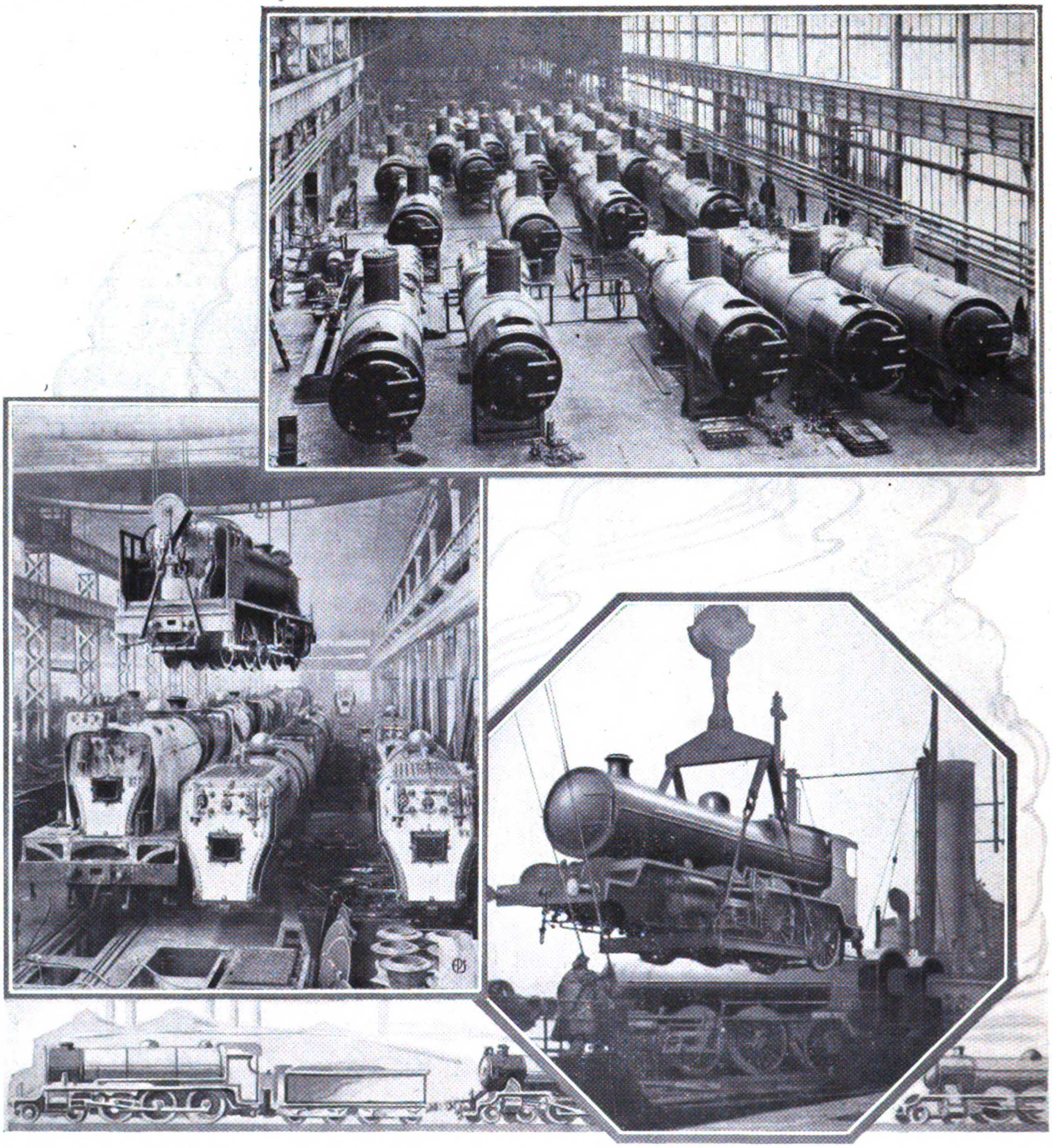
The RUSTON DRAGLINES shown alongside are working on Indian Irrigation Schemes. They were ordered after the first Ruston machine employed on this work had demonstrated the superiority of British Excavators.



RUSTON & HORNSBY LTD: LINCOLN, ENGLAND:

ARMSTRONG · WHITWORTH

SHIPS
MARINE ENGINES
LOCOMOTIVES
MACHINE TOOLS
FORGINGS CASTINGS
NON FERROUS PRODUCTS
DROP STAMPINGS
HIGH SPEED STEELS
SMALL TOOLS GAUGES
PNEUMATIC TOOLS
ELECTRIC LIGHTING SETS
ROAD MAKING MACHINERY
HYDRAULIC MACHINERY
HYDRO ELECTRIC PLANT
CIVIL ENGINEERING
GENERAL ENGINEERING



LOCOMOTIVE *after* LOCOMOTIVE

The potential output of the A.W. Scotswood Works is 450 main line locomotives per annum. This is the first reason why A.W. deliveries are good. The highest quality of workmanship, ensuring that each locomotive passes its inspection tests the same day as it is submitted, is the second. To-day A.W. Locomotives are in use on British, Colonial and Foreign railways all over the world. The numerous repeat orders received are the best proof of the satisfactory service they are giving.

We invite your enquires.

SIR W. G. ARMSTRONG, WHITWORTH & CO., LTD.

8, GREAT GEORGE STREET, WESTMINSTER, LONDON, ENGLAND.

Telephone: Victoria 4010 (6 lines). *Code: Bentley's.* *Telegrams: Zigzag, Parl, London.*

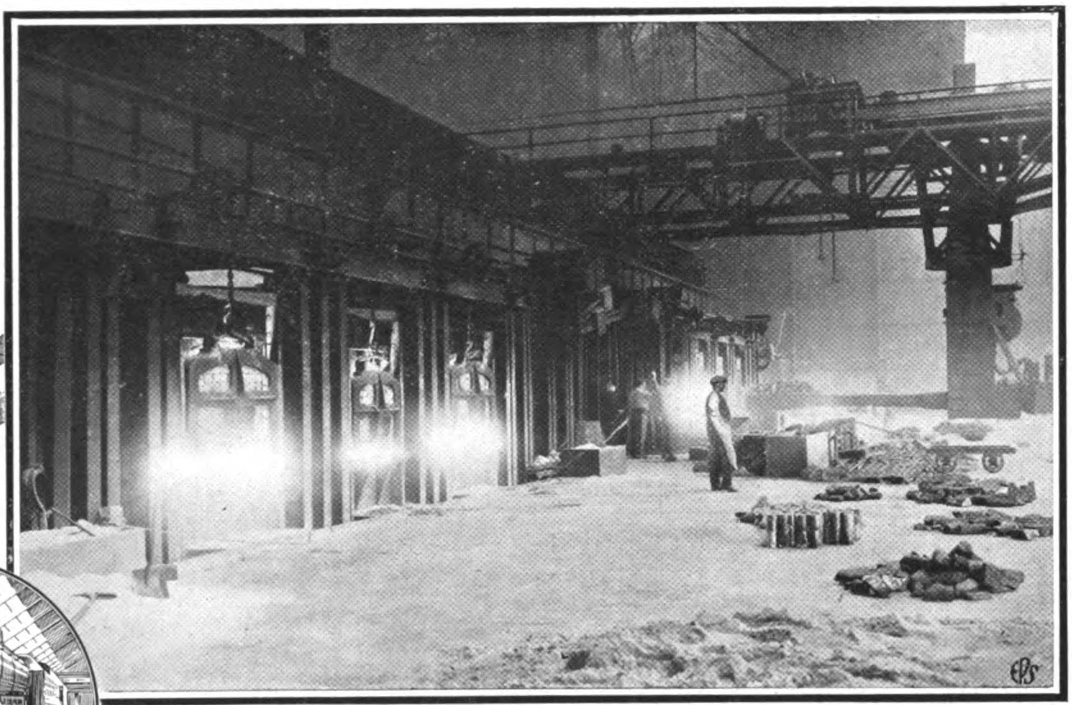
SCOTSWOOD WORKS, NEWCASTLE-ON-TYNE, ENGLAND.

Agents for Japan:
Messrs. Samuel Samuel & Co., Ltd.,
Tokyo Nichi Nichi Shimbun Building,
Yurakucho—1 Ichome, Tokyo, Japan.

Representatives for North China:
Messrs. H. St. Clair. Smallwood & Co.,
5, Rue Marco Polo, Legation Quarter,
Peking, China.

Agents for South China:
Messrs. Shewan Tomes & Co.,
Hongkong.

ARMSTRONG·WHITWORTH



STEEL

Over 70 Years' Experience.

IN 1852 we produced Steel by the Crucible Process, in 1873 by the Acid Open Hearth Process, and from 1912 by the Electric Furnace.

To-day, as then, we are continually searching for new and better steels, which will further enhance the high reputation of A.W. Steels. Our Research Department, which includes some of the most skilled metallurgists in the steel trade, is always ready to advise correct choice of steel for any duty.

We invite enquiries for:

HIGH SPEED ALLOY AND CARBON TOOL STEELS.
AERO AND MOTOR STEELS.
" VIBRAC " STEEL.
STAINLESS STEEL.
RUSTLESS IRON.
INGOTS FROM 50 LBS. TO 120 TONS.
BLOOMS AND BILLETS, BOTH ROLLED AND FORGED.
ROLLED AND HAMMERED BARS.
FORGINGS AND CASTINGS.
STEELS FOR SPECIAL PURPOSES.

SIR W. G. ARMSTRONG, WHITWORTH & CO., LTD.
OPENSHAW WORKS, MANCHESTER, ENGLAND.

London Office: 8, Great George Street, Westminster, London, England

Telephone: *Victoria 4010 (6 lines).* *Code:* *Bentley's.* *Telegrams:* *" Zigzag, Parl, London."*

Agents for Japan:
Messrs. Samuel Samuel & Co., Ltd., Tokyo Nichi Nichi Shimbun building, Yurakucho—1 Ichome Tokyo, Japan.

Representatives for North China:
Messrs. H. St., Clair, Smallwood & Co., 5, Rue Marco Polo, Legation Quarter, Peking, China.

Agents for South China:
Messrs. Shewan Tomes & Co., Hongkong.

TRADE MARK

SHIPS
MARINE ENGINES
LOCOMOTIVES
MACHINE TOOLS
FORGINGS CASTINGS
NON FERROUS PRODUCTS
DROP STAMPINGS
HIGH SPEED STEELS
SMALL TOOLS GAUGES
PNEUMATIC TOOLS
ELECTRIC LIGHTING SETS
ROAD MAKING MACHINERY
HYDRAULIC MACHINERY
HYDRO ELECTRIC PLANT
CIVIL ENGINEERING
GENERAL ENGINEERING

The Green Island Cement Co., Ltd.

SHEWAN, TOMES & CO.,

GENERAL MANAGERS, HONGKONG

Are You Going to Build?

Insist on your Architect specifying the use of the best brand of Portland cement in construction. If the house or factory is to be blocks or tiles, they should be of concrete, if stucco, only the best cement should be employed; if reinforced concrete is used, only a standard cement will stand the test; if your building is to be fireproof, waterproof, safe against earthquake or typhoon, improving with age, and lowering the cost of insurance, you must employ concrete, and the best concrete construction is only secured through the use of

Green Island Cement

Green Island Cement is supplied in Bags = 250-lbs. net, Casks = 375-lbs. net, Iron Drums = 375-lbs. net.

Also, Glazed Stoneware, House Drains, Sewer Pipes, and Fittings, Paving Bricks, Tiles, Fire Bricks and Fire Clay.

The Green Island Brand has become the standard Portland Cement of Asia, owing to its purity, uniformity and tests.

Used by H.B.M.'s Government in Hongkong, United States Government in the Philippines for all important Public Works.

Also by H.B.M.'s Government in Singapore and Federated Malay States for Government Buildings, Railways and Harbour Works.

Established 1883 Telegraphic Address "ROPEWORK," HONGKONG

THE HONGKONG ROPE MANUFACTURING Co., Ltd.

Manufacturers of Pure Manila Hemp Rope

Rope supplied to the British Navy on the China Station and to all Mail and regular Steamship Lines.

Ropes, Cables and Hawsers ½-in. to 15-in. Circumference. Driving Ropes for Mills; Bull Ropes and Drilling Cables for Oil Wells a Specialty.

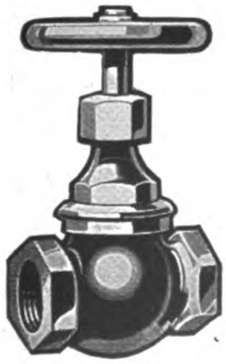
SHEWAN, TOMES & CO.

General Managers

St. George's Building HONGKONG.

FAIRBANKS

SCALES, VALVES, TRUCKS AND BARROWS

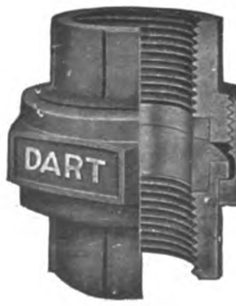


"FAIRBANKS" Scales have a world-wide reputation for dependability, because of their unusually long life and continued accuracy.

"FAIRBANKS" Globe, Angle and Check Valves, in brass and iron, also asbestos packed Cocks, are of a known quality, made and suitable for all pressure requirements. "Dart" Union Couplings are non-corrosive and leak proof—made so by two bronze seats.

"FAIRBANKS" Trucks and Wheelbarrows are manufactured in many styles and for practically every purpose, and are made to meet all requirements.

Catalogs sent on request.



THE FAIRBANKS COMPANY

416 Broome St., New York, U.S.A.

London Office: The FAIRBANKS Company (Europe), Ltd., 15 Mallow St., Old St., London, E.C.1.

NOBEL INDUSTRIES LIMITED
AT THE
BRITISH EMPIRE EXHIBITION

Front entrance to the Nobel Exhibit at Wembley, 1925.

Nobel Industries Ltd., in addition to exhibiting in the Palace of Industry examples of all their products, have installed machinery in the Nobel Bay to give the public an insight into the manufacture of their products. The machinery includes the assembling of Eley and Kynoch shot-gun cartridge cases, the gauging of Kynoch .303 Service ammunition, electric welding with the Premier Electric Welding Co.'s plant, many operations in the making of "Ironclad" Gas Mantles, the minting of the Nobel commemoration medal on a Kynoch Coining Press and the ubiquitous "Lightning Fastener."

Outside the Palace of Industry will be found other Nobel products—explosives in the Coal Mine and Exhibition Hall, ammunition in the Rifle Ranges, "Pegamoid" and "P-V" Leather Cloth in South Africa where Kynoch Fertilisers, Dips and Disinfectants are also exhibited.

The decoration of the Nobel Bay and certain parts of the Exhibition is carried out with Nobel Metal Powders and Medium.

NOBEL

A book descriptive of Nobel's share in the British Empire Exhibition will be sent free on request to Advertising Dept., NOBEL INDUSTRIES LTD., NOBEL HOUSE, LONDON, S.W.1.

NOBEL

UNITED STATES STEEL PRODUCTS COMPANY

30 Church St., New York, U.S.A.

Sole Exporters of the Products of

Carnegie Steel Company
Illinois Steel Company
American Steel & Wire Company
American Sheet & Tin Plate Company
The Lorain Steel Company
American Bridge Company
National Tube Company
Tennessee Coal, Iron & Railroad Company
Minnesota Steel Company
Canadian Steel Corporation

BRANCH OFFICES and REPRESENTATIVES IN

Antwerp, Belgium
Birmingham, England
Bombay, India
Brussels, Belgium
Buenos Aires, Argentine Republic
Concepcion, Chile
Havana, Cuba
Honolulu, Hawaii
Lima, Peru
Los Angeles, California
London, England
Mexico City, Mexico
Montivideo, Uruguay
Montreal, Canada
New Orleans, La
Port Elizabeth, South Africa
Portland, Oregon
Rio de Janeiro, Brazil
Rome, Italy
Rosario de Santa Fe, Argentine Republic
San Francisco, California
Santiago, Chile
Sao Paulo, Brazil
Seattle, Washington
Shanghai, China
Soerabaya, Java
Sydney, New South Wales
Talcahuano, Chile
The Hague, Holland
Tokio, Japan
Toronto, Canada
Valparaiso, Chile
Vancouver, Canada
Winnipeg, Canada

WAREHOUSES AT

Antwerp, Belgium
Bombay, India
Buenos Aires, Argentine Republic
Callao, Peru
Havana, Cuba
Port Elizabeth, South Africa
San Francisco, California
Santiago, Chile
Sao Paulo, Brazil
Talcahuano, Chile
Valparaiso, Chile

We give prompt attention to inquiries for all classes of our Steel Products, including the following :—

Aerial Tramways—Reversible, specially designed
Alloy Steel
Alloy Steel Sheets
Ammonia Cylinders
Angles
Armature Sheets
Axles—Locomotive, Railroad and Tramway Cars
Bamboo Steel
Barbed Wire
Bars—Merchant and Concrete Reinforcement, plain, deformed and cold twisted
Billets
Black Sheets
Blooms
Boiler Tubes, Lapwelded and Seamless
Bolts and Nuts
Bridges—Railway, Highway, specially designed
Buildings—Steel Warehouses, Structural Steel for Buildings
Cables—Steel Hoisting and Haulage Cables
Cars—Steam Railway, Mine and Industrial Railway Cars
Car Angles
Car Wheels
Channels
Cold Rolled Flat Wire
Copper Rail Bonds
Copper Bearing Steel Sheets
Derricks
Drilling Machines
Drilling Rigs for Oil Wells
Duquesne Rail Joints
Electrical Sheets
Electrical Wires and Cables—Bare and Insulated
Fabricated Structural Material for Bridges, Turntables, Steel Buildings, etc.
Fencing Materials—Wire Fencing, Steel Posts
Forgings
Frogs and Switches—Steam and Electric Railways
Hoops and Bands
Machine Forgings
Mine Timbers
Nails—Wire
Nail Rods
Nail Wire
Pig Iron
Piling—Steel Sheet
Pipe—Black and Galvanized Wrought, for Steam, Gas and Water, American or English Threads; Lapwelded Boiler Tubes, Matheson Lead Joint Pipe, Seamless Steel Tubing
Plates—Boiler, Tank, Ship, Flange and Fire Box Steel
Poles—Steel Tubular
Rails—Light and Heavy Rails for Railways, Tramways, Mine and Industrial Railways. Special Track Work
Reinforcement for Concrete—Triangle Wire Mesh
Rivets
Rope—Wire for Mine Hoists, Derricks, Cranes, etc.
Screw Spikes
Screw Stock—Cold Drawn
Shafting
Shapes—Standard Structural
Sheet Bars
Sheets—"Apollo" Brand Galvanized, Corrugated and Plain
Skelp
Slabs
Spikes—Railway Track Spikes
Sleepers—Steel
Spring Steel
Steam Pipe and Tubes
Stove Pipe Sheets
Switches and Switch Stands
Tank Plates
Terne Plates
Tin Mill Products
Tin Plate—"Coke," "Charcoal" and "Terne"
Tool Steel
Towers—Steel
Triangle Mesh Concrete Reinforcement
Tubes—Gas, Water, Steam and Boiler
Turntables for Light and Heavy Railway Service
Upholstery Springs
Washers
Weatherproof Insulated Wires and Cables
Wheels—Solid Rolled Steel for Steam, Electric, Mine and Industrial Railways.
Wire—Bright, Annealed, Galvanized, Baling and Fencing and all Classes of Coated and Uncoated for Manufacturing Purposes.

The Combined Actual Annual Ingot Production of our Manufacturing Companies for the year 1924 was in excess of 16,000,000 tons.

SHANGHAI OFFICE: Union Building—1 Canton Road

TOKYO OFFICE: Yusen Building, Marunouchi

OKURA & CO. (TRADING) LTD.

No. 14 Canton Road, Shanghai

President:
Baron K. Okura

BRANCHES at Hakodate, Yokosuka, Yokohama, Osaka, Kobe, Maizuru, Kure, Moji, Saseho, Keelung, Taihoku, Seoul, Antung, Penhsihu, Mukden, Tientsin, Peking, Hankow, Changsha, Kiukiang, Tsingtau, Hongkong, Vladivostok, Sydney, San Francisco, New York, London.

Head Office:
Ginza Tokio

GENERAL IMPORTERS AND EXPORTERS

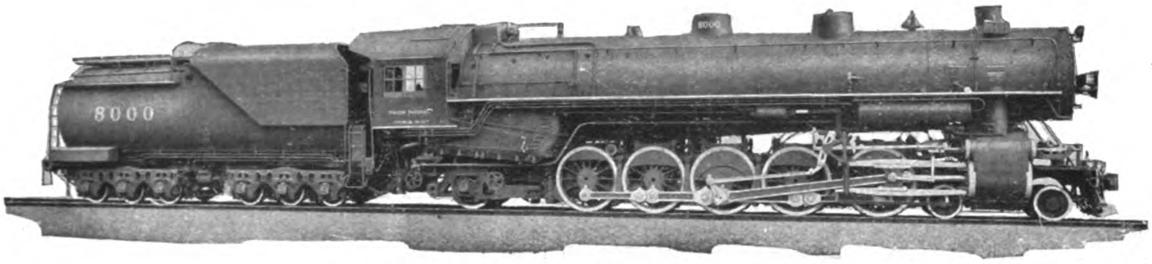
Rails, Bridges, Locomotives and other Railway Supplies
Electric Plants, Electrical Supplies
Sugar Plants, Spinning Machinery, Machine Tools
Factory Equipments, and all kinds of Machines
Automobiles, Guns and Explosives
Structural Materials, Steel Materials, Metals
Mineral Products, Chinese and Japanese Produce, Silk
Cotton, Wool, and their Manufactures
Fertilizers, Chemicals, Vegetable Oils and Wax, Dye Stuffs
Food Stuffs, Hides and Fur, Skins, Pen-hsi-fu Smokeless Coal and Pig Iron, etc.

BUILDING AND CIVIL ENGINEERING CONTRACTORS,
INSURANCE AGENTS

Yih Chong Wharf (Okura)

POOTUNG, SHANGHAI

THE THREE CYLINDER LOCOMOTIVE



"UNION PACIFIC OVERLAND TYPE"

THREE CYLINDER LOCOMOTIVE BUILT FOR THE UNION PACIFIC SYSTEM

Weight on Driving Wheels, Est. 288,000 pounds; Weight of Engine, Est. 407,000 pounds; Three Cylinders, $\frac{1}{25} \times 28$, $\frac{2}{25} \times 30$ inches; Diameter of Driving Wheels, 63 inches; Boiler Pressure, 210 pounds; Maximum Tractive Power, 78,000 pounds.

A more uniform turning movement permitting greater tractive power per pound of weight on drivers.

Reduction in piston thrust due to smaller size of piston used.

Reduction in reciprocating weight per individual cylinder with corresponding reduction in counterbalance and hammer blow on rail.

Increased and steadier draft due to six exhaust impulses instead of four.

Increased tonnage per pound of weight on drivers.

For further information write to our nearest representative:

AMERICAN LOCOMOTIVE SALES CORPORATION

NEW YORK CITY U. S. A.

Telegraphic Addresses:

Locomotive: Peking, China
Mitsui: Tokio, Japan

Nottac: Manila, P. I.
Dilpax: Honolulu, Hawaii

Cable Address: "MITSUI"

MITSUI BUSSAN KAISHA

LIMITED

Capital: Yen 100,000,000
Reserve: „ 35,750,000

(MITSUI & CO., LTD., IN EUROPE AND AMERICA)

IMPORTERS AND EXPORTERS

SHIPOWNERS AND SHIPBUILDERS

***Head Office*: TOKYO, JAPAN**

Branches:

HOME—Yokohama, Nagoya, Osaka, Kobe, Otaru, Muroran, Hakodate, Nijgata, Moji, Wakamatsu, Kuchinotsu, Nagasaki, Karatsu, Miike, Taipeh, Keelung, Tainan, Takow Seoul, Chemulpo, Fusan, etc. etc.

ABROAD—London, Hamburg, New York, San Francisco, Seattle, Portland, Ore, Manila, Bombay, Karachi, Calcutta, Singapore, Bangkok, Rangoon, Soerabaya, Batavia, Semarang, Sydney, Melbourne, Hongkong, Canton, Amoy, Foochow, Shanghai, Chefoo, Hankow, Changsha, Newchwang, Tientsin, Dairen, Antunghsien, Mukden, Tieling, Tsingtau, Chungchun, Vladivostok, Harbin, etc. etc.

SHIPBUILDERS, ENGINEERS AND REPAIRERS SHIPYARDS AND DRYDOCKS AT TAMA, OKAYMA, JAPAN, For Construction and Repairing. SAWMILL OWNERS IN HOKKAIDO

PRINCIPAL LINES OF BUSINESS:

EXPORT.

Raw Silk and Silk Textiles, Coal, Lumber, Rice, Seeds, Beans, Flour, and Other Cereals, Sugar, Copper and other Metals, Vegetable and Wood Oils, Camphor, Matches, Fertilizers, Paper, Canned Foods, Fish Products, Tea, Sulphur, Cement, etc , etc.

IMPORT.

Machinery and Tools, Ships, Steel and Iron, Locomotives, Rails and other R. R. Equipment, Sugar, Rice, Wool, Phosphate, Sulphate of Ammonia, Nitrate of Soda, Rubber, Dyes, Drugs and Chemicals, Jute and Gunnies, Flax and Hemp, Wheat, Seeds, and other Cereals, Bean Cakes, Lumber, etc., etc.

ENGINEERING DEPARTMENT

Sole Agents for Leading American and European Makers, including

American Locomotive Co.
British Thomson Houston Co., Ltd.
Bucyrus Co.
California National Supply Co.
De La Vergne Machine Co.
General Electric Co.
General Motors Export Co.
Mesta Machine Co.
Nordberg Manufacturing Co.
Sullivan Machinery Co.
Belliss & Morcom, Ltd.
Geo. Cradock & Co., Ltd.
Platt Brothers & Co., Ltd.
Ruston & Hornsby, Ltd., etc., etc.

Also, AGENTS IN JAPAN, ORIENT, and INDIA for Well-known Japanese Insurance Cos.

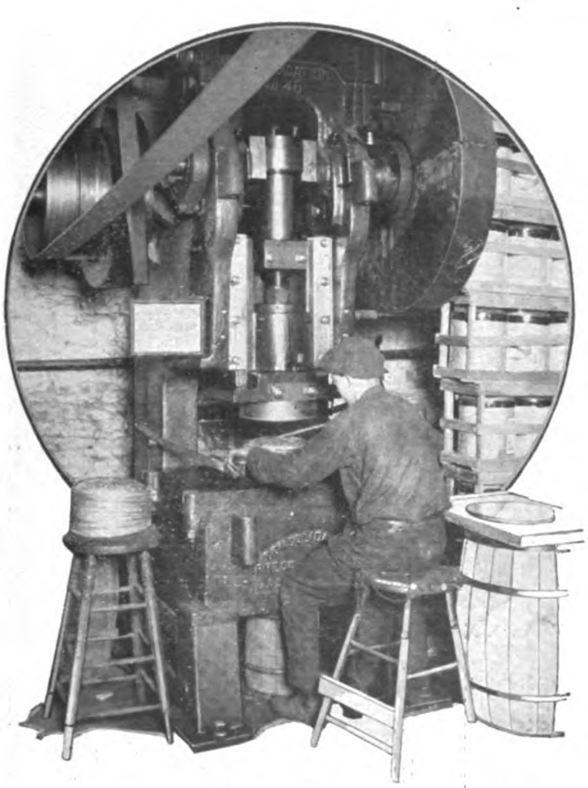
Prompt shipment from stocks at Glasgow, London, Liverpool and Cardiff. Write for quotations and catalogue.

THESE wire ropes have a world reputation for reliability. The wire is drawn to our own specification and carefully tested. We spin wires ranging from 5/1,000 to over 1/5 of an inch in diameter and as far as possible ropes are made without joins in the wires. Large and varied stocks are maintained to cover all standard requirements and special ropes can be designed to specification and supplied quickly.

Allanwhyte WIRE ROPES

ALLAN, WHYTE & CO., LTD.
Clyde Patent Wire Rope Work,
Rutherglen—Glasgow—Scotland.
London Office :
6/8 Lime Street Square, E.C.3.
Cables :
"Alwhytrop-Fen London"

163.49



"Bliss" Arch Power Press drawing tops for round 5-gallon oil cans at the rate of 400 per hour

SHEET METAL WORKING MACHINERY

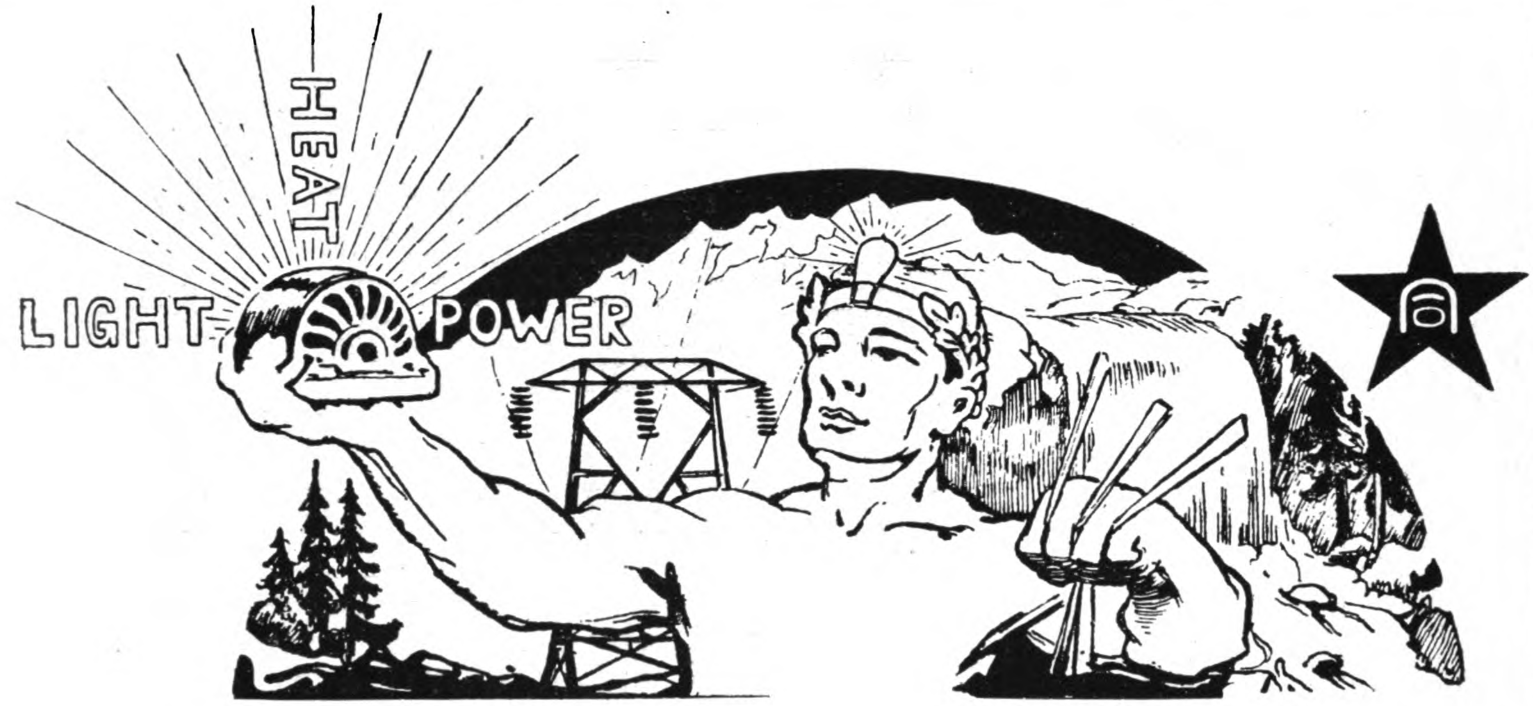
We build hundreds of various types of presses, each of which is built in many sizes and all of which have their particular use in the wide field of sheet metal working.

There is a Bliss Press to meet every sheet metal working requirement. Avail yourself of 68 years of experience in specializing in the building of sheet metal working machinery by writing us your sheet metal working machinery requirements.

BLISS *for* MACHINERY

E. W. BLISS CO., BROOKLYN, N. Y., U. S. A.
Factories: Brooklyn, N. Y. Hastings, Mich. Salem, O. Cleveland, O.
Foreign Factories & Offices: London, Eng. Turin, Italy Paris, France

BLISS



The Forces of Nature Are the People's Servants

Through long centuries men lived on the banks of mountain streams, hunting wild beasts and tilling the soil for a livelihood, all unsuspecting the presence of a miraculous power that lay concealed within the sparkling water. The precious secret of employing that hidden power for the greater happiness of mankind was yet to be discovered.

But at last the idea of hydro-electricity was born. The world's rivers assumed a new importance, and from that day industry has been surging forward at an unprecedented pace.

To-day Japan's natural water-power resources are the foundation of an industrial structure of which the ultimate strength and scope may now be only imagined. And the corner-stone of the foundation—the leader among all the hydro-electric enterprises of Japan, is the Daido Denryoku Kabushiki Kaisha.

The Daido organization, with its six enormous power units on the Kiso River (in the Japanese Alps) has pointed the way for all future hydro-electric development in this country. Its plants are the most extensive and its power capacity the greatest in the Eastern Hemisphere. And by all who know industrial conditions in Japan, it is recognized not only as a modern and efficient business organization, but a guiding star for the forward movement of industrial organizations in the East.

The territory served by Daido comprises Japan's principal industrial districts, with a total population of 20,000,000 and constantly increasing needs for electric power.

The $15,000,000 bond issue successfully floated by Daido in New York August 1, 1924, was the first private Japanese industrial loan to be offered in the American market.

Water Power Generated by Daido

	Kilowatt
Kisogawa Shizumo Power Station ...	14,700
" Yomigaki " " ...	40,700
" Oi " " ...	42,900
" Okuwa " " ...	11,000
" Suhara " " ...	9,200
" Momoyama " " ...	23,100
Yahagigawa Kushihara Power Station	6,000
Kuzuryugawa Nishi Kadohara Power Station	7,200
Total (Kilowatt)	154,800

Steam Power Generated by Daido

	Kilowatt
Kema Power Station	12,500
Ajikawa East Power Station ...	18,000
Kasugade No. 1 Power Station ...	30,000
Kasugade No. 2 " " ...	40,000
Total (Kilowatt)	100,500

Power Received from Other Sources

	Kilowatt
Bisan Electric Power—Asahi Station.	1,300
Bisan Electric Power—Tokise Station	6,000
Kisogawa Denryoku—First and Second Station	2,700
Chuo Electric—Otani Station ...	6,000
Kamioka Water Power—Atotsugawa First Station	7,200
Total (Kilowatt)	23,200

CAPITAL AUTHORIZED, Y112,963,000—TOTAL POWER GENERATING CAPACITY, 255,300 KILOWATT

DAIDO DENRYOKU KABUSHIKI KAISHA

(Great Consolidated Electric Power Co., Ltd.)

MOMOSUKE FUKUZAWA, *President*

NAGOYA TOKYO (Head Office) OSAKA

STANDARD OIL COMPANY OF NEW YORK

26 Broadway New York

The Mark of Quality

SOCONY PRODUCTS

Illuminating Oils

Gasoline and Motor Spirits

Asphaltums, Binders and Road Oils

Lubricating Oils and Greases

Fuel Oil

Paraffine Wax and Candles

Lamps, Stoves and Heaters

BRANCH OFFICES IN THE PRINCIPAL CITIES OF

Japan	Philippine Islands	Turkey
China	Straits Settlements	Syria
Indo-China	Netherlands India	Bulgaria
Siam	South Africa	Greece
India	Australasia	Jugoslavia

THE

HONGKONG & WHAMPOA DOCK CO.

LIMITED,

HONGKONG

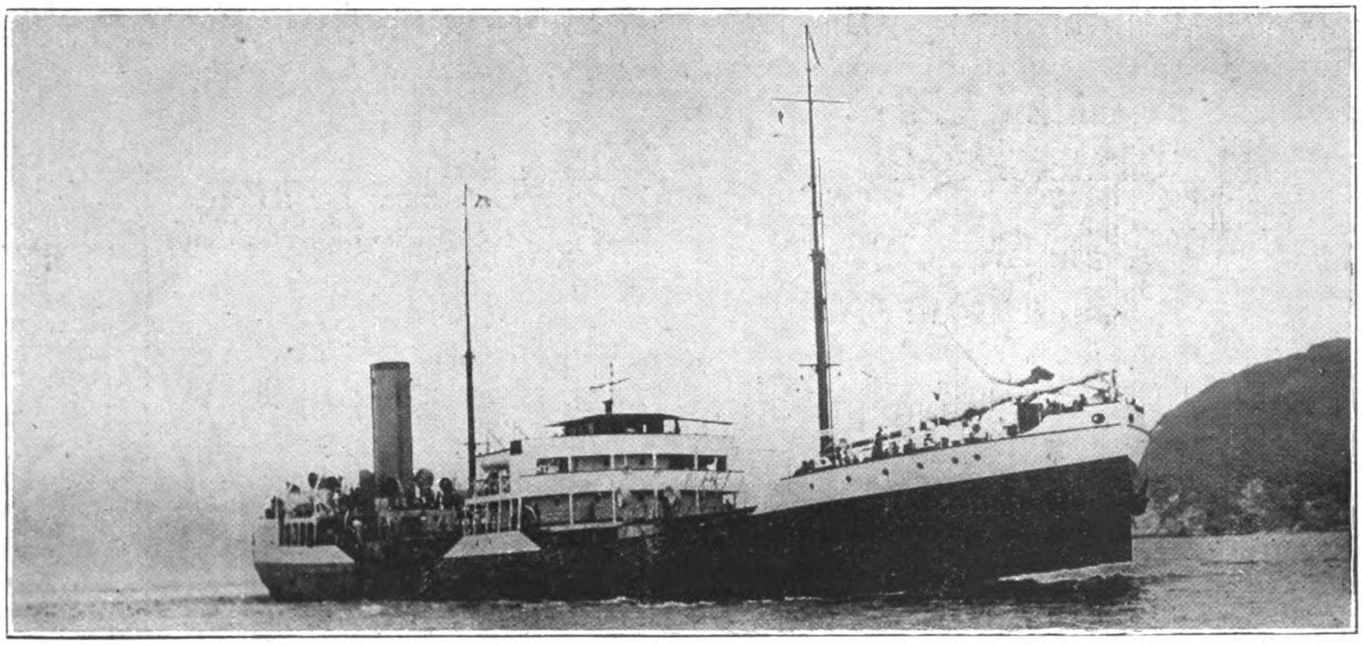
BUILDERS AND REPAIRERS OF SHIPS AND ENGINES OF ALL KINDS

and Makers of

BOILERS, IRON and BRASS CASTINGS, FORGINGS and CONSTRUCTIONAL IRON WORK, RAILWAY ROLLING STOCK, Etc.

Dock Owners, Ship Builders, Marine and Land Engineers, Boiler Makers, Iron and Brass Founders, Forge Masters, Electricians

The Company possesses Six Granite Docks and Two Patent Slipways and these are Equipped for Expeditious Work. The Plant is of the most modern type throughout. Ship Owners and Captains are assured that Docking and Repairs are carried out Promptly and at Moderate Charges.



Oil Tank Steamer *PALUDINA*, 427-ft. 0-in. by 53-ft. 1-in. by 31-ft. 0-in. by 8,400 tons d.w. by 3,100 H.P. Built by The Hongkong & Whampoa Dock Co., Ltd. at Kowloon Docks to the order of The Anglo-Saxon Petroleum Co., Ltd., being one of four similar vessels built in these Works to the same order.

Address Enquiries to the Chief Manager, R. M. DYER, B.Sc., M.I.N.A., Kowloon Docks, Hongkong

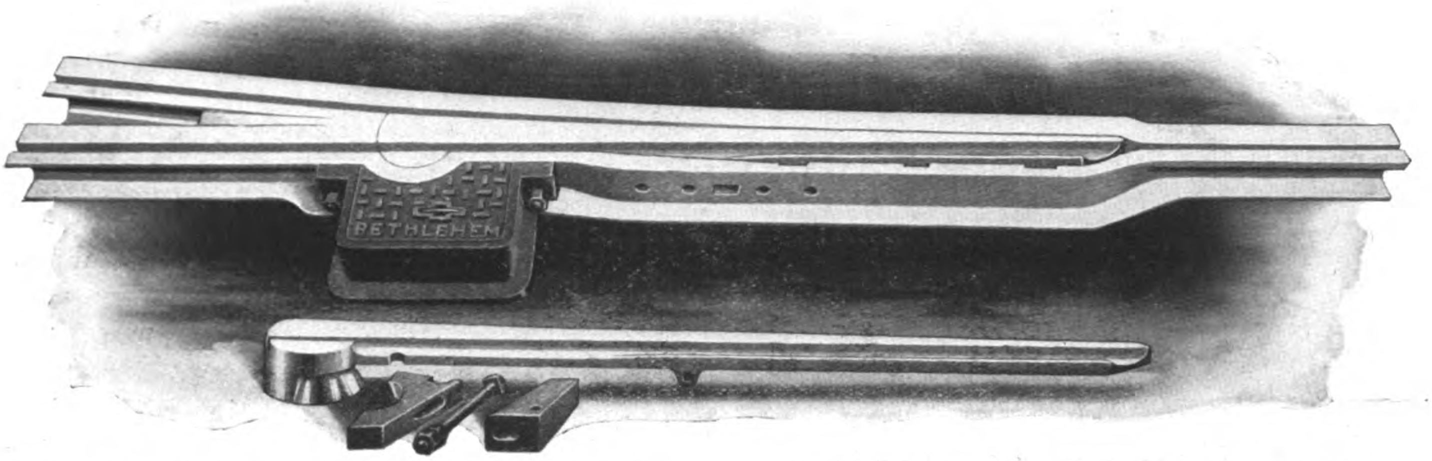
HEAD OFFICE: KOWLOON
TELEPHONE No. 55 K.

TOWN OFFICE: QUEEN'S BUILDINGS
TELEPHONE No. 20 HONGKONG

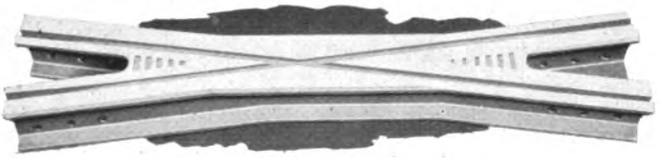
TELEGRAPHIC ADDRESS: "MANIFESTO" HONGKONG

Codes Used: A1; A.B.C., Fifth Edition; Engineering, First and Second Editions; Western Union and Watkins

Bethlehem Electric Railway Materials

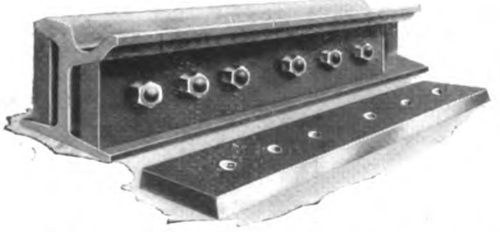


Solid Manganese Tongue Switch, Improved "Big Pin" Type, Design 905, is equipped with an adjusting device which holds the tongue down as well as back.
This adjusting and hold-down device consists of a wedge take-up and bolt as illustrated above. The hold-down block fits the inclined, or cone-shaped, surface of the heel; as the bolt is tightened, the wedge action forces the tongue back and also holds the tongue down. The "Big Pin" is 9½-in. diameter, and provides ample bearing surface or support. The extra large box at the heel of the tongue provides ample room for easy adjustment and quick cleaning.
The deep socket which surrounds the greater portion of the heel resists any tendency for the tongue to roll over under side thrust, or "Kick-up" at the point due to the pounding action of car wheels.



Solid Manganese Frog, Design 940, is cast in one piece manganese steel. The top surface is finish-ground to insure an absolutely level running surface. The ends are accurately ground to fit the connecting rail and splice plates.

Solid Manganese Mate, Design 920, is a solid one-piece manganese steel casting, finish-ground in the same way as Frog, Design 940. These pieces are manufactured to fit all girder and high tee rail sections. They are especially recommended for all heavy traffic locations.



Machine Fitted Joint, Design 980, is made from heavy rolled steel bars, cut to length and punched. The top and bottom are accurately machined to a true bearing surface free from kinks, wind, burrs, and mill scale. It is made in any length or thickness to fit any rail section and may be electric seam welded

Center Rib Base Plate, provides reinforcement and support directly under the center of the rail joint, supporting the joint and preventing "battering" or "cupping" of the rail ends. The reinforcing rib is out of the way and does not interfere with proper tie tamping. It is designed for use with either bolted or welded joints—in the latter case the plate is usually welded to the rail, thus imparting additional strength and stiffness to the joint.

Bethlehem Railway Materials for Steam and Electric Railways, Contractors, Mines, Sugar Centrals, Industrial Plants, etc. include Light and Heavy Rails, Switch Stands, Sail Braces, Frogs, Switches, and Crossings of built-up or Manganese construction, Bethlehem Steel Mine Ties, and all kinds of Track Accessories.

BETHLEHEM STEEL EXPORT CORPORATION

25 *Broadway, New York City, U.S.A.*

Sole Exporters of the Commercial Products of Bethlehem Steel Company

F. M. GIBSON, AGENT FOR JAPAN, NIPPON YUSEN KAISHA BLDG., MARUNOUCHI, TOKYO

Cable Address: Bethlehem, New York *Codes:* Western Union five letter, Bentley's, Lieber's, and A.B.C.

BETHLEHEM

The Shanghai Dock and Engineering Co., Ltd.

Established 1862 **(LATE S. C. FARNHAM, BOYD & CO., LTD.)**

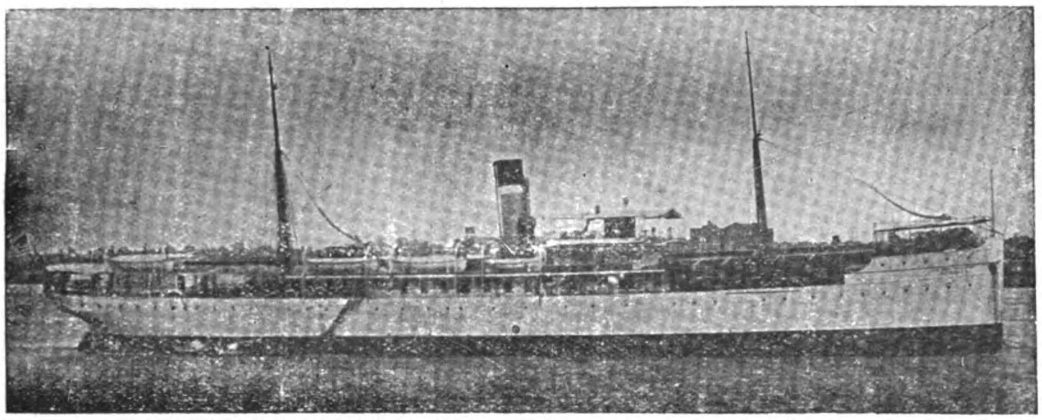
Boilermakers, Dock Proprietors, Shipbuilders, Engineers and Electricians

HEAD OFFICE:

26 Broadway,

Shanghai

Telephone No. 7



U.S. ARMY TRANSPORT "MERRITT," 300′ 0″ × 45′ 0″ × 28′ 3″

Cable Address "FARNHAM"
Codes Used, A.B.C. 4th, 5th & 6th Editions A-1, Watkin's, Scott's, Western Union, Bentley's and Engineering.

The "Merritt" is one of Twenty-Seven Steam Vessels built during the last few years to the order of The American Government for service in the Philippine Islands.

The Docks are four in number, ranging in length from 355 feet to 700 feet on the Blocks, and breadth of entrance from 53 feet to 80 feet, with a depth of water on the sill of from 16 feet to 27 feet.

The Dock charges are the most moderate in the Far East.

The Company's Yards and Docks cover 96 acres. The Water Frontage is about 1½ miles in length. Wharves and Pontoons are arranged where steamers can moor during repairs; and slips for hauling up small vessels are provided. Sheer legs capable of lifting 65 tons are placed at the various Docks.

The extensive Shipbuilding yards and workshops, lit by Electric Light, are provided with the latest improvements, such as travelling cranes of 60 tons' capacity, hydraulic and pneumatic machinery and tools.

Light railway lines are laid throughout workshops and yards.

A Staff of Divers, and powerful salvage appliances, and Floating Cranes ready for any emergency at short notice. Enquiries immediately attended to.

Estimates given for all classes of work: Coast Steamers, Side and Stern Wheelers, Tugboats, Launches, Steam Barges, Dredgers, Floating Cranes, and Lighters a speciality.

Every description of repairs and renewal work undertaken and expeditiously executed.

Motor, Land and Marine Engines and Boilers, Centrifugal, Mining, and other pumping machinery always in stock or in progress, also power driven Machine Tools. Engineer's Hand Tools, Steam, Gas, Oil, and Electric machinery and Engineering accessories generally.

Low Pressure Hot Water and Steam Heating Installations

CALL FLAG FOR VESSELS IN SHANGHAI HARBOUR
"F.B." INTERNATIONAL CODE

Berths for Building Steamers up to 10,000 tons Deadweight Capacity.

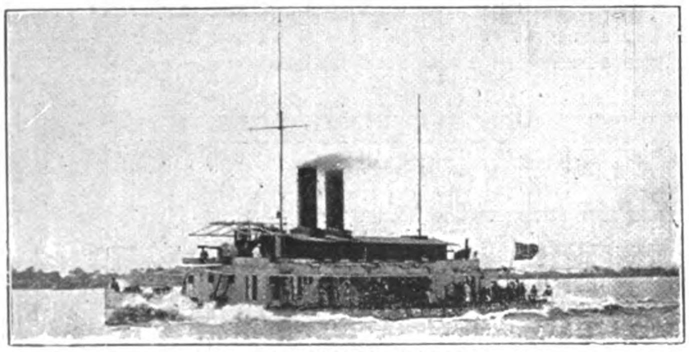
Representatives and workmen attend vessels at Woosung and outports on request.

☛ Telegraphic and Wireless Instructions from vessels promptly attended to

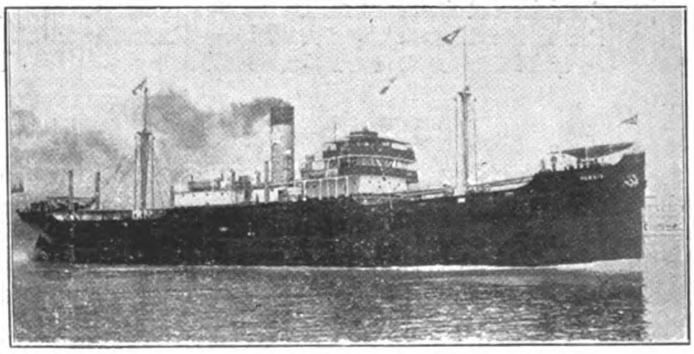
ENQUIRIES SOLICITED

PARTICULARS OF DRY DOCKS

Names	Length on Blocks	High Water	
		Breadth of Entrance	Depth of water on Sill
Cosmopolitan Dock ...	700 feet	80 feet	27 feet
International Dock ...	528 ,,	77 ,,	23 ,,
Old Dock	399 ,,	53 ,,	16 ,,
Tunkadoo Dock ...	350 ,,	67 ,,	16 ,,



H.I.M.S. "ERMANNO CARLOTTO"
Designed and Constructed for the Royal Italian Navy
Length 160 feet. Twin Screw Engines.
Draft 2 feet 10 inches with full equipment and 30 tons of coal on board. Mean continuous speed 14 knots per hour.



s.s. "YANNIS" ex "WAR TIARA"
Sister Ship s.s. "PANAGIS" ex "WAR DIADEM"
Sister Ship s.s. "MELLON" ex "WAR REGALIA"
Built for the British Government.

Cable Address:
"DOCKYARD" KOBE
"DOCK" DAIREN

A1, A.B.C. (4th and 5th),
Engineering, Scott's, Lieber's
Bentley's
and
Western Union Codes Used

KAWASAKI DOCKYARD CO., LIMITED

CONTRACTORS TO THE IMPERIAL JAPANESE ARMY AND NAVY AND TO FOREIGN GOVERNMENTS

KOBE

ESTABLISHED 1870

STEEL MAKERS, SHIP-OWNERS, LOCOMOTIVE BUILDERS, SHIPBUILDERS, ENGINEERS AND REPAIRERS

BRANCHES:

DAIREN, N.-C.
Dockyard & Engineering Works

HYOGO, KOBE
Steel Foundry, Bar Mill and Railway Shops

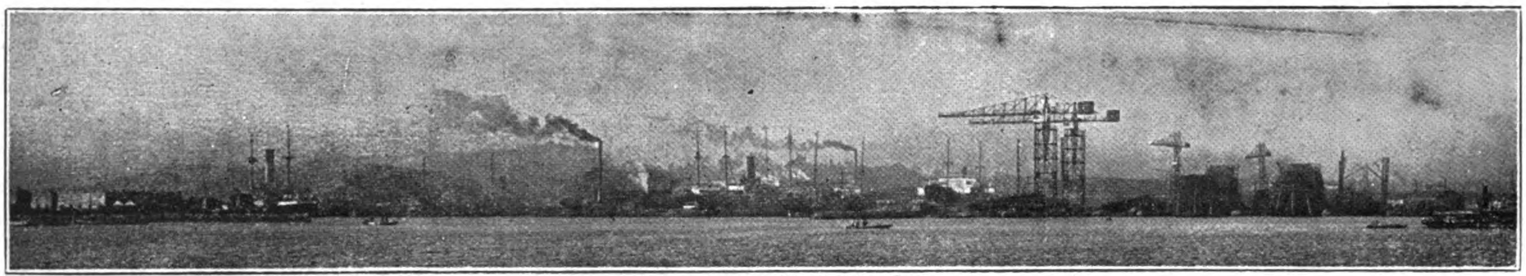
FUKIAI, KOBE
Plate Mill

BUILDERS OF

BATTLESHIPS, CRUISERS, TORPEDO-BOATS, DESTROYERS, SUBMARINES

ALSO, BUILDERS OF

FIRST-CLASS HIGH-SPEED OCEAN STEAMERS OF THE LARGEST SIZE AND POWER



View of Yokohama Dock Co., Ltd.

THE YOKOHAMA DOCK COMPANY, LTD.

Dock Owners, Shipbuilders, Repairers, Engineers, Machinists, Boiler Makers and Warehousemen.
Operating Dockyard, Shipbuilding Yard and Storage Warehouses at Yokohama, Japan.

Head Office: Nagasumi-cho :: *Warehouse Office:* Midori-cho

Builders for
United States Shipping Board,
Japanese Navy,
Nippon Yusen Kaisha,
and other Principal Shipowners

Cable Address:
"DOCK"
Code Used:
A. 1. A.B.C. 4th and 5th, Bentley's

DRY DOCKS:

No. 1	... ...	625′ × 80′ × 28′
No. 2	... ...	380′ × 50′ × 26′
No. 3	... ...	480′ × 63′ × 21½′

SHIPBUILDING BERTHS:

No. 1	... ...	400′ × 27′
No. 2	... ...	490′ × 30′
No. 3	... ...	580′ × 36′
No. 4 } No. 5 }	... ...	680′ × 38′

WAREHOUSES:		TSUBO.
Iron Building	... ...	8,871.57
Concrete Building	... ...	1,636.99
Brick Building ...	... ...	2,011.72
Others	... ...	5,807.74

Directors: TOSHINOBU SUDA, Esq. *(Chairman)*, MANKICHI MIYANAGA, Esq. *(Managing Business Dept.)*, TAMATARO TOJO, Esq. *(Managing Shop Dept.)*

Agencies: NIPPON YUSEN KAISHA, London Branch. NIPPON YUSEN KAISHA, New York Branch.

All situated in Yokohama Harbour, the First Port at which Trans-Pacific Steamships arrive, and the Last Port from which they depart.

Complete Facilities for Every Work and Fully Equipped up to date for

All Repairing Work. All Engine Work. All New Ship Work. All Boiler Work.

AWARDED GRAND PRIZE OF HONOUR
PANAMA PACIFIC EXHIBITION, SAN FRANCISCO, 1915.
MOST POPULAR **BEER** IN THE ORIENT

ASAHI YEBISU SAPPORO

BREWED BY

THE DAI NIPPON BREWERY CO., LTD.

HEAD OFFICE: TOKYO
BRANCHES OSAKA, SAPPORO, SEOUL, SHANGHAI, TSINGTAO.
SOLD EVERYWHERE
Agents: MITSUI BUSSAN KAISHA,
China, Straits Settlements, Dutch East Indies, and British India

---

CANADIAN CARBIDE GIVES MORE GAS PER POUND

AND GAS IS WHAT YOU ARE BUYING

Export Drum with Wood over Cask

Years of manufacturing experience, plus facilities for quantity production assure highest gas yield and moderate prices.

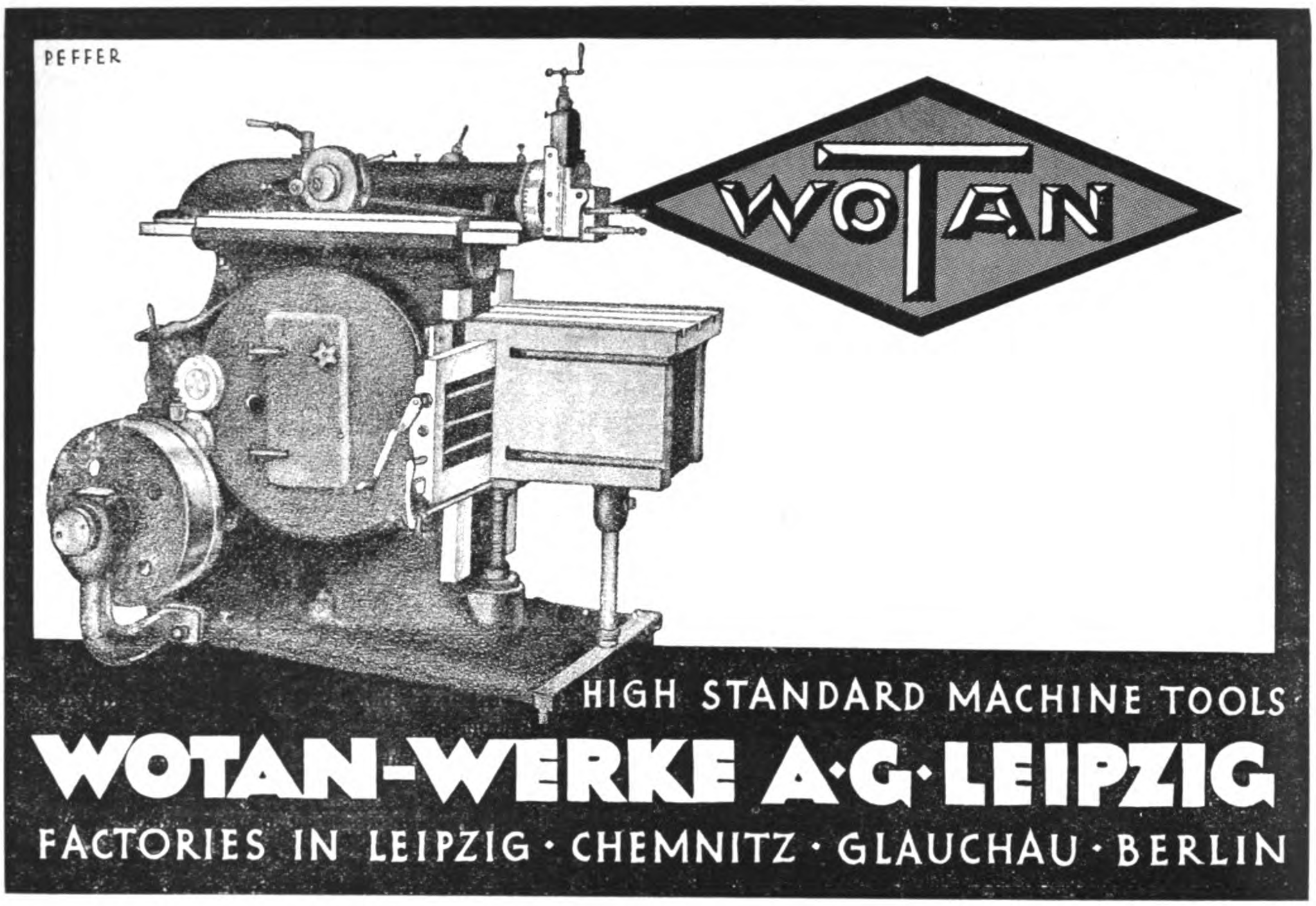
CANADA CARBIDE CO., LTD.

Power Building, MONTREAL, CANADA.

Manufacturers and Exporters of

"S" BRAND HIGH-GRADE CARBIDE OF CALCIUM

Cable Address: CARBIDE, Montreal, Canada
Western Union, Bentley's and A.B.C. 5th Edition Codes.



The Wotan Manufacturing Programme includes:

Wotan S.S.S. High Speed Lathes

Wotan Cone and Single Pulley Heavy Duty Crank Shapers

Wotan Planing Machines

Wotan Plain and Universal Millers

Wotan Vertical and Horizontal Surface Grinders

Wotan Universal Circular and Internal Grinding Machines

Wotan High Power Hack Saws

WOTAN-WERKE A.-G., LEIPZIG (Germany)

Works in

Leipzig — Glauchau — Chemnitz — Berlin

A.B.C. Code 5th and 6th ed. Correspondence also in English

Siemens China Company

SHANGHAI, 24 KIANGSE ROAD (C.P.O. Box 1040)

Telegraphic Address : Electrical Department, "MOTOR," Shanghai

Telegraphic Address : Railway and Mining Department, "BERGBAU," Shanghai

Branches : PEKING, TIENTSIN, MUKDEN, HARBIN, HANKOW, TSINANFU, NANKING, AMOY, HONGKONG

Representatives in other important places throughout China

A LARGE STAFF OF EXPERIENCED ENGINEERS ON HAND FOR EVERY KIND OF TECHNICAL ENTERPRISES, ESPECIALLY ELECTRICITY, RAILWAY AND MINING

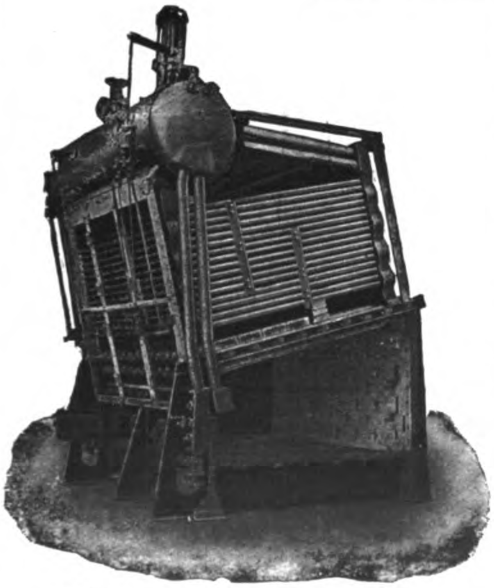
Agents for :

Siemens-Schuckert-Werke, Berlin
Siemens & Halske, A. G., Berlin
Protos-Automobil-Werke, Berlin
East-Asiatic-Wireless Telegraph Co., Telefunken
Deutsch-Luxemburgische Bergwerks- & Huetten A. G., Dortmund
Gelsenkirchener Bergwerks A. G., Gelsenkirchen
Bochumer Verein fuer Bergbau- and Gusstahlfabrikation, Bochum
"Allkog" Allgemeine Kohle-Verwertungs-Gesellschaft, Berlin
Konsortium Luftbild-Stereographik, G.m.b.H., Muenchen

BABCOCK & WILCOX, LIMITED

PATENT WATER-TUBE STEAM BOILERS

SUITABLE FOR ALL INDUSTRIES, AND FOR BURNING ANY KIND OF FUEL
ALSO MAKERS OF "EXPRESS" TYPE LIGHT-WEIGHT BOILERS



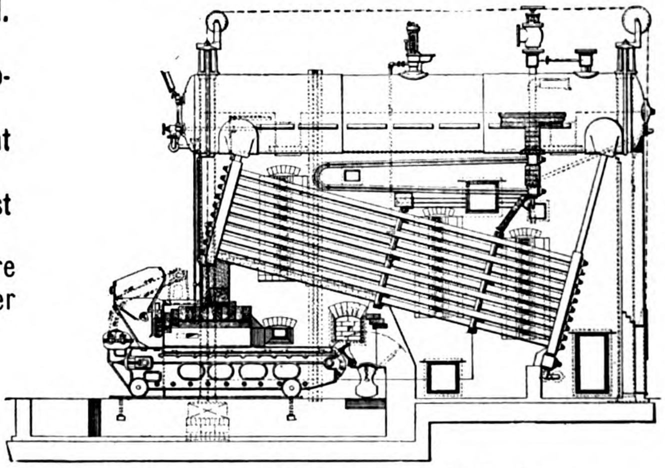
Babcock & Wilcox Marine Boiler

ADVANTAGES:

Simple in Design. Easy to Clean
Constructed of Wrought Steel. Rapid Steam Raiser
Economical in coal. Economical in Repairs
Very Durable. All Straight Tubes
No Screwed Joints. No Cast Metal
No Joints exposed to the Fire
Rapid Circulation of Water
Steady Water Level
Ample Steam Space

Largely installed in China and Japan

24,000,000 H.P. FOR LAND AND MARINE WORK INSTALLED OR ON ORDER.



BABCOCK & WILCOX LAND BOILER, fitted with Patent Superheater and Chain Grate Stoker
For Burning Chinese and Japanese Coal Smokelessly

Complete Steam Piping Plants and all Boiler House Accessories

Head Office in China: 1 THE BUND, SHANGHAI
" " Japan: MEIKAI BUILDING, 32 AKASHI-MACHI, KOBE

MANUFACTURERS OF

Steam Superheaters
Feed-Water Heaters
Coal Conveyors
Suction Ash Plants
Economisers
Water Softeners and Purifiers
Structural Work
Liquid Fuel Equipment
Mechanical Stokers
Steel Chimneys
Electric and Oil-driven Cranes

Standard Structural

Shapes

Beams—6 to 12 inches inclusive.
Channels—5 to 15 inches inclusive.
Angles—3 to 6 inches inclusive.

Ship Channels and Bulb Angles

We offer unexcelled facilities and service to the trade on Standard Materials, Plates, Shapes, Bars, also on Semi-finished Material and Pig Iron. Your inquiries regarding these products are solicited.

UNITED STATES STEEL PRODUCTS CO.

30 Church Street, New York, N. Y.

Shanghai Office:
Union Building—1 Canton Road

Tokyo Office:
Yusen Building, Marunouchi

MITSUBISHI IRON AND STEEL CO., LTD.

(MITSUBISHI SEITETSU KAISHA, LTD.)

HEAD OFFICE: MARUNOUCHI, TOKYO

CAPITAL (PAID UP): YEN 30,000,000

MILL (LLOYD'S APPROVED): KENJIHO, CHOSEN (KOREA)

PRODUCTS:—PIG IRON—Basic & Foundry 100,000 tons.

STEEL—High Tensile & Mild Steel 50,000 tons.

BY-PRODUCTS—Sulphate of Ammonia; Pitch; Naphthalene; Tar Oil (light, middle, heavy); Slag-Cement; Slag Wool.

Sales Agents: **The Mitsubishi Trading Company, Limited**

BRANCHES AND AGENCIES: Tokyo, Yokohama, Nagoya, Osaka, Kobe, Moji, Wakamatsu, Karatsu, Nagasaki, Otaru, Tsuruga, Kure, Muroran, Hakodate, Kushiro, Vladivostok, Dairen, Kirin, Harbin, Peking, Shanghai, Hankow, Hongkong, Canton, Tientsin, Tsingtao, Tsinan, Singapore, London, Paris, Lyons, Marseilles, Berlin, New York, Seattle.

MITSUBISHI MARINE & FIRE INSURANCE Co., Ltd.

MITSUBISHI KAIJO KASAI HOKEN K. KAISHA

Head Office:

MARUNOUCHI, TOKYO

SUBSCRIBED CAPITAL - - Yen 5,000,000
PAID-UP CAPITAL - - - „ 1,250,000

Branches and Agencies:

LONDON, NEW YORK, OSAKA, KOBE, SHANGHAI, AND OTHER IMPORTANT CITIES AND PORTS IN THE WORLD

MITSUBISHI WAREHOUSE CO., LD.

(MITSUBISHI SOKO KAISHA, LTD.)

LANDING, SHIPPING AND FORWARDING AGENTS, STEVEDORES, CUSTOMS BROKERS & WAREHOUSEMEN

Head Office: MARUNOUCHI, TOKYO

Branches: TOKYO, YOKOHAMA, KOBE, OSAKA AND MOJI

General Managers of the

KYODO UNYU KAISHA

YOKOHAMA

3 KAIGAN-DORI, ITCHOME
YOKOHAMA
WITH TWO BRANCHES IN TOKYO

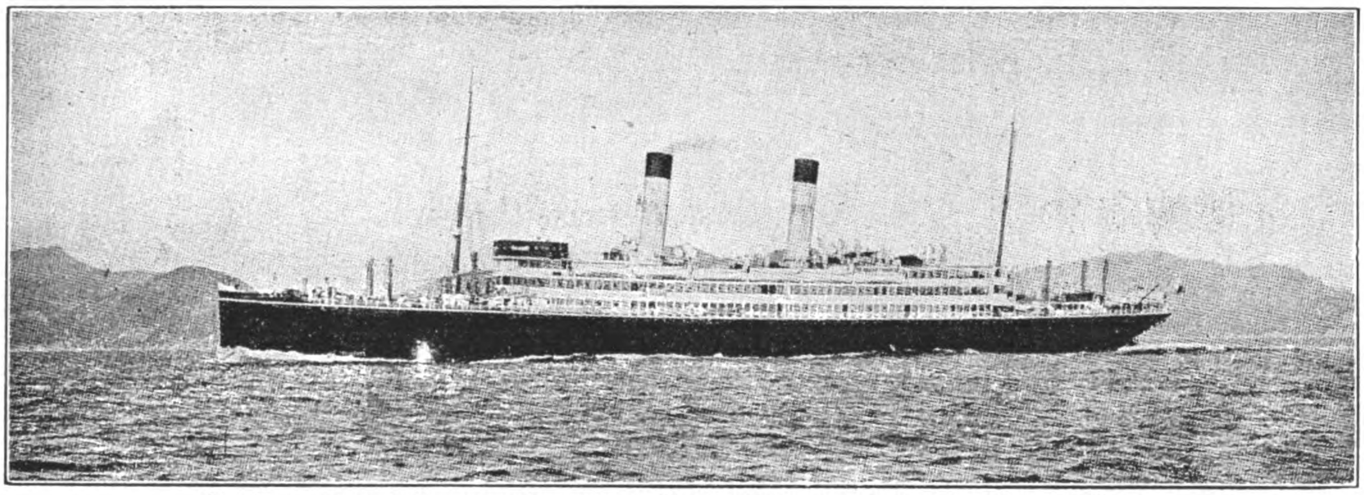
The Brill Model 75 Gasoline Car, which seats 56 passengers, develops 193 H.P. at 1,300 R.P.M. and is capable of hauling a 60-passenger Trailer. Weight of motor car, 21 tons.

The J. G. Brill Company

Philadelphia, U.S.A.

Cable Address: "Brill" Philadelphia

Builders of Electric Railway Cars and Trucks, Gas-electric and Gasoline-propelled Cars.



The *Tenyo Maru*, built and engined by the Mitsubishi Zosen Kaisha, Ltd., Nagasaki Works

MITSUBISHI ZOSEN KAISHA, LTD., NAGASAKI WORKS

(ex Mitsubishi Dockyard & Engine Works, Nagasaki)

DOCK No. 1			DOCK No. 2			DOCK No. 3		
Extreme Length	523	Ft.	Extreme Length	371	Ft.	Extreme Length	728.9	Ft.
Length on Blocks	513	,,	Length on Blocks	350	,,	Length on Blocks	714	,,
Width of Entrance on Top	89	,,	Width of Entrance on Top	66	,,	Width of Entrance on Top	99½	,,
,, ,, ,, ,, Bottom	77	,,	,, ,, ,, ,, Bottom	53	,,	,, ,, ,, ,, Bottom	88½	,,
Water on Blocks at Spring Tide	26½	,,	Water on Blocks at Spring Tide	24	,,	Water on Blocks at Spring Tide	34½	,,

THE BEST EQUIPPED SHIPBUILDING PLANT IN THE FAR EAST

With Special Facilities for Handling the Heaviest Castings and the Repairing or Building of Ships, Engines, and Boilers
Also Electrical Work

LARGE STOCK OF MATERIAL AND FITTINGS ALWAYS ON HAND

TOSHIN SOKO

KABUSHIKI KAISHA

(THE TOSHIN WAREHOUSE CO., LTD.)

WAREHOUSEMEN, FORWARDING, LANDING, AND SHIPPING AGENTS

STEVEDORES AND CUSTOMS BROKERS

WAREHOUSING AREA - - - - - - -	76,000 tsubo (27,000,000 Sq. Ft.)
VALUE OF GOODS IN WAREHOUSE (latest date) - - - -	Yen 150,000,000
CAPITAL -	Yen 15,000,000

President: BARON TOSHITARO MITSUI

Managing Directors: H. OKUMURA and R. KADONO

Directors: K. HAYASHI and K. FUKUI

Auditors: Y. KOSHI and T. MAJIMA

HEAD OFFICE: No. 5 HONKAWAYA-CHO, NIHONBASHI-KU, TOKYO

BRANCHES and SUB-BRANCHES:

TOKYO—Nihonbashi, Fukagawa, Shibaura.

OSAKA—Nakanoshima, Nishi, Utsubo, Ajikawa, Sakurashima Chikko

YOKOHAMA—Shinko-cho

NAGOYA—TSUKIJI, YOKKAICHI

KOBE—Kano-cho

MOJI—Hama-cho

SHIMONOSEKI—Kannonzaki-cho

AMERICAN ORIENTAL MAIL LINE

TRANS-PACIFIC PASSENGER AND EXPRESS SERVICE

THE FIVE STARS OF THE PACIFIC:

President Grant—President Madison—President McKinley—President Jefferson—President Jackson

SAILING EVERY 12 DAYS

To Seattle via Kobe, Yokohama and Victoria and to Hongkong and Manila

AMERICAN ORIENTAL MAIL LINE

operated for United States Shipping Board by Admiral Oriental Line, Managing Agents

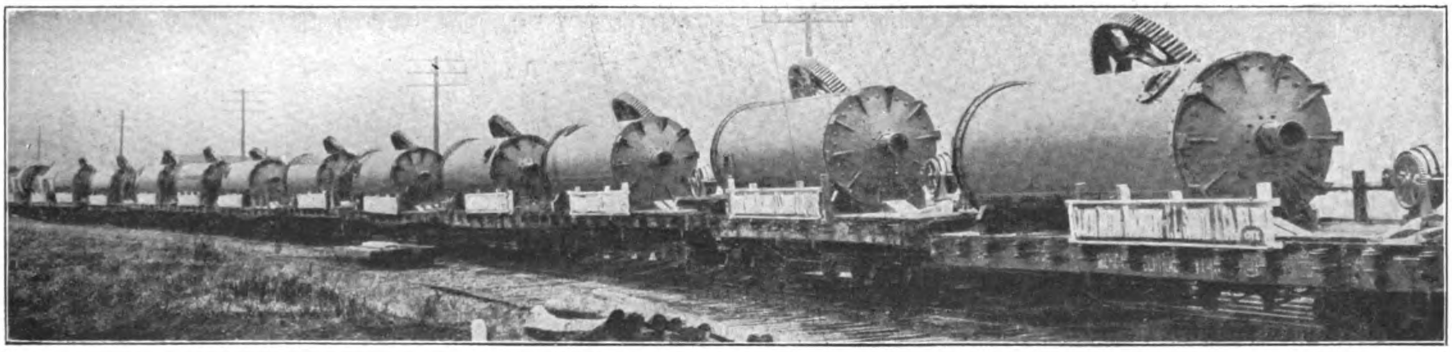
YOKOHAMA KOBE SHANGHAI HONGKONG MANILA

F. L. SMIDTH & Co.

PEKING—CHINA

Telegraphic Address: "FOLASMIDTH," PEKING
Head Office: 33 VESTERGADE, COPENHAGEN

LONDON—SYDNEY—PARIS—RIO DE JANEIRO—TURIN—NEW YORK—BIELSKO—TOKYO



A Shipment of Rotary Tube Mills

MACHINERY FOR CEMENT WORKS

LIME WORKS, BRICK WORKS, NODULISING PLANTS FOR IRON ORE AND VARIOUS MINING INDUSTRIES

More than 300 Rotary kilns, with a total yearly output of 60,000,000 Barrels, have been supplied and 5,000 grinding plants equipped with our Machinery

Osaka Shosen Kaisha

(Osaka Mercantile Steamship Co.)

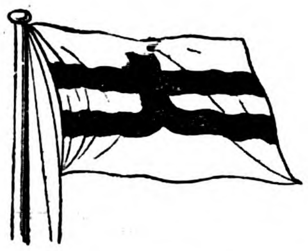
HEAD OFFICE: OSAKA, JAPAN

Cable Address: "SHOSEN, OSAKA."

Branches and Agencies at all the important ports in the World.

Codes Used: A1, A.B.C. 5th Ed.,

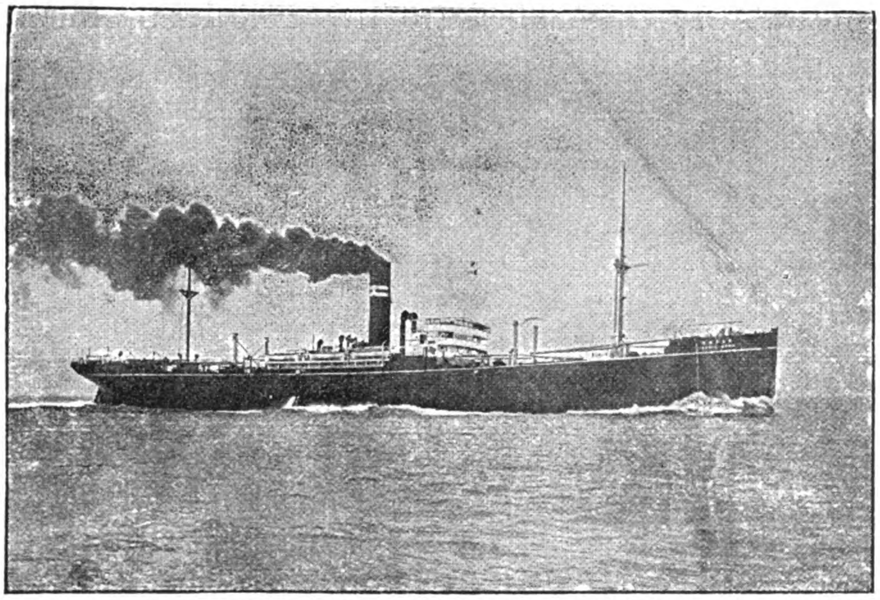
Scott's 10th Ed. & Bentley's.



Capital: Y. 100,000,000

Reserves: Y. 66,000,000

40 Regular Lines with a Fleet of 500,000 Tons Gross.



PRINCIPAL REGULAR LINES:

JAPAN-EUROPE LINE (via Suez)—Monthly—Ports of Call: Yokohama, Kobe, Moji, Shanghai, Hongkong, Singapore, Colombo, Port Said, Marseilles, London, Antwerp, Rotterdam and Hamburg.

JAVA-EUROPE LINE:—Monthly—Ports of Call: Sourabaya, Padan, Colombo, Port Sudan, Suez, Genoa, Marseilles, Antwerp and Hamburg.

CALCUTTA-NEW ORLEANS LINE: 7 sailings per annum—Ports of Call: Calcutta, Singapore, Hongkong, Nagasaki, Kobe, Yokohama, San Francisco, Balboa, Cristbal, Cienfuegos and New Orleans.

SINGAPORE-NEW YORK LINE:—Monthly—Ports of Call: Singapore, Hongkong, Shanghai, Moji, Kobe, Yokohama, San Francisco, Balboa, Cristbal, Havana and New York.

JAPAN-BOMBAY LINE:—Fortnightly—Ports of Call: Yokohama, Yokkaichi, Osaka, Kobe, Moji, Hongkong, Singapore, Colombo and Bombay.

HONGKONG-PUGET SOUND LINE:—Fortnightly—Ports of Call: Hongkong, Manila, Keelung, Shanghai, Nagasaki, Kobe, Yokkaichi, Shimizu, Yokohama, Victoria, Seattle, Tacoma and Vancouver.

JAPAN SOUTH AMERICA LINE:—Monthly—Ports of Call: Yokohama, Kobe, Nagasaki, Hongkong, Singapore, Colombo, Mauritius, Durban, Cape Town, Rio de Janeiro, Santos and Buenos Ayres.

JAPAN-AUSTRALIA LINE:—Monthly—Ports of Call: Yokohama, Kobe, Osaka, Moji, Hongkong, Manila, Sydney, Melbourne and Adelaide.

JAPAN-JAVA LINE:—Monthly—Ports of Call: Osaka, Kobe, Moji, Keelung, Manila, Sandakan, Tawao, Batavia, Sourabaya and Macassar.

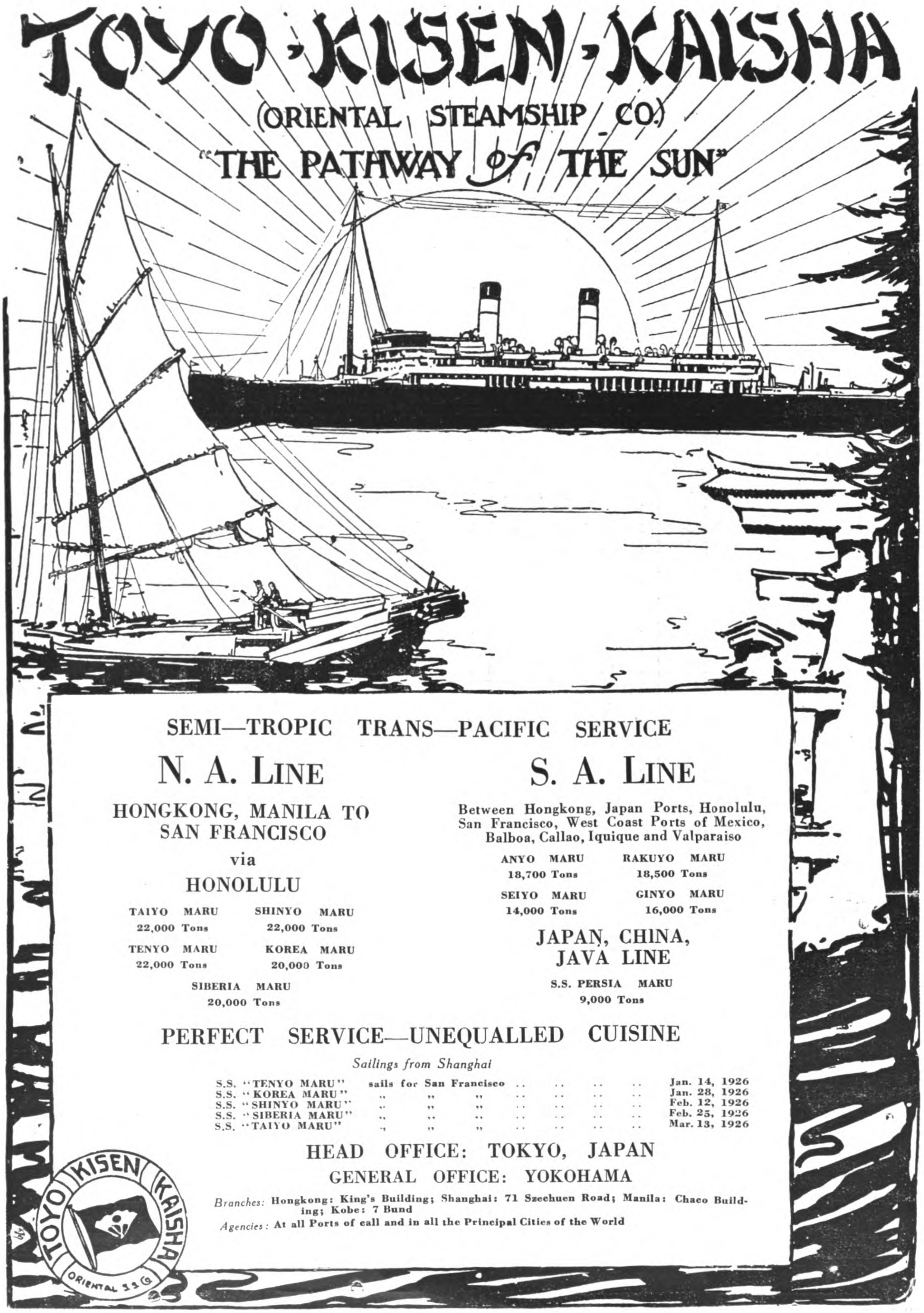
SERVICES TO CHINA.—

OSAKA—Dairen Line.—Semi-Weekly.
OSAKA—Tientsin Line.—6 Sailings per month.
OSAKA—Tsingtau Line.—2 Sailings per month.
YOKOHAMA—Dairen-Tientsin Line.—About 8 Sailings per month.
TAKAO—Tientsin Line.—2 Sailings per month.
Keelung-Hongkong Line.—Weekly.

Besides the above mentioned, Mail and Passenger Services are maintained by over THIRTY-FIVE REGULAR LINES, calling at all important ports in JAPAN, as well as STRAITS, DUTCH EAST-INDIES, FORMOSA, CHINA, KOREA, Etc., Etc.

COMPANY'S LOCAL OFFICES IN CHINA

AMOY, CANTON, FOOCHOW, HANKOW, SHANGHAI, TIENTSIN, DAIREN, HONGKONG



TOYO KISEN KAISHA
(ORIENTAL STEAMSHIP CO.)
"THE PATHWAY of THE SUN"
SEMI—TROPIC TRANS—PACIFIC SERVICE
N. A. LINE
HONGKONG, MANILA TO SAN FRANCISCO
via
HONOLULU
TAIYO MARU 22,000 Tons
SHINYO MARU 22,000 Tons
TENYO MARU 22,000 Tons
KOREA MARU 20,000 Tons
SIBERIA MARU 20,000 Tons
S. A. LINE
Between Hongkong, Japan Ports, Honolulu, San Francisco, West Coast Ports of Mexico, Balboa, Callao, Iquique and Valparaiso
ANYO MARU 18,700 Tons
RAKUYO MARU 18,500 Tons
SEIYO MARU 14,000 Tons
GINYO MARU 16,000 Tons
JAPAN, CHINA, JAVA LINE
S.S. PERSIA MARU 9,000 Tons
PERFECT SERVICE—UNEQUALLED CUISINE
Sailings from Shanghai
S.S. "TENYO MARU" sails for San Francisco .. .. Jan. 14, 1926
S.S. "KOREA MARU" " " " .. .. Jan. 28, 1926
S.S. "SHINYO MARU" " " " .. .. Feb. 12, 1926
S.S. "SIBERIA MARU" " " " .. .. Feb. 25, 1926
S.S. "TAIYO MARU" " " " .. .. Mar. 13, 1926
HEAD OFFICE: TOKYO, JAPAN
GENERAL OFFICE: YOKOHAMA
Branches: Hongkong: King's Building; Shanghai: 71 Szechuen Road; Manila: Chaco Building; Kobe: 7 Bund
Agencies: At all Ports of call and in all the Principal Cities of the World
TOYO KISEN KAISHA
ORIENTAL S.S. Co.

BUTTERFIELD & SWIRE

FRENCH BUND, SHANGHAI
Telephone No. Central 4881
AGENTS FOR

Amoy, Antung, Canton, Changsha, Chefoo, Chinkiang, Chungking, Dalny, Hankow, Harbin, Hongkong, Ichang, Kiukiang, Kobe, Nanking, Newchwang, Ningpo, Shanghai, Shasi, Swatow, Tientsin, Tsingtao, Wuhu, Yokohama

BLUE FUNNEL LINE

Fast Services: Japan, China, Hongkong, Philippines, Straits and Java to Europe via Suez Canal and to New York via Suez and Panama Canals also Trans-Pacific between Oriental ports and West Coast of N. America.

CANADIAN GOVERNMENT MERCHANT MARINE

WORLD-WIDE CARGO SERVICES :—REGULAR MONTHLY SERVICES TO AND FROM MONTREAL and VANCOUVER connecting with Straits Settlements, Hongkong, China and Japan, etc.

CHINA NAVIGATION CO., LTD.

Passenger and Freight Steamship Services

SHANGHAI TO, AND FROM,

Weihaiwei, Chefoo and Tientsin (for Peking): Tsingtao, Newchwang; Antung.

Hankow, Ichang, Chungking. Changsha. and Intermediate Yangtze Ports.

Hongkong and Canton; Amoy and Swatow; Ningpo; and General Coasting Services.

HONGKONG TO, AND FROM,

Weihaiwei, Chefoo and Tientsin (for Peking)

Canton; Hoihow, Pakhoi and Haiphong; Bangkok and Singapore.

Amoy and Swatow.

Shanghai and Yangtze Ports (as above)

Sydney, Melbourne and Australian Ports (Australian-Oriental Line)

TAIKOO SUGAR REFINING CO., LTD.

FINEST CANE SUGARS

TAIKOO DOCKYARD & ENGINEERING COMPANY OF HONGKONG LIMITED

Ship Builders, Ship Repairers, Engine Builders, Boiler Makers, etc.

INSURANCE FIRE AND MARINE

Fire

London and Lancashire Insurance Co., Ltd.
Royal Exchange Assurance Corporation.
Guardian Assurance Co., Ld.
Orient Insurance Company.
British Traders Insurance Co., Ltd.
Sea Insurance Co., Ltd.

Marine

British and Foreign Marine Insurance Co., Ltd.
Standard Marine Insurance Co., Ltd.
Royal Exchange Assurance Corporation.
Sea Insurance Co., Ltd.
Guardian Assurance Co., Ltd.

KOKUSAI KISEN KAISHA

Nominal Capital	- -	Yen 100,000,000.00
Paid-up Capital	- -	„ 87,500,000.00
Aggregate Tonnage	- -	500,000 Tons

FLEET OF STEAMSHIPS

Name	Tons D.W.	Name	Tons D.W.
Rozan-Maru	8,700	Capetown-Maru	9,100
Vancouver-Maru	9,100	Suez-Maru	6,600
Boston-Maru	8,800	Daio-Maru	9,000
Tofuku-Maru	9,100	Kashu-Maru	8,800
Chifuku-Maru	9,100	No. 2 Kifunesan-Maru	5,000
Ryufuku-Maru	9,100	Yousan-Maru	5,000
Hankow-Maru	6,400	Taisan-Maru	5,000
Yoni-Maru	11,000	Yuri-Maru	11,000
Taibu-Maru	8,900	Texas-Maru	11,000
San Francisco-Maru	9,100	Tamatsu-Maru	6,600
Naple-Maru	9,100	Eifuku-Maru	9,100
Glasgow-Maru	9,100	Kifuku-Maru	9,100
Yayoi-Maru	8,700	Toyofuku-Maru	9,000
Yaye-Maru	11,000	Raifuku-Maru	9,100
Malta-Maru	8,700	Keifuku-Maru	9,100
Buyo-Maru	8,800	Washington-Maru	9,100
Brazil-Maru	9,100	Tokufuku-Maru	9,100
Kofuku-Maru	9,100	Portland-Maru	9,100
Yezari-Maru	6,900	England-Maru	9,100
Yugao-Maru	5,000	Chili-Maru	9,100
Yubaye-Maru	5,000	Argentine-Maru	9,100
Sydney-Maru	6,400	Port Said-Maru	9,100
Shanghai-Maru	6,400	New York-Maru	9,100
Singapore-Maru	9,100	Karorin-Maru	6,400
Jyufuku-Maru	9,100	Tasmania-Maru	6,400
Hiyeizan-Maru	6,700		

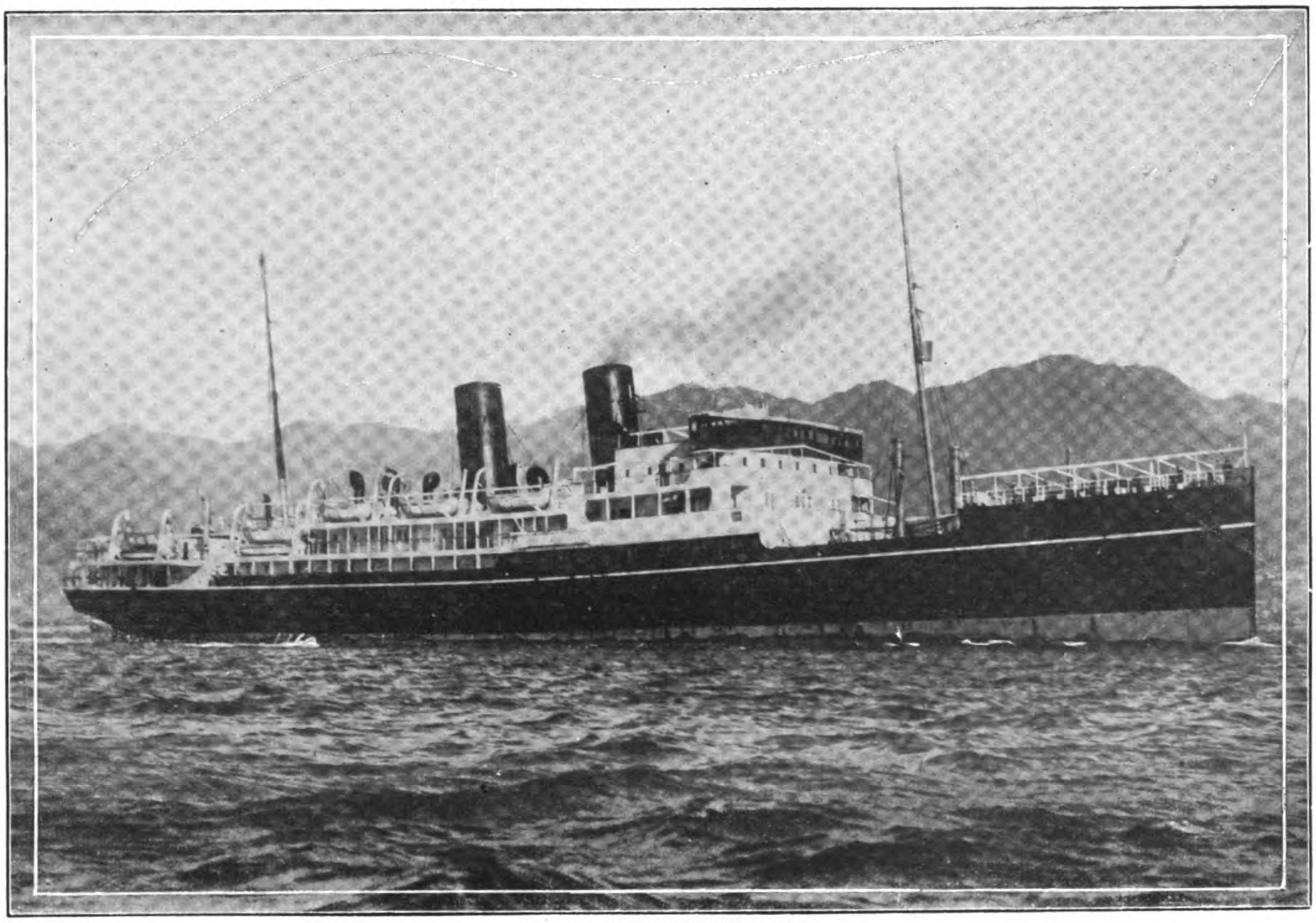
Head Office: No. 8 Kaigan-dori, Kobe

BRANCH OFFICE:

Tokyo Kaijo Building, Maruno-uchi, Tokyo, Japan

N. Y. K. LINE

(NIPPON YUSEN KAISHA)
HEAD OFFICE: TOKYO, JAPAN



The s.s. "Nagasaki Maru"

CHINA-JAPAN RAPID EXPRESS-SERVICE

"NAGASAKI MARU" AND "SHANGHAI MARU"

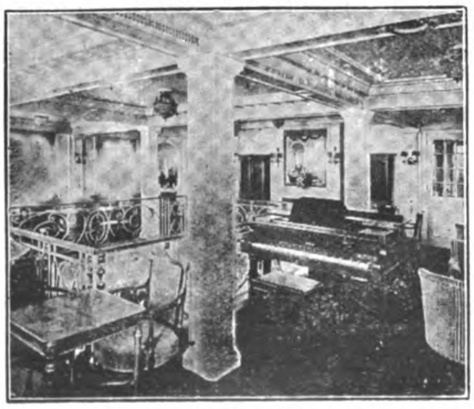
on the Service between

SHANGHAI—NAGASAKI—KOBE

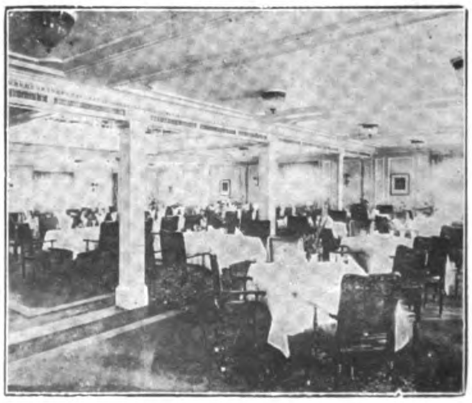
SAILING EVERY FOUR DAYS

COMFORT — CLEANLINESS — COURTESY

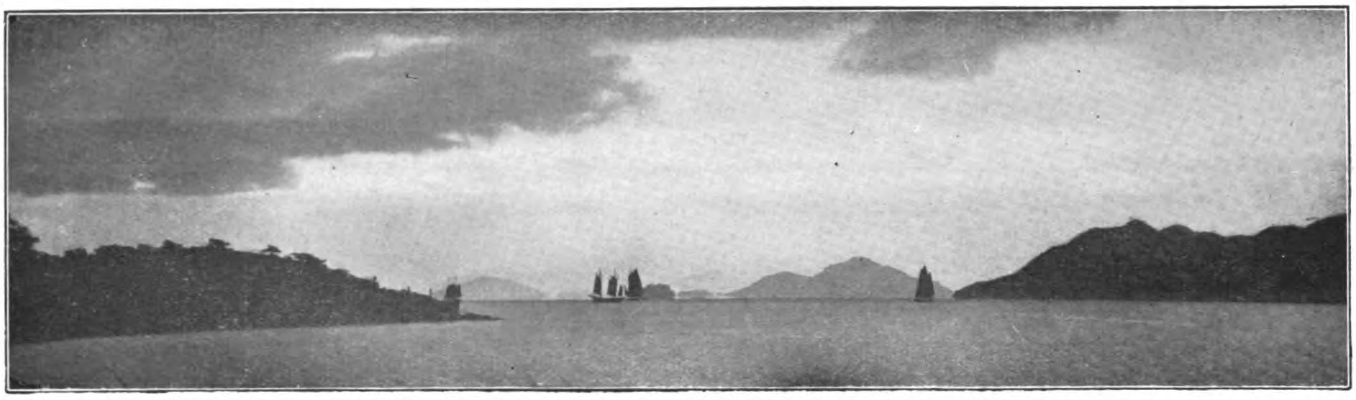
Smoking Room



Social Hall



Dining Saloon



No matter how often it is passed through, the Inland Sea always gives the traveller a fascinating trip.

Special Advantages and Facilities Offered by this Service

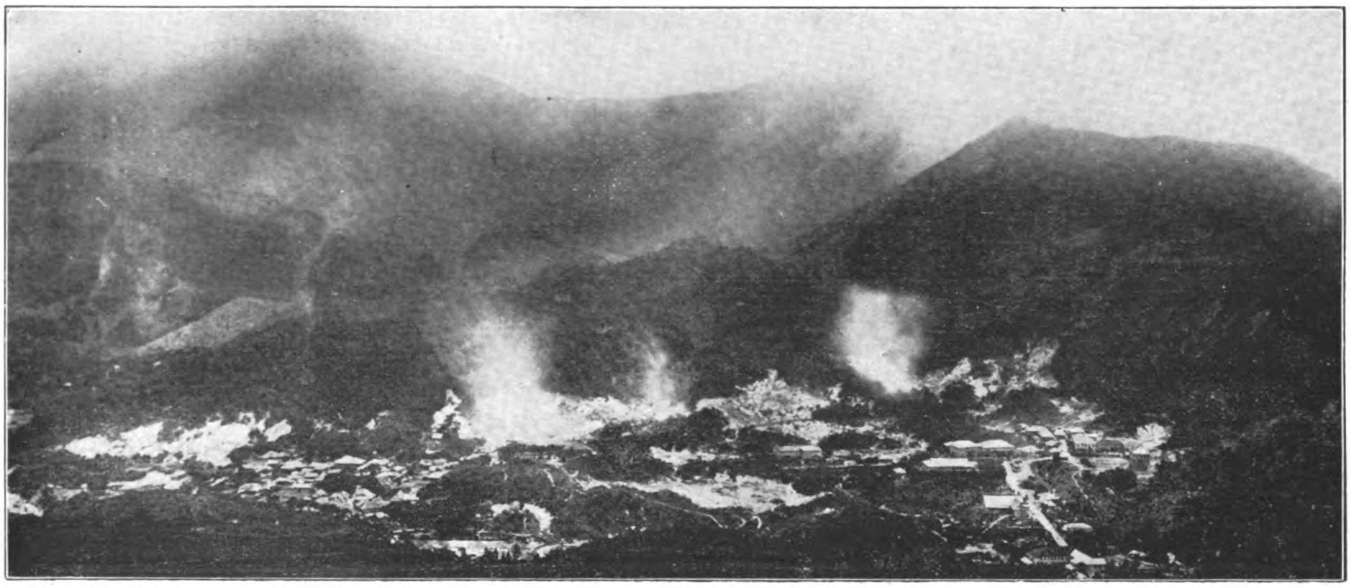
Exceptional Speed, Comfort and Economy.—Passengers by the splendid liners can be assured of these three requisites in modern travel, as each liner covers the distance between Shanghai and Nagasaki in 26 hours (and between Nagasaki and Kobe in 23 hours)—the fastest time that can be made by any steamer in the Far East—and that in perfect comfort and economy.

The Inland Sea of Japan.—Special advantage offered by this service is that the sailing of these steamers is so timed that the fascinating Inland Sea of Japan is passed through in daylight, and passengers are thus enabled to enjoy that world-famous scenic beauty to their hearts' content.

Unzen Park.—Passengers will also be brought within easy reach of many points of interest, scenic or otherwise, in central and southern parts of Japan, especially Unzen Park in the mountains near Nagasaki. The Park boasts splendid scenery, hot springs, golf-links and other all-the-year round attractions. The fame of Unzen as an ideal summer resort is now firmly established. Flaming azaleas and fresh verdure in the spring, autumnal tints and the "Silver Thaw" in the winter add glory to the place.

For Passage and Particulars Please Apply to:

N.Y.K. No. 3 North Yangtze Road, Shanghai.
N.Y.K. Ticket Office, Palace Hotel, Shanghai.



Unzen Park abounds with hot springs of highly medicinal properties, the water of which is piped to the baths in the hotels. Many solfataras bubble and hiss. Superheated steam and sulpurous gases rise from the numerous fumaroles. These wonderful spectacles combined with manifold other attractions make a visit to Unzen very interesting.

Chartered Bank of India, Australia and China

(INCORPORATED IN ENGLAND BY ROYAL CHARTER, 1853)

Capital **£3,000,000**
Reserve Fund **£4,000,000**

Head Office: 38 BISHOPSGATE, LONDON, E.C.
Shanghai Branch: 18 THE BUND.

Bankers:

THE BANK OF ENGLAND.
MIDLAND BANK, LTD.
WESTMINSTER BANK, LTD.
NATIONAL PROVINCIAL BANK, LTD.
THE NATIONAL BANK OF SCOTLAND, LTD.

Agencies and Branches:

Alor Star (Kedah)	Canton	Hamburg	Klang	Madras	Rangoon	Taiping (F.M.S.)
Amritsar	Cawnpore	Hankow	Kobe	Manila	Saigon	Tavoy (L. Burma)
Bangkok	Cebu	Hongkong	Kuala-Lumpur (F.M.S.)	Medan	Semarang	Tientsin
Batavia	Colombo	Iloilo	Kuching (Sarawak)	New York	Seremban	Tokyo
Bombay	Delhi	Ipoh		Peking	Shanghai	Tsingtao
Calcutta	Haiphong	Karachi		Penang	Singapore	Yokohama
				Puket	Sourabaya	Zamboanga

Drafts granted on the above Agencies and Branches and also on the principal Commercial Cities throughout the world. Bills of Exchange bought and received for collection. Travellers' Letters of Credit issued and every description of Banking business undertaken.

C. J. SCOTT,
Manager.

ATTWATER & SONS

CANADIAN AND INDIAN MICA—

CUT, SLAB, and SPLITTINGS (Minimum Stock 200,000 lbs.) DYNAMO TAPES, ASBESTOS TAPES, and HOLLOW BRAIDS. EMPIRE CLOTH and LINO TAPES. PURE COTTON DUCKS and DRILLS. ARMATURE BINDING CORDS and ROPES VULCANISED FIBRE EBONITE, SHEET, RODS and TUBES.

PEERLESS LEATHEROID INSULATION

THE GREATEST INSULATING PAPER MADE

"RESISTIT" (SYN. BAKELITE) PAPER, SHEET, & TUBE

PRESSPAHN AND INSULATING PAPERS

ELECTRICAL PURE RUBBER AND ADHESIVE TAPE

Contractors to the Admiralties and War Office, British, American, French and Italian Governments

Hopwood Street Mills, PRESTON, Eng. ESTABLISHED 1868

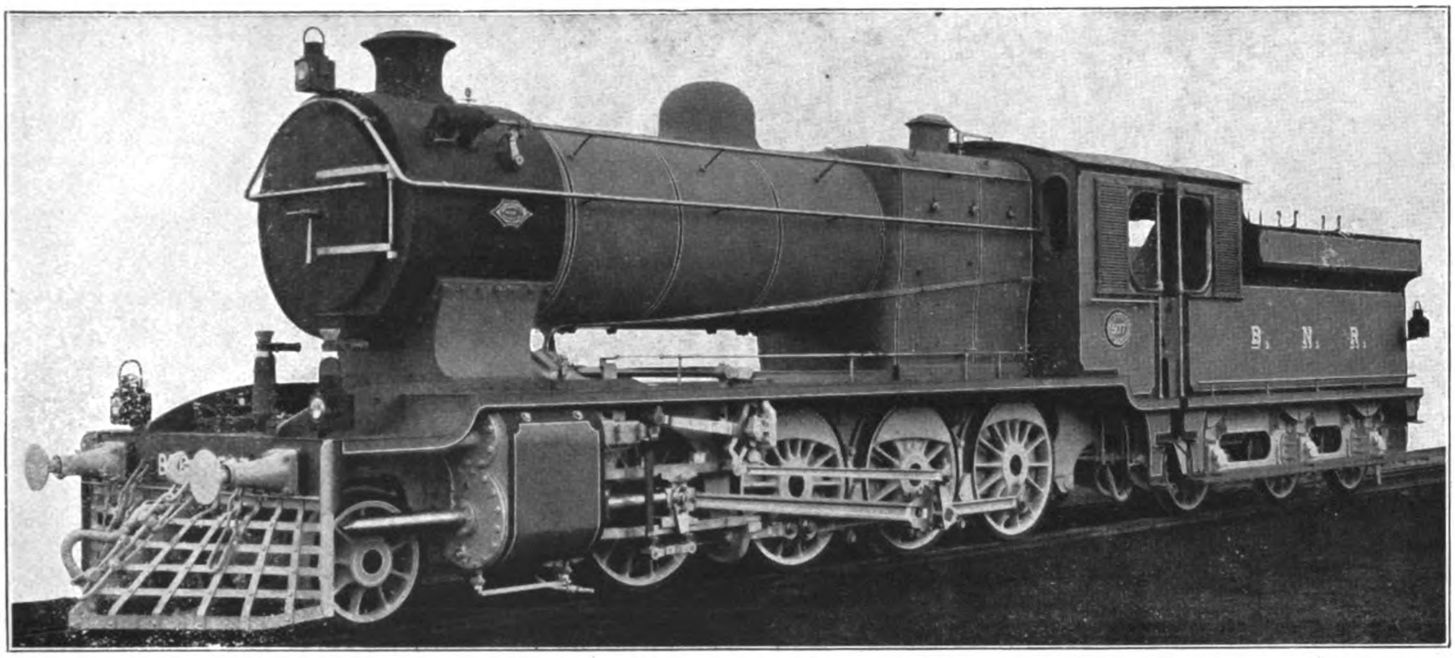
Telegrams: "Attwaters, Preston" *Telephone No.:* 1045 (2 lines) *Codes:* 5th Edition A.B.C., and Western Union

ASSOCIATED BRITISH LOCOMOTIVE MANUFACTURERS FOR CHINA

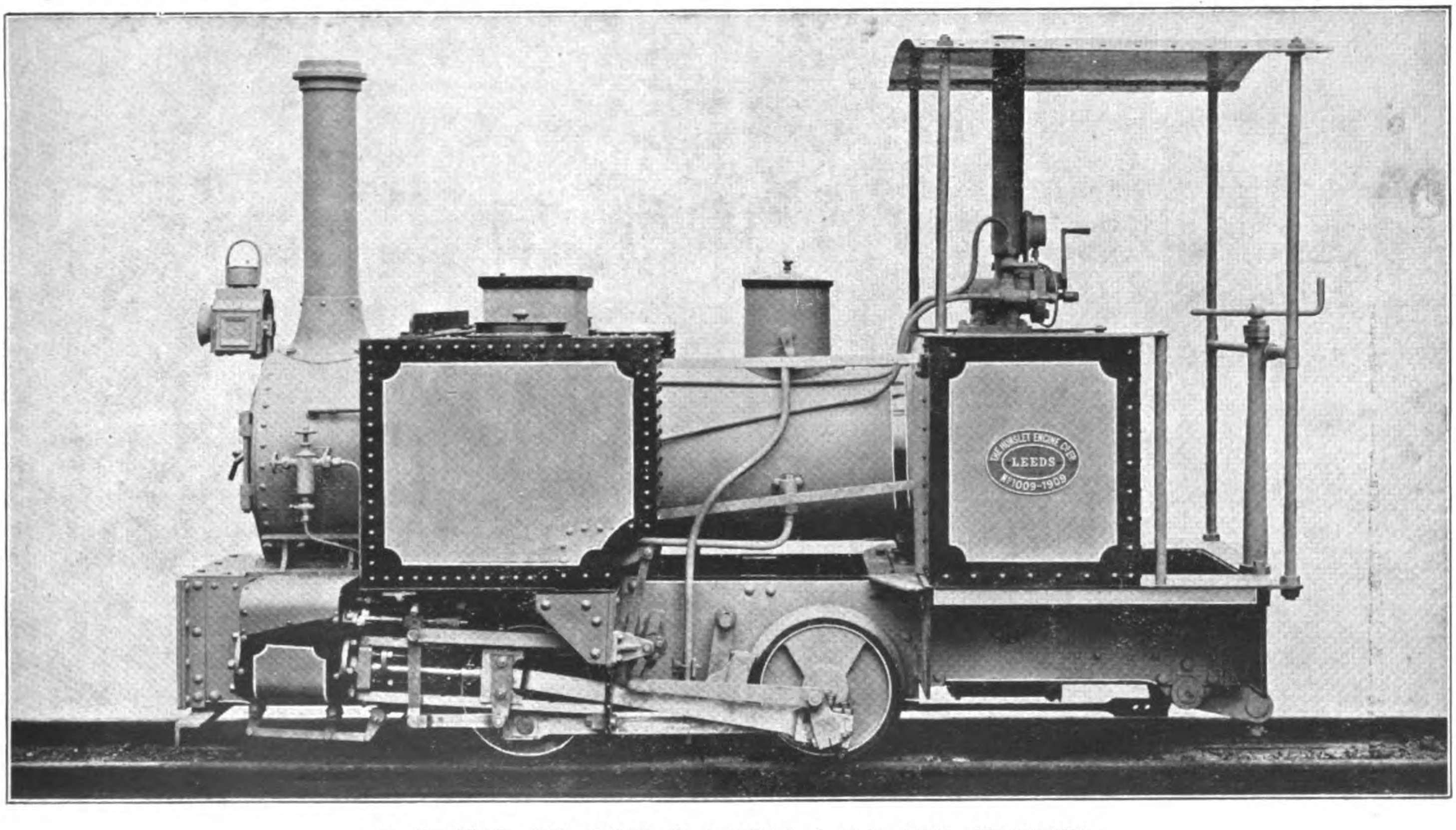
Head Office:
7 HOBART PLACE
GROSVENOR GARDENS
LONDON

Tel. Address:
TRACTION, PEKING

RESIDENT TECHNICAL
REPRESENTATIVE IN PEKING
42 WAI CHIAO PU CHIEH,
EAST CITY, PEKING



ANDREW BARCLAY SONS & CO., LTD.
THE AVONSIDE ENGINE CO., LTD.
W. G. BAGNALL LTD.
BEYER PEACOCK & CO., LTD.
HAWTHORN LESLIE & CO., LTD.
HUDSWELL CLARKE & CO., LTD.
THE HUNSLET ENGINE CO., LTD.
KITSON & CO., LTD.
NASMYTH WILSON & CO., LTD.
THE NORTH BRITISH LOCOMOTIVE CO., LTD.
ROBERT STEPHENSON & CO., LTD.
THE VULCAN FOUNDRY, LTD.
THE YORKSHIRE ENGINE CO., LTD.



AS BUILT AT ONE OF THE A.B.L.M.C. WORKS

Chinese Eastern Railway Publishes New Magazine

Beginning with the 1st of January, 1925, the Chinese Eastern Railway Administration is publishing a monthly illustrated magazine, the "Manchuria Monitor," each issue containing from 100-120 pages in the Russian language with a parallel English text, the Economical Bureau of the Railway being the editor.

The aim of this magazine is to enlighten the questions of economics and civilization in the Far East.

The journal will contain original articles and notes on the character and history of the population, its conditions of life, civilization, industry, finance, transport and natural resources of Far Eastern countries, and chiefly Manchuria, international relations, bibliography, etc.

The first issue will contain the following articles:—

"Ominous heat lightning flashes in Eastern Asia," by G. Diky
"Russia in the Far East," by Prof. N. N. Ustrialoff
"Agricultural importance of Manchuria," by E. E, Yashnoff
"The recent civil war in China," by Porf. V. V. Engelfeld
"The socialist movement in Japan," by N. P. Mazokin
"The Maritime Province in the past few years," by V. Toogoff
"American explorations in Mongolia," by Prof. V.V. Lamansky
"Opportunity for raising soya beans in Russia," by M. D. Gleboff
"Population and Progress," by G. R. Davies
"International Life," by Asiatic
"Sights of Peking," by Prof. N. N. Ustrialoff
"Give a citizen," by E. Lejneff
"Co-operation in the USSR," by G. B.
"The Manchuria Tiger," by Baikoff
"The ruins of Paicheng," by Tolmacheff

A weekly "Economist Bulletin" will be issued as a free supplement to the "Manchuria Monitor," containing orders and regulations regarding the commercial operations of the Chinese Eastern Railway: the most important information in respect of the commercial and industrial life of North Manchuria and neighbouring countries; current information of the activity of the Chinese Eastern Railway and the adjoining railways as regards commercial operations, bulletines of the Harbin Bourse and other important exchange in the country, reviews and notes on the more important economic problems of the Far East and so forth.

Subscription rates to the "Manchuria Monitor" with the "Economist Bulletin" Post free, in Mexican Dollars:

	1 year	*6 months*	*3 months*
Harbin	12.00	6.00	3.50
Other points in China. ...	13.00	7.00	4.00
Other countries	15.00	8.00	5.00

***Address of Editor's Office*: Chinese Eastern Railway Administration, Harbin, Manchuria, China**

AMERICAN BLOWER CO.

(EXPORT DEPARTMENT)

50 CHURCH ST., NEW YORK, U.S.A.

ENGINEERS AND MANUFACTURERS

FANS AND BLOWERS

For Heating, Ventilating, Cooling, Humidifying, De-Humidifying, Mechanical Draft, etc.

DRYING SYSTEMS

For Lumber, Bricks, Fruit and Vegetables, etc.

BLAST EQUIPMENT

For Forges, Furnaces, Cupolas.
Conveying Materials by Air Blast.

STEAM ENGINES

For Blowers, Generators, Pumps, Mechanical Stokers, etc.

STEAM TRAPS

Executive Offices: Detroit, Mich., U.S.A.

Works: Detroit, Mich., U.S.A. Cincinnati, O., U.S.A.

PUBLISHED ANNUALLY

THE LONDON DIRECTORY

with Provincial & Foreign Sections and Trade Headings in Five Languages

enables traders to communicate direct with

MANUFACTURERS AND DEALERS

in London and in the Provincial Towns and Industrial Centres of the United Kingdom and Ireland, the Continent of Europe, Africa, America, Asia, Australasia, etc. The names, addresses and other details are classified under more than 3,000 trade headings, including

EXPORT MERCHANTS

with detailed particulars of the Goods shipped and the Colonial and Foreign Markets supplied;

STEAMSHIP LINES

arranged under the Ports to which they sail, and indicating the approximate Sailings.

One-inch BUSINESS CARDS of Firms desiring to extend their connections or Trade Cards of

DEALERS SEEKING AGENCIES

can be printed at a cost of **£1.10s. 0d.** for each trade heading under which they are inserted. Larger advertisements at £16 per page.

The directory is invaluable to everyone interested in overseas commerce, and a copy will be sent by parcel post for **£2,** net cash with order.

THE LONDON DIRECTORY CO., LTD.

25 Abchurch Lane, London, E.C. 4, England

BUSINESS ESTABLISHED IN 1814.

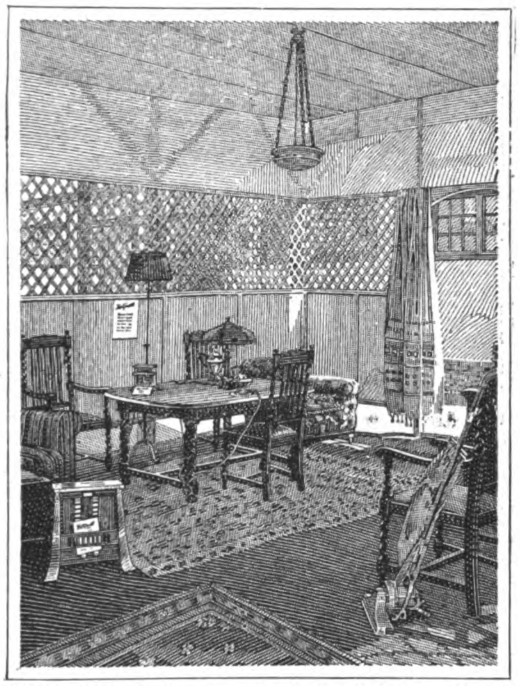


Exhibit of electrical servants by the South African General Electric Company at the Witwatersrand Agricultural Show, Johannesburg, South Africa.

South Africa profits by the service of

GENERAL ELECTRIC

HOME comfort and accomplishment are enhanced—farm and dairy work made easier—by electrical appliances and devices which General Electric has introduced everywhere.

Electrical service, such as promoted by General Electric, marks a new stride in the advance of civilization.

INTERNATIONAL
GENERAL ELECTRIC
COMPANY
INCORPORATED
SCHENECTADY NEW YORK, U.S.A.
120 BROADWAY NEW YORK, U.S.A.

Int-9-25

European, Australasian and Far Eastern Representatives

AUSTRALIA—Australian General Electric Co., Ltd., Wentworth Ave. and Goulburn St., Sydney, and Cor. Queen & Little Collins Sts., Melbourne

BELGIUM AND COLONIES—Societe d'Electricite et de Mecanique, S.A., 54 Chaussee de Charleroi, Brussels

CHINA—Andersen, Meyer & Co., Ltd., 4 Yuen Ming Yuen Road, Shanghai. International General Electric Co., Inc., 140 Robison Road, Shanghai

DUTCH EAST INDIES—International General Electric Co., Inc., 59 Koepang Boulevard, Soerabaia, Java

EGYPT—British Thomson-Houston Co., Ltd., Sharia Madabegh, No. 46, A., Cairo, P.O. Box 901

FRANCE—Compagnie Francaise Thomson-Houston, 173 Boulevard Haussmann, Paris 8me. International General Electric Company, Inc., 4 Rue d'Aguesseau, Paris 8me.

GREAT BRITAIN AND IRELAND—British Thomson-Houston Co., Ltd., Rugby, England. International General Electric Co., Inc., Crown House Aldwych, London, W. C., 2

GREECE AND COLONIES—Compagnie Francaise Thomson-Houston, 173 Boulevard Haussmann, Paris 8me.

HOLLAND—Mijnssen & Co., Keizergracht 205, Amsterdam

INDIA—International General Electric Co., Inc., B-3 Clive Building, Calcutta; Exchange Building, Ballard Estate, Bombay

ITALY AND COLONIES—Compagnie Generale di Elettricita, Via Borgognone 40, Milan (24)

JAPAN—International General Electric Co., Inc., Chiyoda Kwan, Minami Denma-Cho, Kyobashiku, Tokyo; P.O. Box 24, Osaka; Shibaura Engineering Works, 1 Shinhamacho Shibaku, Tokyo; Tokyo Electric Co., Ltd., Kawasaki, Kanagawa-Ken

NEW ZEALAND—National Electrical & Engineering Co., Ltd., Wellington; Auckland, Dunedin, Christchurch

PHILIPPINE ISLANDS—Pacific Commercial Co., Manila

PORTO RICO—International General Electric Co., Inc., San Juan

PORTUGAL AND COLONIES—Sociedade Iberica de Construcciones Electricas, Lda., Prace dos Restauradores 78-1º, Lisbon

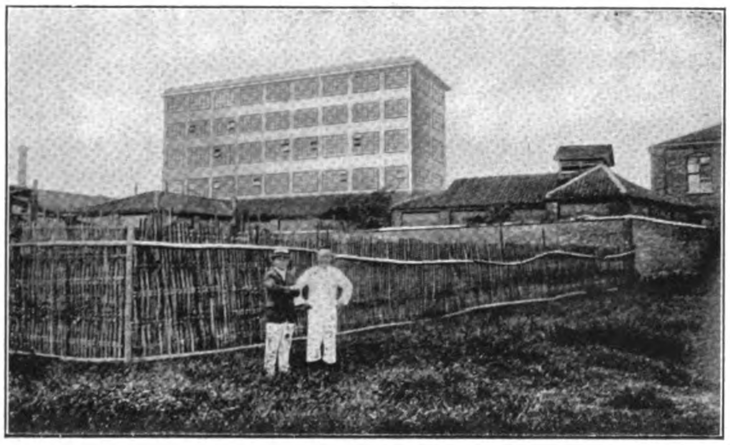
SOUTH AFRICA—South African General Electric Co., Ltd., G-E Building, Marshall & Simmonds Sts., Johannesburg, Transvaal; Tyne Building, Cor. Long & Dorp Sts., Capetown

SPAIN AND COLONIES—Sociedad Iberica de Construcciones Electricas, Apartado 990, Madrid, Rambla de Cataluna 13, Barcelona; Apartado 330: Bilbao

SWITZERLAND—Trolliet Freres, 44, Rue du Stand Prolongee, Geneve

GENERAL ELECTRIC SERVES AROUND THE WORLD

MAKING WHEAT FLOUR IN THE FAR EAST



Yue Fong Flour Mill

YUE FONG FLOUR MILL, Shanghai, China

This modern 1,500 barrel flour mill designed by Monarch engineers and equipped throughout with Monarch Machinery.

No mill too large for us to build; no inquiry too small to receive careful attention.

Modern Milling Machinery is enabling China and Japan to depend more and more upon their own mills to furnish the flour for their millions of people. Many more mills, however, will be built to meet the increasing demand for clean and wholesome white flour.

Sprout, Waldron & Company, Builders of MONARCH machinery, America's most complete line of Flour, Feed and Cereal Milling Equipment, is pleased to have a part in the development of this industry.

Forty years of successful mill building experience and the help of an expert milling engineer is available to anyone interested in the building and equipping of a mill for any capacity.

Complete information and catalogs on request.

SPROUT, WALDRON & CO.

Muncy, Pa., U.S.A.

Represented in

China by
Arnhold & Co., Ltd.
Shanghai, China

Japan by
Suzuki & Co.
Kobe, Japan

WALWORTH

Eighty years of alert experience

Walworth products include valves, fittings, tools and specialties for all working requirements in steam, water, gas, oil and air; made complete in the Walworth plants in brass, cast iron, malleable iron, steel and semi-steel. Each article is designed to allow for a large margin of safety.

Walworth engineers and representatives are in constant touch with all branches of industry so that our 80 years of experience may be put to the best service in special needs.

Walworth's complete line (23,000 items) and large production (50,000 tons a year) allow us to make prompt delivery in the largest specifications and for the highest pressures. Our products are available through leading distributors throughout the world. Specify Walworth on your orders.

For Catalog prices or information, address:
Walworth International Co., 29 Szechuen Road, Shanghai, China.

Walworth Manufacturing Co.
Boston, U.S.A.
Established 1842

Walworth International Co.
New York
Foreign Representative

Manufacturers of 23,000 different items

Valves, Fittings, Tools for Steam, Water, Gas, Oil and Air

When You Go to America

Establish Acquaintance—A traveler making his Statler reservations need only address the first Hotel Statler he will visit. This hotel will take care of reservations in the other Statler cities, will assist him in getting in touch with people he wants to see, and will serve him in many other helpful ways.

THERE are five cities of the United States which you will almost certainly want to visit—and in each of them is a Statler-operated hotel. In all these hotels every room has a private bath and many other unusual and much-appreciated conveniences. In all of them especial attention is paid to the traveler from overseas. In any of them you can be sure that you are getting the best there is, at prices no higher than in other hotels of the first class.

ST. LOUIS — Hotel Statler
DETROIT — Hotel Statler
CLEVELAND—Hotel Statler
BUFFALO — Hotel Statler
NEW YORK — Hotel Pennsylvania

Hotels Statler

This small picture of Hotel Pennsylvania will give you some idea of its size.

How to Reserve Accommodation

Reservations for accommodation at any of the Statler Hotels or Hotel Pennsylvania can be made at any office of Messrs. Thos. Cook & Son, or the American Express Company, or the American-Oriental Banking Corporation—or at principal hotels and steamship offices in the larger cities of the Orient. Reservations so made can be depended upon absolutely.

Hotel Pennsylvania

NEW YORK

Opp. Pennsylvania Station—**The Largest Hotel in the World**—2200 Rooms, 2200 Baths

THE BANK OF CHOSEN

Capital Subscribed - - - Yen 80,000,000
Capital Paid-up - - - Yen 50,000,000

Governor : K. Nonaka, Esq.
Deputy-Governor : S. Suzuki, Esq.

Directors :

Y. Katayama, Esq. M. Hashimoto, Esq.
I. Iuchi, Esq. T. Kakiuchi, Esq.

Head Office: SEOUL (Korea)

FOREIGN DEPARTMENT (TOKYO)

(All communications relating to correspondence arrangements and the Bank's general foreign business to be addressed to the Foreign Department)

Branch Offices:

Japan Proper—Tokyo, Osaka, Kobe, Shimonoseki
Korea—Chemulpo, Pyengyang, Fusan, Wonsan, Taiku, Chinnampo, Kunsan, Mokpo, Hoilyong, Chungjin
Manchuria—Antung, Mukden, New Town (Mukden), Dairen, Yingkow (Newchwang), Changchun, Harbin, Tiehling, Liaoyang, Ryojun, Kaiyuan, Chengchiatun, Szupingchieh, Fuchiatien, Kirin, Lungchingtsun
China Proper—Shanghai, Tientsin, Tsingtao, Tsinan
Siberia—Vladivostok, Alexandrofsky Port

NEW YORK AGENCY :

G. Benenson Investing Building, 165 Broadway, New York City

LONDON REPRESENTATIVE :

Palmerston House, 34 Old Broad Street, London, E. C. 2

Correspondents:

San Francisco, Seattle, New York, London, Paris and in other commercial centers throughout the world

International Banking Corporation

CAPITAL AND SURPLUS - - - U.S. $10,000,000.00

OWNED BY THE NATIONAL CITY BANK OF NEW YORK

HEAD OFFICE: 60 WALL STREET. NEW YORK

LONDON OFFICE: 36 BISHOPSGATE, E.C.

Branches:

BARCELONA
BATAVIA
BOMBAY
CALCUTTA
CANTON
CEBU
COLON
DAIREN
HANKOW
HARBIN
HONGKONG
KOBE
MADRID
MANILA
OSAKA
PANAMA
PEKING
RANGOON
SAN FRANCISCO
SANTO DOMINGO
SHANGHAI
SINGAPORE
TIENTSIN
TOKIO
YOKOHAMA

Commercial and Travellers' Letters of Credit, Bills of Exchange and Cable Transfers bought and sold. Current Accounts and Savings Bank Accounts opened and Fixed Deposits in local and foreign currencies taken at rates that may be ascertained on application to the Bank.

We are also able to offer our Customers the services of the Branches of the National City Bank of New York in the principal countries of Europe, South America and in the West Indies.

N. S. MARSHALL, *Manager.*

1A KIUKIANG ROAD.

BANQUE DE L'INDO-CHINE.

Capital nominal	... ...	**Frcs. 72,000,000**
Capital paid up	... ...	**„ 68,400,000**
Reserves (31/12/24)	... ...	**„ 85,760,726**

HEAD OFFICE: 96 BOULEVARD HAUSSMANN, PARIS.

Succursales et Agencies:

Bangkok	Fort-Bayard	Hongkong	Peking	Shanghai
Battambang	Haiphong	Mongtze	Pnom-Penh	Singapore
Canton	Hankow	Nouméa	Pondichery	Tientsin
Djibouti	Hanoi	Papeete	Saigon	Tourane

Bankers:

IN FRANCE: Comptoir National d'Escompte de Paris, Credit Lyonnais; Banque de Paris et des Pays-Bas; Crédit Industriel et Commercial Société Générale.

IN LONDON: The National Provincial and Union Bank of England, Ltd.; Comptoir National d'Escompte de Paris; Crédit Lyonnais.

The Shanghai Agency undertakes all banking operations and exchange business; grants credits on goods and approved securities and receives deposits on current and fixed deposits according to arrangement.

G. LEBOUCQ, *Manager.*

JUGO GINKO, LIMITED

(THE FIFTEENTH BANK)
TOKYO, JAPAN

Telegrams: "Jugo Tokyo"

Capital Subscribed Y. 100,000,000 Capital Paid-up Y. 49,750,000 Reserve Funds Y. 31,460,000

***President*: Masayasu Naruse, Esq.**

***Managing Directors*: Yutsuha Sato, Esq., Kanesato Aiko, Esq., Sei Usagawa, Esq.**

***Directors*: Prince Iwao Matsukata, Viscount Yukiyoshi Aoyama, Yoshiteru Shimidzu, Esq., The Hon. Nagayuki Asano, Masao Matsukata, Esq., Masakadzu Hisano, Esq. and Isami Sakihana, Esq.**

***Head Office Manager*: Eikichi Tatsuoka, Esq.**

***Head Office*: No. 6, 7chome, Kobiki-cho, Kyobashiku, Tokyo.**

BRANCHES:

SHINBASHI, MARUNOUCHI, NIHONBASHI, KAKIGARACHO, NINGYOCHO, RYOGOKU, FUKAGAWA, KANDA (TOKYO). OSAKA, TAMATSUKURI, NISHI, KUJO, MINAMI, NAMBA, TENNOJI, KITA, TENGACHAYA, NISHINODA (OSAKA), KOBE, SAKAEMACHI, FUKIAI, HYOGO (KOBE). KYOTO, HORIKAWA, (KYOTO) YOKOHAMA, NAGOYA, SAKAI, WAKAYAMA, NISHINOMIYA, OKAYAMA, HIROSHIMA, SHIMONOSEKI, FUKUOKA, KUMAMOTO, KAGOSHIMA, SENDAI.

LONDON BANKERS AND AGENTS:

LAZARD BROTHERS & CO., LTD. WESTMINSTER BANK, LTD. UNION DISCOUNT CO. OF LONDON, LTD.

THE

MITSUBISHI BANK,

LIMITED

CAPITAL SUBSCRIBED - Yen 50,000,000
CAPITAL PAID-UP - - - Yen 30,000,000

CHAIRMAN:

Mr. Manzo Kushida

MANAGING DIRECTORS:

Mr. Kiyoshi Sejimo Mr. Takeo Kato
Mr. Toru Otobe

HEAD OFFICE:

No. 3 Yayesucho Nichome, Kojimachi-ku, Tokyo, Japan.

BRANCH OFFICES:

Fukagawa (Tokyo), Tokio Kaijo Building (Tokyo), Marunouchi Building (Tokyo), Nihombashi (Tokyo), Osaka, Nakanoshima (Osaka), Semba (Osaka), Kobe, Sannomiya (Kobe), Kyoto, Nagoya, Otaru

Shanghai, London and New York.

General Banking and Exchange Business

Agents for the Hongkong and Shanghai Banking Corporation

THE MITSUI BANK, LTD.

The Oldest Bank in Japan, Founded in 1673

Capital Subscribed............Y. 100,000,000.00
Capital Paid-Up..................Y. 60,000,000.00
Reserve Funds (Sept., 1925) Y. 51,400,000.00

HEAD OFFICE: TOKYO
No. 5 Honkawayacho

Home Branches:

FUKUOKA, HIROSHIMA, KOBE, KYOTO, MARUNOUCHI (Tokyo), MOJI, NAGASAKI, NAGOYA, NIHONBASHI (Tokyo), OSAKA, OSAKA-DOJIMA, OSAKA-KAWAGUCHI, OSAKA-NISHI, OTARU, SHIMONOSEKI, WAKAMATSU (Kyushu), YOKOHAMA.

Foreign Branches:

Bombay, London, New York, Shanghai, Sourabaya.

London Bankers:

Barclay's Bank, Ltd. Midland Bank, Ltd.

New York Bankers:

Bankers Trust Co. Chase National Bank.
National City Bank of New York.

Industrial Bank of Japan, Limited

(NIPPON KOGYO GINKO)

Incorporated by Special Charter in 1902 to Encourage Foreign Investments

CAPITAL SUBSCRIBED - - - - - Yen 50,000,000

HEAD OFFICE:

7 EIRAKU-CHO, NICHOME, MARUNOUCHI, TOKYO. CABLES "KOGIN," TOKYO

BRANCHES:

TOKYO: NIHONBASHI
OSAKA: KORAIBASHI
KOBE: NAKAMACHI

YEIJIRO ONO, Esq., President JIUI MATSUMOTO, Esq., Vice-President

DIRECTORS:

KATSUMI IYANAGA, Esq. KOZO MATSUMOTO, Esq.
ICHIMATSU HORAI, Esq. KEIKICHI AMANOYA, Esq.

AUDITORS:

TAICHI OBA, Esq. TEIZO IWASA, Esq.
VISCOUNT TAKAMASA HACHIJO

All descriptions of general banking, exchange, both foreign and domestic, and trust and corporation financial business transacted.

Correspondents in the principal cities at home, and in London, Paris, New York, and San Francisco.

BUSINESS TRANSACTED:

1.—Loans on the security of public bonds of debentures and shares, estates (Zaidan), specified land and buildings.
2.—Subscription and underwriting public bonds or debentures.
3.—Deposits and safe custody of valuables.
4.—Trust company business.
5.—Discounting of bills.
6.—Foreign exchange business.
7.—Other banking business sanctioned by the Minister of State for Finance in accordance with Law of Ordinance.

Hongkong and Shanghai Banking Corporation

(INCORPORATED IN HONGKONG)

Capital:	Authorised Capital	$50,000,000
	Issued and fully paid up	$20,000,000
Reserve Funds:	Sterling	£4,500,000
	Silver	$26,500,000
	Reserve Liability of Proprietors	$20,000,000

Court of Directors:

G. M. YOUNG, Esq.
Chairman

H. P. WHITE, Esq.
Deputy Chairman

W. H. BELL, Esq.
D. G. M. BERNARD, Esq.
A. H. COMPTON, Esq.
Hon. Mr. P. H. HOLYOAK
Hon. Mr. A. O. LANG
W. L. PATTENDEN, Esq.
J. A. PLUMMER, Esq.
T. G. WEALL, Esq.

Head Office:
HONGKONG

Chief Manager:
HONGKONG . . . . A. H. BARLOW, Esq.

London Bankers:
THE WESTMINSTER BANK, LIMITED

Shanghai Branch: 12 The Bund
Sub-Agency: 9 Broadway

Branches and Agencies:

AMOY	LONDON
BANGKOK	LYONS
BATAVIA	MALACCA
BOMBAY	MANILA
CALCUTTA	NAGASAKI
CANTON	NEW YORK
CHEFOO	PEKING
COLOMBO	PENANG
DAIREN	RANGOON
FOOCHOW	SAIGON
HAIPHONG	S. FRANCISCO
HAMBURG	SHANGHAI
HANKOW	SINGAPORE
HARBIN	SOURABAYA
ILOILO	SUNGEI PATANI
IPOH	TIENTSIN
JOHORE	TOKYO
KOBE	TSINGTAO
KUALA LUMPUR	YOKOHAMA

Interest allowed on Current Accounts and on Fixed Deposits according to arrangement.

Local Bills Discounted. Credits granted on approved Securities and every description of Banking and Exchange business transacted. Drafts granted on London and the chief commercial places in Europe, India, Australia, Africa, China, Japan and America.

G. H. STITT, *Manager.*

THE ONE HUNDREDTH BANK, LTD.

(DAI HYAKU GINKO)

ESTABLISHED 1878

HEAD OFFICE: TOKYO, JAPAN

CAPITAL - - - - - - - - - - -	Yen 25,000,000.00
RESERVE FUND AND UNDIVIDED PROFIT - -	Yen 10,935,821.00

KUNIZO HARA, Esq., *President*

Branches: Yokohama, Kobe, Kyoto, Osaka and 13 Others
Agents and Correspondents: More than 3,000 at Home and Abroad

Exceptional Facilities Offered to Banks and Bankers in China and her Adjacent Countries for Banking and Exchange Business

CORRESPONDENCE INVITED

SEND YOUR BUSINESS TO US

THE SUMITOMO GOSHI-KAISHA

OSAKA, JAPAN

OWNERS OF BESSHI COPPER MINE, COAL MINES, SILVER AND GOLD MINES, ETC.

Manufacturers of: Tubes, Plates, Sheets and Bars of Copper, Brass, Bronze and other Alloys, Solid and Drawn Steel Tubes, etc.—Superphosphate and Composite, Manure, Sulphuric and Nitric Acid, etc.

WORKS AND DEPARTMENTS

Mining Offices ... Besshi, Wakamatsu, Sapporo & Ohgayu
WORKS:
Copper Works ... ... Osaka
Fertilizer Works ... ... Niihama

Sales Departments ... ... Osaka, Tokyo, Yokosuka, Nagoya, Kobe, Kure, Hakata and Shanghai
Forestry Department ... ... Osaka.

The Sumitomo Steel Works, Limited

OSAKA, JAPAN

Capital Subscribed: Yen 12,000,000

Manufacturers of: Steel Ingots, Steel Forgings, Steel and Iron Castings of Every Description for Railways, Shipbuilding Yards Mines, Hydraulic Electric and Other Engineering Works, etc., etc.

The Sumitomo Electric Wire & Cable Works, Limited

OSAKA, JAPAN

Capital Subscribed: Yen 10,000,000

Manufacturers of: Copper, Brass, Bronze and Nickel Wires and Strips, Trolley Wires, Insulated Wires and Cable of Every Description for Telephone, Telegraph, Lighting, Power Transmission, etc., etc.

THE SUMITOMO WAREHOUSE CO., LTD.

Capital Subscribed: Yen 15,000,000

Head Office: Osaka, Japan **Branches: Osaka, Kobe & Tokyo**

Warehousing, Forwarding, Landing, Shipping and Dock Business, Stevedores and Custom Brokers

THE SUMITOMO BANK, LTD.

KITAHAMA, OSAKA, JAPAN

Subscribed Capital .. .. **Yen 70,000,000**
Paid-up Capital .. .. **Yen 50,000,000**
Reserve & Surplus Funds .. .. .. **Yen 25,490,000**
Deposits .. .. **Yen 408,000,000**

DIRECTORS:

Baron K. SUMITOMO ... ... President
N. YATSUSHIRO ... ... Managing Director
S. IMAMURA ... ... ,, ,,
K. YUKAWA ... ... Director
K. NAKADA ... ... Director
K. HORI ... ... ,,
S. YOSHIDA ... ... ,,
K. OHDAIRA ... ... ,,

Home Branches: Tokyo (15), Yokohama, Nagoya, Kyoto (2), Osaka (13), Kobe (3), Onomichi, Niihama, Kure, Hiroshima (2), Yanai, Shimonoseki, Moji, Kokura, Wakamatsu, Hakata, Kurume and Kumamoto.

Foreign Branches: London, New York, San Francisco, Los Angeles, Bombay, Shanghai and Hankow.

Affiliated Banks: The Sumitomo Bank of Seattle, Seattle. The Sumitomo Bank of California, Sacramento, Cal. The Sumitomo Bank of Hawaii, Limited, Honolulu.

Bankers: Lloyds Bank, Ltd., London. The National City Bank of New York, New York. Lloyds and National Provincial Foreign Bank, Ltd., Paris.

Correspondents: In all important places at home and abroad.

The Bank buys, sells and receives for collection Drafts and Telegraphic Transfers; issues Commercial and Travellers' Letters of Credit available in all important parts of the World, and acts as Trustee for Mortgage Bond, besides doing General Banking Business.

Business with Canada,

SOUTH AMERICA,
WEST INDIES, &c.

WE offer a Complete Banking Service in all these countries through our 900 branches, special attention being given to the handling of collections.

Valuable information regarding markets, tariffs and confidential credit reports is at your disposal through our special departments created for this purpose.

The Royal Bank of Canada

Head Office: *MONTREAL.*

London Office: *PRINCES ST., E.C. 2.*

THE EXCHANGE BANK OF CHINA

Registered in the Ministry of Finance, 1918

Capital	**Yen 10,000,000.00**
Reserve Funds and Balance Brought Forward to Next Account	**Yen 2,667,000.00**

HEAD OFFICE, PEKING:

President	C. C. Chang, Esq.,
Managing Director	W. Kobayashi, Esq.

PEKING BRANCH:

Chief Manager	K. C. Lee, Esq.
Sub-Manager	S. Uyeda, Esq.

TIENTSIN BRANCH:

Manager	Shieh Ling, Esq.,
Sub-Manager	R. Tonegawa, Esq.

SHANGHAI BRANCH: 5 Foochow Road, Shanghai.

TELEGRAPHIC ADDRESS "KNABEX"

Manager	K. H. Lin, Esq.,
Sub-Manager	H. Yokoyama, Esq.

Foreign and Domestic Exchange and General Banking Business of Every Description Transacted.

Interest allowed on Current Accounts and Fixed Deposits according to arrangement.

Foreign Agencies at Tokyo, Yokohama, Kobe, Osaka, Nagasaki, Moji, Kyoto, Nagoya, Shimonoseki, Otaru, Hakodate, Seoul (Korea), Taipeh (Formosa), Singapore, Bombay, London, New York.

Domestic Agencies at Shanghai, Tientsin, Hankow, Tsingtao, Dairen, Changchun, Mukden, Foochow, Amoy, Swatow, Hongkong, Canton, Tsinan, Antung, Harbin.

THE BANK OF TAIWAN, LTD.

Established 1899

TAIPEH, FORMOSA (TAIWAN)

Tokyo Branch:

No. 1 Nichome, Eiraku-cho, Kojimachi-ku

Telegraphic Address: TAIWANGINK

Telephones:

3421, 4539, 4540, 5617, 5618 & 2326 Ushigome

Capital Subscribed	Y. 60,000,000
Capital (Paid-up)	Y. 52,500,000
Reserve Fund	Y. 14,180,000

President:

Kojuro Nakagawa, Esq.

Vice-President:

Hirozo Mori, Esq.

Directors:

Gunji Kawasaki, Esq.
Tadasu Hisamune, Esq.
Denkichi Takita, Esq.
Masakazu Shuto, Esq.

Branches:

Japan:	Tokyo, Kobe, Osaka, Yokohama.
Taiwan:	Keelung, Tainan, Takow, and 11 others.
China:	Amoy, Canton, Foochow, Hankow, Shanghai, Swatow.
London:	25 Old Broad Street.
New York:	Benenson Investing Bldg., 165 Broadway.
Others:	Bangkok, Bombay, Calcutta, Hongkong, Singapore, Sourabaia, Semarang, Batavia.

CORRESPONDENTS:

In the principal cities and towns throughout the world. Every description of Exchange and General Banking business transacted. Special facilities are available for exchange business on China, Strait Settlements, East Indies, Australia, Great Britain, America, Canada, South Africa, etc.

THE DAI-ICHI GINKO, LTD.

(FORMERLY THE FIRST NATIONAL BANK)
ESTABLISHED 1873

Capital (Paid Up) - - - Yen 50,000,000.00
Reserve Funds - - - - Yen 46,400,000.00

Y. SASAKI, *President*
K. ISHII, *Managing Director.* Y. NOGUCHI, *Managing Director.* S. SUGITA, *Managing Director.*

HEAD OFFICE:
No. 1 KABUTO-CHO, NIHONBASHI-KU, TOKYO.
T. AKASHI, *Manager*

CITY BRANCHES:
MUROMACHI, SHIN-OSAKACHO, FUKAGAWA, MARUNOUCHI, KYOBASHI, ASAKUSA.

HOME BRANCHES:
YOKOHAMA, NAGOYA, TAMAYACHO (NAGOYA), YOKKAICHI, KYOTO, NISHIJIN (KYOTO), GOJO (KYOTO), FUSHIMI, OSAKA, NISHIKU (OSAKA), MINAMIKU (OSAKA), HONMACHI (OSAKA), KOBE, HYOGO, KYOMACHI (KOBE), HIROSHIMA, SHIMONOSEKI, CHOFU, MOJI, KOKURA, FUKUOKA, KURUME, KUMAMOTO, HAKODATE, OTARU, SAPPORO, MURORAN.

BRANCHES IN COREA:
SEOUL, FUSAN.

LONDON & NEW YORK BANKERS:
London { Westminster Bank, Ltd. / Midland Bank, Ltd. / The Yokohama Specie Bank, Ltd.
New York { The National City Bank of New York. / The National Bank of Commerce in New York. / The Yokohama Specie Bank, Ltd.

CORRESPONDENTS:
The Bank, in addition to its own Branches, has numerous Agencies or Correspondents in the principal Cities and Towns at Home and Abroad.

THE YASUDA BANK, LTD.

(ESTABLISHED 1863)

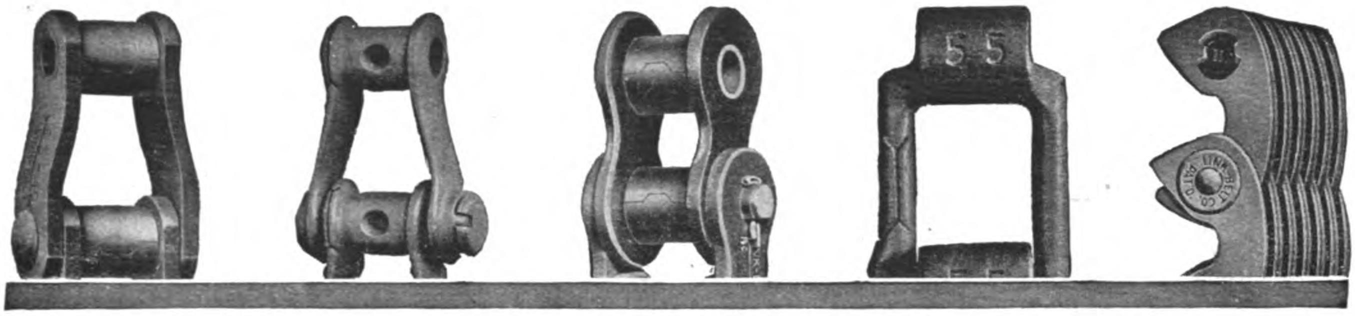
CAPITAL SUBSCRIBED - - - - - Yen 150,000,000
CAPITAL PAID-UP - - - - - - - ,, 92,750,000
RESERVE FUNDS - - - - - - - ,, 48,650,000
DEPOSITS - - - - - - - - - - ,, 572,514,504

Head Office: Nichome, Eiraku-cho, Marunouchi, Tokyo, Japan

President ... ... ZENJIRO YASUDA
Vice-President ... ... TOYOTARO YUKI
Managing Director ... ... TEIZABURO TAKEUCHI
,, ,, ... HISASHI HYOSU

The Yasuda Bank has Branches or Agents throughout Japan and in all the principal parts of the world.

Cable Transfers, Drafts, and Letters of Credit issued; the Negotiation and Collection of Bills of Exchange and other Banking Business transacted. Offers exceptional facilities for handling transactions in the Far East.



Are You Using the Right Chain for Your Drive?

DURING the past fifty years we have designed and manufactured all types of drive chains—the malleable iron detachable Link-Belt in all its many varieties, the "combination" malleable iron and steel chains, the heavier, more rugged types of all-steel chains, the finished steel roller chains and the highly efficient Link-Belt Silent Chains.

We are therefore perfectly free to recommend the type of chain which will most effectively and most economically accomplish the results. It is a matter of pride with us that our judgment as to the correct use of a chain is sought by many experienced users of chain.

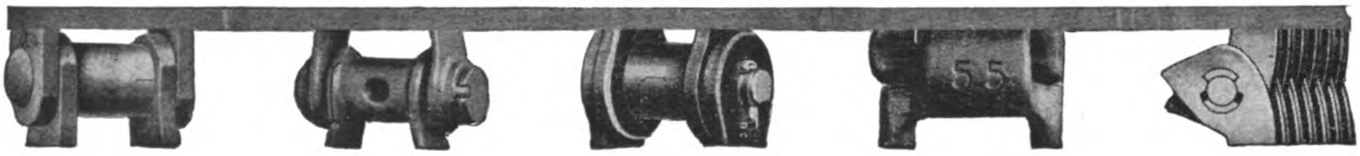
Let us help you. There is a standard Link-Belt chain for every power transmission service. We can show you when and where to use each to get the utmost in trouble free service.

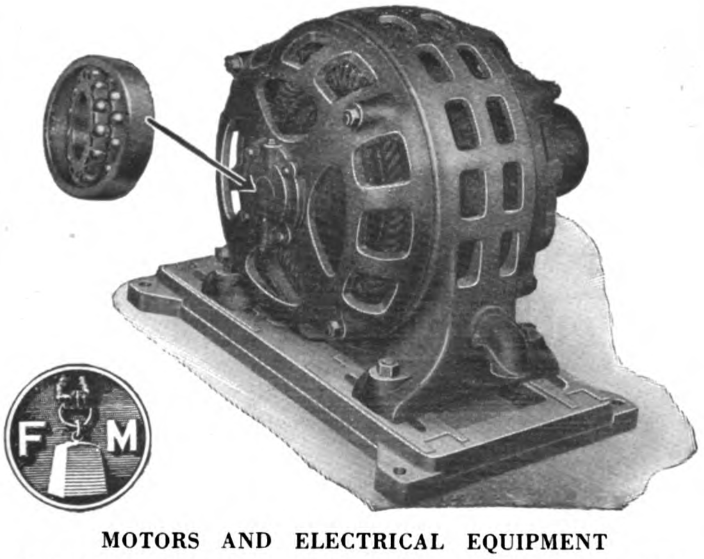
Send for 832 page General Catalog No. 400.

LINK-BELT COMPANY

WOOLWORTH BUILDING, NEW YORK, N. Y., U. S. A. 1562-A

CABLE AND RADIO ADDRESS "LINKBELT"





MOTORS AND ELECTRICAL EQUIPMENT

Fairbanks-Morse Motors are designed upon a sound and efficient basis having back of them long and careful laboratory tests and practical shop tests Sturdiness of construction and liberality of design coupled with high efficiency and economy are their outstanding features.

A Fairbanks-Morse dealer will be glad to help you with your electrical equipment problems. Write or visit nearest representative.

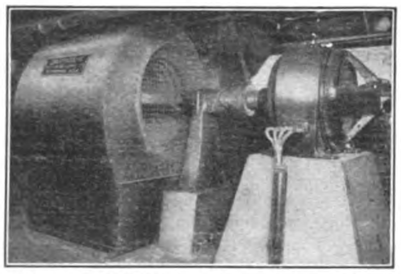
Manufacturers:

Fairbanks, Morse & Co.
INCORPORATED MANUFACTURERS

Export Dept., 30 Church St., New York, U.S.A.

Far Eastern Agents:

Sale & Frazar, Ltd., Tokio
L. M. Hausman & Co., Manila
Borneo Co., Ltd., Singapore
M. S. Vernal & Co., Calcutta
International Engineering Co., Bangkok
Technisch Bureau Soenda, Bandoeng
McKenzies, Ltd., Bombay



Sturtevant Turbovane Fan installed in the Public Service Electric Company's Power Plant Newark, New Jersey, U. S. A.

Sturtevant Turbovane Fans Give High Boiler Ratings!

The Sturtevant Turbovane Fan is a high speed, high efficiency forced draft fan especially designed for use with modern stokers. Its characteristic curves indicate:

—ability to meet sudden changes in the fuel bed.
—economical performance over a wide range of operation.
—insurance against overloading the driving unit.

Over two thousand Turbovane Fans are giving splendid service in power houses of 200 to 250,000 boiler horse power capacity.

We will gladly assist you in any mechanical draft problem. Send for our Bulletin No. 330 on Turbovane Fans.

B. F. STURTEVANT CO., Hyde Park, Boston, Mass., U. S. A.
Established 1865 **Cable Address, "Sturtevant," Boston**

Foreign Representatives

AMERICAN TRADING CO., 3 Canton Road, Shanghai

CATTON-NEILL ENG. and MACHINE CO.
25 Santa Cruze Bridge
Manila, P. I.

Sturtevant
PUTS AIR TO WORK

AMERICAN TRADING CO., Inc.
1 Itchome, Yuraku-Cho, Kojimachi Ku, Tokyo, Japan
1431

SOUTH MANCHURIA RAILWAY

TOURIST TRAVEL OFF THE BEATEN TRACK

Tourists in the Far East should not miss Manchuria. Through Japan, Chosen (Korea), and Manchuria (or vice versa) is an ideal trip, combining the distinctive characteristics of three unique and profoundly interesting countries.

MANCHURIA LINES are under the management of the South Manchuria Railway Company. Express trains have been temporarily suspended (except between Antung and Changchun and Dairen and Changchun), but the **ORDINARY TRAINS ARE EQUAL TO MOST AMERICAN TRAINS**, run at least twice a day from each end, and to some of them Sleeping and Dining Cars are attached. Sleeping berths should be reserved in advance.

HOTELS under the Company's management are established **ON FOREIGN LINES** at **MUKDEN** (ancient capital of China, home of the Manchuria Dynasty, noted for Imperial Palaces and Tombs), **CHANGCHUN** (junction for three railways and "key to Manchuria"), **PORT ARTHUR** (of world-wide fame for its historic sieges and ruined forts), **DAIREN** (one of the greatest commercial cities in the Orient), and **HOSHIGAURA** (the finest seaside resort in North China).

FROM DAIREN there are **FREQUENT AND REGULAR STEAMERS** to and from Shanghai, Tsingtao, Tientsin, etc.

For pictorial guide-books, pamphlets, and further particulars, apply to the Ticket Agencies of: The International Sleeping Car Co., Messrs. Thos. Cook & Son, Ltd., the Nordisk Resebureau (Gothenburg), American Express Co., Japan Tourist Bureau, Tokyo Station, Japan or direct from the

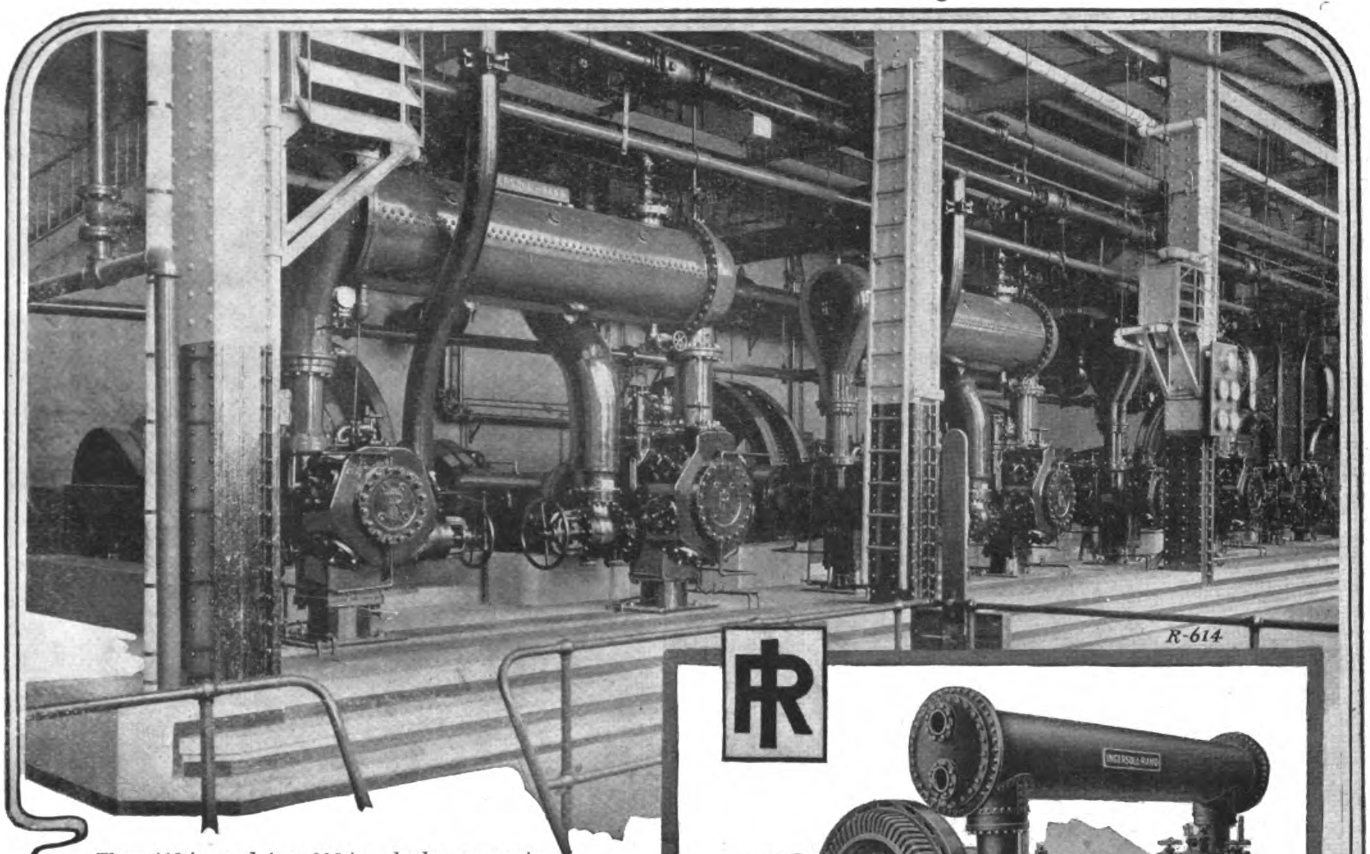
SOUTH MANCHURIA RAILWAY COMPANY

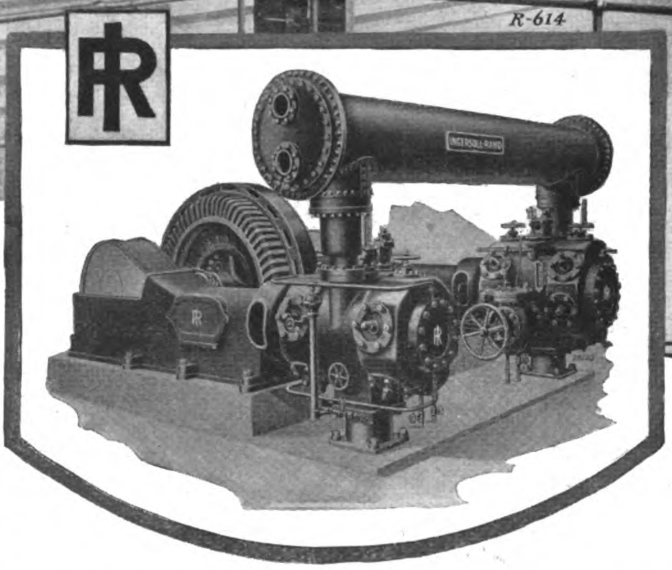
Head Office: DAIREN

Branch Offices: TOKYO, OSAKA, SHIMONOSEKI, HARBIN, KIRIN, PEKING, SHANGHAI AND NEW YORK.

Cable Address: MANTETSU or SMRCO. Codes: A.B.C. 5th & 6th Editions, A1 Lieber's, and Bentley's

I-R Compressors in World's Largest Electrically Driven Raw Water Ice Plant





Three 415-ton and two 205-ton duplex ammonia compressors in plant of Arctic Hygeia Ice Company, New York City. In this plant there are also three air compressors for agitation purposes and one ammonia compressor for pump-out service.

THE Arctic Hygeia Ice Company, New York City, has installed a complete electrically driven 1,000-ton raw water ice plant. All compressors, both for air and for ammonia, totaling 3,440 H.P., are of Ingersoll-Rand manufacture.

All of the compressors, except the small pump-out machine, are provided with Ingersoll-Rand Clearance Control. This method of control permits economical operation at partial load.

All compressors have Ingersoll-Rand Plate Valves—the valve whose tightness is sustained by use—affording unrestricted gas passage.

The Ingersoll-Rand Company maintains a highly specialized corps of refrigeration specialists whose co-operation is at your disposal without expense or obligation. The complete range of I-R compressors covers every commercial size and type of drive.

In New York, San Francisco, Honolulu, Manila, Shanghai, Soerabaja, Calcutta, Cairo, Vienna, Paris, London—ringed around the world—north to Juneau and south to Johannesburg, are Ingersoll-Rand branches or agents with expert engineers and ample stocks at your immediate service.

INGERSOLL-RAND COMPANY, 42 KIANGSE ROAD, SHANGHAI, CHINA

Exclusive Agents in Japan: **American Trading Company, Tokyo and Kobe, Japan**
Agents for Hongkong: **Jardine Engineering Corporation, Ltd., Hongkong.**
Agents for Netherlands East Indies: **Lindeteves-Stokvis, Soerabaja, Samarang, Batavia.**

Ingersoll-Rand

11 BROADWAY, NEW YORK

THE WORLD'S GAZE

TURNS

POLITICALLY, ECONOMICALLY, ARTISTICALLY

TOWARDS

JAPAN

WHERE

Oriental charms are jealously preserved intact amidst the most advanced Oriental civilization

TOURISTS ARE ASSURED

OF

Comfort, Convenience and Safety

TWO MOST RELIABLE ORGANIZATIONS FOR TRAVELLERS

1. JAPAN TOURIST BUREAU
   Head Office: Tokyo Station, Tokyo, Japan
2. JAPAN HOTEL ASSOCIATION
   c/o Traffic Bureau, Japanese Government Railways

JAPANESE GOVERNMENT RAILWAYS

JAPANESE GOVERNMENT RAILWAYS

The Beauty, Fascination, and Mystery of the Orient Await you in Japan

THROUGH BOOKING

JAPAN TO CHINA

Single and Return Tickets between Japan and China.

Japan-China Party Trip Tickets.

Japan-China Circular Tour Tickets.

Japan-China Parcel Through Traffic.

Japan-China Overland Tour Tickets for Steamer Passengers.

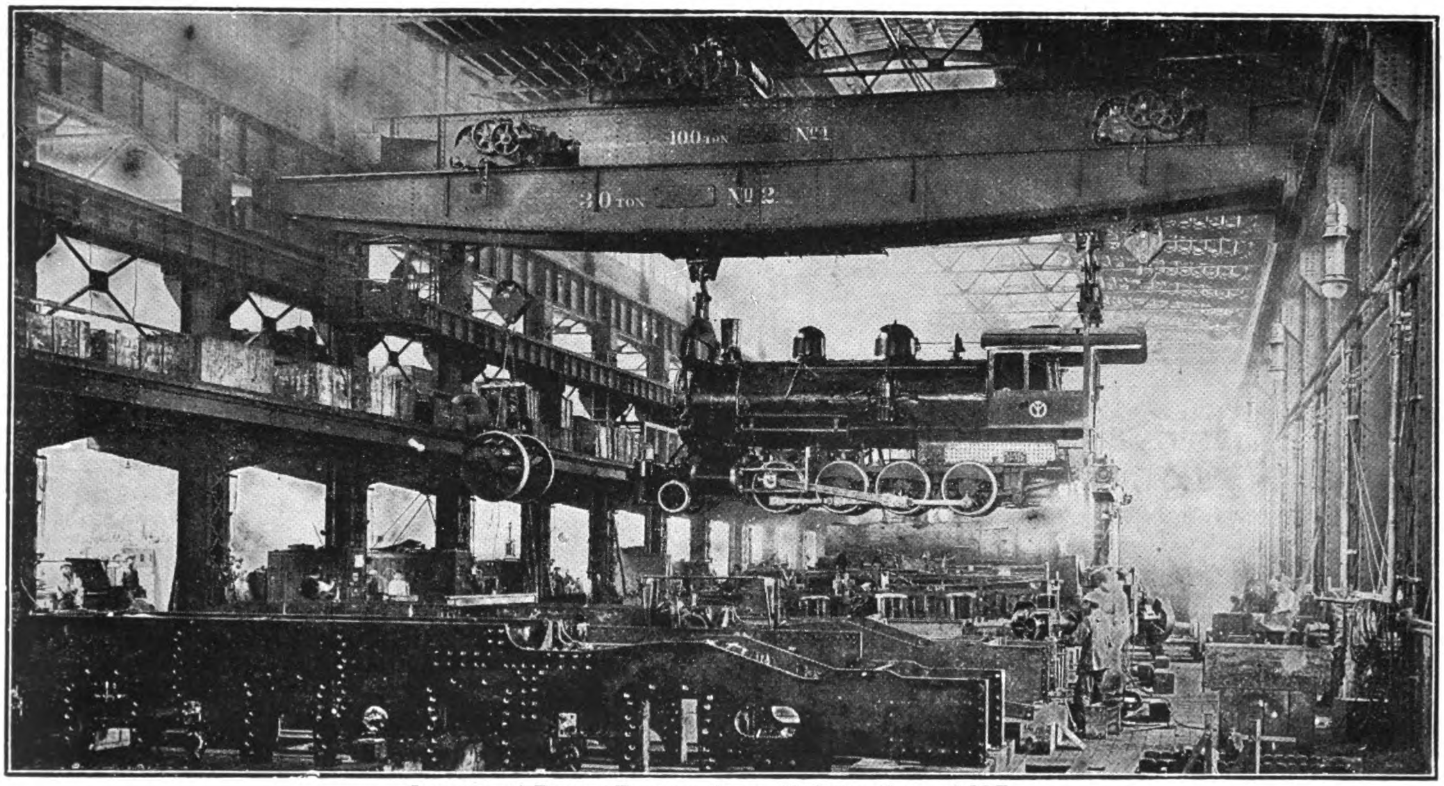
For particulars please apply to the

Traffic Bureau, Department of Railways

TOKYO, JAPAN

SOUTH MANCHURIA RAILWAY

SHAKAKO RAILWAY WORKSHOPS



Interior of Engine Erecting Shop, Shakako Shops, S.M.R.

LARGEST AND MOST COMPLETE IN ALL MANCHURIA AND CHINA

AREA OF LAND: About 300,000 Tsubo. OFFICES & WORKSHOPS, 14,000 Tsubo

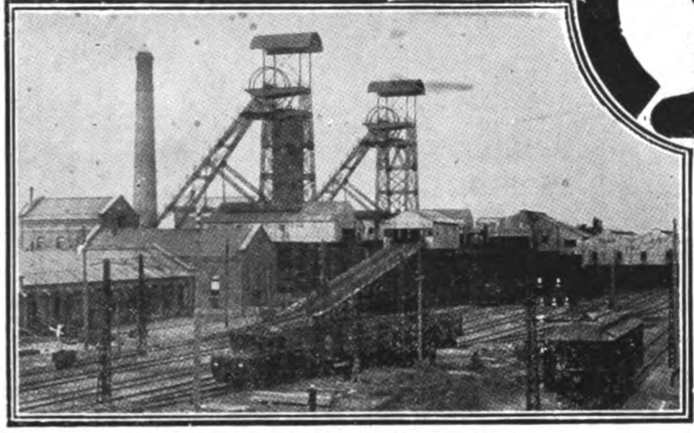
CAPACITY OF EXECUTING REPAIRS SIMULTANEOUSLY:

27 Locomotives, 36 Passenger Cars, and 130 Freight Cars, besides Constructing and Repairing other Railway Materials, Mining Machinery, etc. Employees: 5,000 Japanese and Chinese.

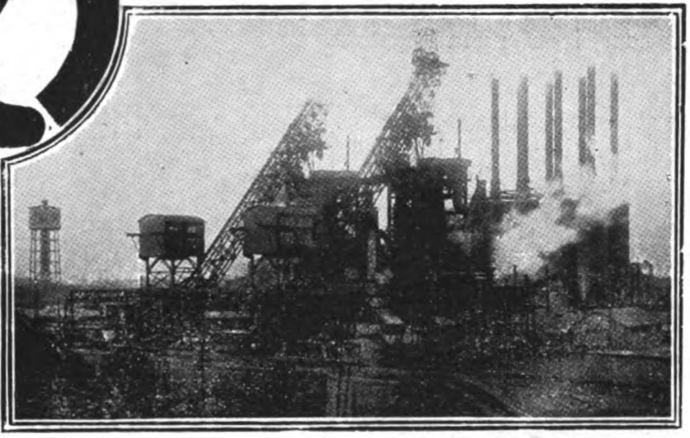
THE EAST IS EAST AND THE WEST IS WEST

SOUTH MANCHURIA RAILWAY

COAL IRON



Togo Pit of the S.M.R. Fushun Collieries



Anshan Steel Works of the S.M.R.

FUSHUN COAL

The Best Steaming Coal in the Far East | Fresh Stocks Always on Hand

Depots:

Dairen	Port Arthur	Newchwang
(Yingkou)	Tientsin	Tsingtao

Agencies:

Chefoo	Takao	Osaka
Manila	(Formosa)	Nagoya
Hongkong	Batavia	Shanghai
Sourabaya	Yokohama	Moji
Singapore	South Seas	Saigon
Penang	Niigata	etc.

Also Sulphate of Ammonia, Fire Clay, and Talc

Pamphlets and Particulars gratis from any of the above Depôts and Agencies, and from the

MINING DEPARTMENT,

South Manchuria Railway Company, Dairen

ANZAN IRON & STEEL WORKS

New Enterprise Set Up Like Magic Amidst the Wilderness of Manchuria.

TRACT OF LAND: about 4,000,000 tsubo.

BLAST FURNACE No. 1 (with a capacity for about 350 tons per day) Opened to service on April 29, 1919.

BLAST FURNACE No. 2 (with a capacity for about 350 tons per day) Made ready for service on February 24, 1920.

MEANS OF TRANSPORTATION in the plant: 24 miles of railway and 2.5 miles of electric tramway in operation, with three light locomotives and a number of slag-, coke, and ore-cars of from 8 to 24 tons.

A NEW TOWN SITE of 400,000 tsubo, with the necessary roads and water and sewage services, laid out and rented to lessees.

OFFICIALS AND EMPLOYEES: 2,300 Japanese and Chinese.

BUT THE TWAIN HAS MET AND BLENDED HERE

Dixon's Cup Greases combine the superior lubricating qualities of the best mineral oils with the simplicity and economy of hard grease.

They are softer than the average grease so begin to lubricate as soon as there is motion. Most greases begin to lubricate only after the parts warm up—that is they have to be thawed out by the frictional heat. Dixon's Cup greases are all thawed out and ready to function—they flow with the revolving parts. They also keep the surfaces from metal contact.

Wherever possible to use cup grease around the plant—on pumps, engine, shafting and other machinery, Dixon's will give better lubrication at lower cost.

Write for Circular

JOSEPH DIXON CRUCIBLE CO.

Jersey City New Jersey

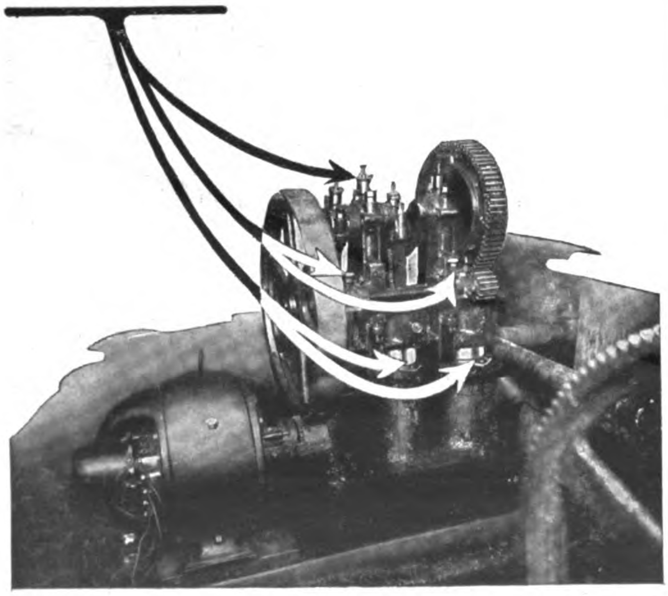
Established 1827

For Prices, Information, etc., communicate with

WALWORTH INTERNATIONAL CO.

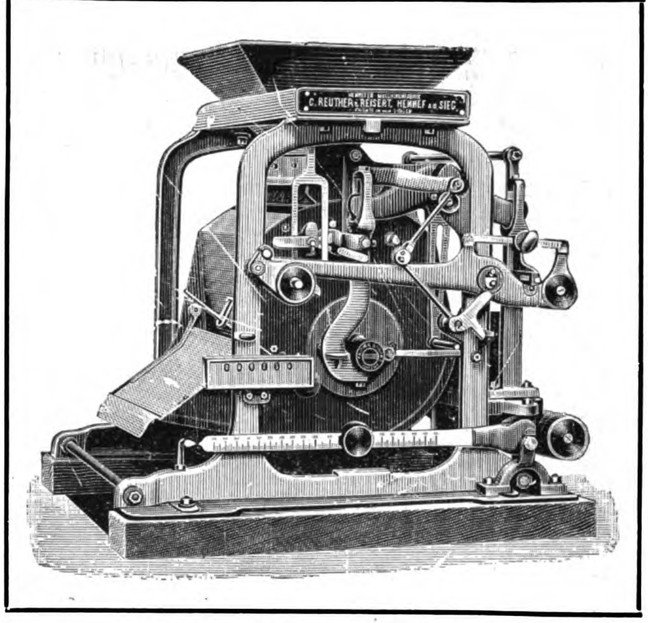
29 Szechuen Road, Shanghai, China

Graphite Cup Grease



For Use in Mills, Breweries, Warehouses, Elevators, Sugar Factories, etc.

Cable Address: "Chronos Hennefsieg"



Use A B C Code 5th Edition

Patent Automatic Scales

"CHRONOS"

For Weighing Wheat, Rye, Barley, Rice, Flour, Oats, Maize, Oil-Seeds, Oils, Beets, Sugar, Coals, etc. *They work and register quite automatically.*

They save time, labor and money!

Over 40,000 "Chronos" scales are working all over the world to the utmost satisfaction

Hennef Engineering Works C. Reuther & Reisert, Ltd.

Hennef on Sieg (Germany)

Oldest and largest Works for automatic self-registering weighers.

Rea's Far Eastern Manual 1924

The 1924 edition of this stupendous compilation of concrete facts, covering the main Engineering and Industrial establishments of Eastern Asia, should be on the desk of every executive of the Engineering and Financial professions doing business in the Orient. *Order your copy now.*

Price Mexican $25.00 or its equivalent

PUBLISHED BY

THE FAR EASTERN REVIEW

16 Jinkee Road Shanghai, China

This Fire Might Be Yours

Tomorrow this may be your fire, and then you would remember the name American-LaFrance as long as you live. American-LaFrance Fire Apparatus is known all over the world because there are 5000 pieces of Motor Fire Apparatus now in active service in various parts of the globe.

For nearly 80 years we have been manufacturing fire apparatus of all types, fire department supplies, and safety devices. We are equipped to fill every requirement of modern fire departments. We also manufacture Motor Trucks. Illustrated catalogue and full particulars may be quickly obtained by addressing our sales representative in your country or our Export Department in New York.

Okura & Company, *Tokyo, Japan* — Pacific Commercial Co., *Manila, P. I.* — Mustard & Co., *Shanghai, China*

E. W. Frazar & Co., *5 Rue de Paris, Tientsin, China*

AMERICAN-LAFRANCE FIRE ENGINE COMPANY, INC.

Export Department:

Fisk Building, Broadway at 57th Street, New York, U. S. A.

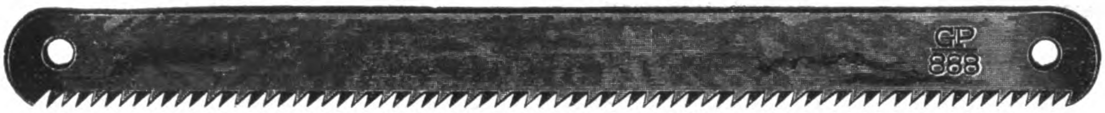
Cable Address: "Amlafranco" — Cable Codes: Bentley's, A.B.C. 5th Edition, Western Union.

GOODELL-PRATT

1500 GOOD TOOLS

GP 888

This mark identifies the Goodell-Pratt *all hard* Hack Saw Blades.



DEPENDABLE HACK-SAW BLADES

Goodell-Pratt offers a variety of dependable Hack-Saw Blades, the two most popular styles being illustrated here.

GP-777 is a flexible blade with a soft center, and hardened back and teeth. Desirable for work which subjects the blade to severe twists and side strains.

GP-888 is an all hard blade, made from a special high grade of hot-rolled sheet steel, .025 inch thick, cut so that the length of the blade runs with the grain. For speed and endurance GP-888 is in a class by itself.

Export Orders are given especial attention, shipments being carefully packed in new and strongly re-enforced wooden cases.

Free catalogues may be obtained direct or from importers of American tools, most of whom carry the Goodell-Pratt line of tools.

Representatives:

Muller, Phipps & Sellers, Ltd., Room No. 758, Marunouchi Building, Tokyo (Central P.O.Box No. 98)

Muller & Phipps (China), Ltd., N.K.K. Building, 2 Canton Road, Shanghai, China

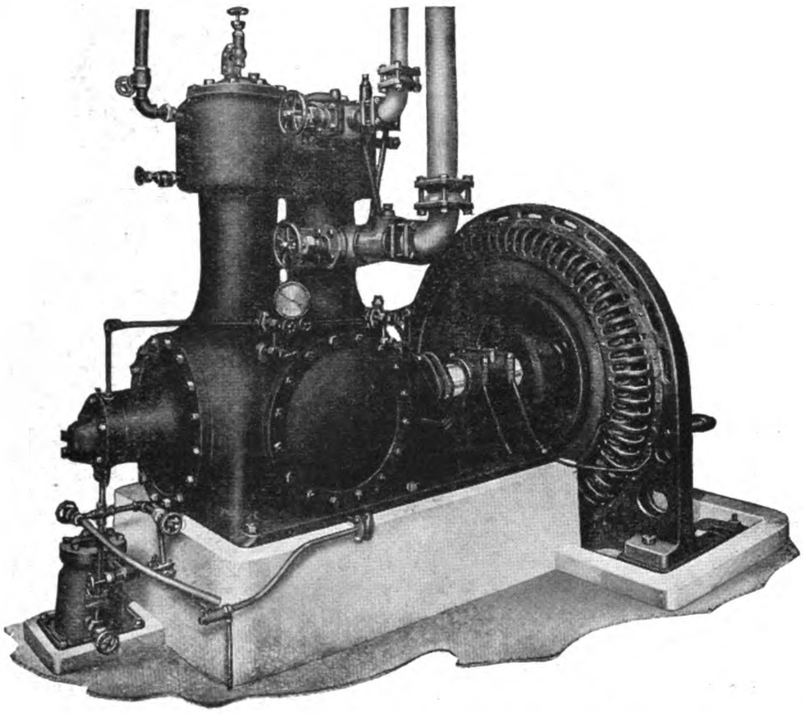
Muller, Phipps & Sellers, Ltd., Dojima Building, Osaka (Central P.O. Box No. 63)

GOODELL-PRATT COMPANY,

Toolsmiths, Greenfield, Mass., U.S.A.

GP 777

Goodell-Pratt *flexible* Hack-Saw Blades carry this mark



ICE MAKING AND
YORK
YORK, PA. U.S.A.
REFRIGERATING MACHINERY

YORK REFRIGERATING EQUIPMENT IS ESPECIALLY DESIGNED FOR

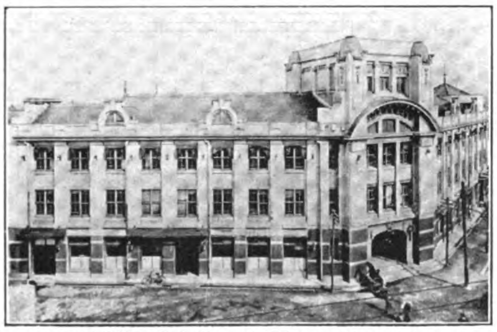
ICE MANUFACTURERS, MEAT AND PRODUCE MARKETS CREAMERIES AND DAIRIES, FUR STORAGE, FLORISTS, PASSENGER AND CARGO BOATS, FRUIT STORAGE, BAKERIES, HOSPITALS AND LABORATORIES, HOTELS AND THEATRES, CONFECTIONERS, FISH MARKETS.

WRITE FOR LITERATURE ON ANY OR ALL OF THESE SUBJECTS.

YORK-SHIPLEY COMPANY OF CHINA, SHANGHAI, CHINA

AMERICAN TRADING CO.
Tokyo and Osaka, Japan

PACIFIC COMMERCIAL CO.
Manilla, P.I.



General Office Building of Ujigawa Electric Power Co., Ltd., Osaka, Japan.

Ujigawa Electric Power Co., Ltd.

Osaka, Japan.

Authorized Capital Yen 85,000,000.00

YASUSHIGE HAYASHI, *President and Director*
SENZABURO KAGEYAMA, *Managing Director*

17 Power houses (erected) with a total capacity of	111,700 K.W.
4 Power houses (under construction) with a total capacity of	31,600 K.W.
9 Power houses (permit obtained) with a total capacity of	83,400 K.W.
15 Power houses (permit applied) with a total capacity of	36,200 K.W.
Grand Total	262,900 K.W.
Power supplied	267,021 H.P.
Its Customers	14,568
Electric Lights	319,186
Its Customers	146,040
Purchased Power	100,100 K.W.

LEAGUE OF NATIONS

Publications of the International Labour Office

INTERNATIONAL LABOUR REVIEW: (Monthly).
Contains articles on problems of industry and employment contributed by leading economists or other persons of authority on industrial and labour affairs.
Annual subscription 24s. Dollars 6.

INDUSTRIAL AND LABOUR INFORMATION: (Weekly).
Current events affecting industry and labour, and the work of the International Labour Organisation.
Annual subscription 30s. Dollars 7.

INDUSTRIAL SAFETY SURVEY:
Published every two months; intended to act as a link between those in all countries who are interested in problems of accident prevention.
Annual subscription 6s. Dollar 1.50

BIBLIOGRAPHY OF INDUSTRIAL HYGIENE: (Quarterly).
A bibliography of industrial hygiene and pathology.
Annual subscription 4s. Dollar 1.

ENCYCLOPAEDIA OF INDUSTRIAL HYGIENE:
The purpose of the Encyclopaedia of Industrial Hygiene is to bring together all the information available in the various countries concerning industries or processes which may be considered unhealthy.
Brochure and volume edition £3. Dollars 15.

INTERNATIONAL LABOUR DIRECTORY: (Annually).
The International Labour Directory contains information with regard to organisations, both official and unofficial, which deal with industrial and labour matters. Contains lists of the most important international and national organisations of employers and workers respectively. Published in seven parts.
Annual subscription 12s. 6d. Dollars 3.25.

LEGISLATIVE SERIES:
Consists of reprints and translations of the texts of the most important laws and regulations affecting labour adopted in all countries of the world.
Annual subscription 20s. Dollars 5.

STUDIES AND REPORTS:
Consists of monographs dealing with various labour problems, e.g Unemployment, Wages & Hours, Industrial Hygiene, Industrial Organisation, etc.
Annual subscription 40s. Dollars 10.

Total annual subscription (comprises all the publications mentioned above). All prices quoted are post free.. .. .. .. £8. Dollars 40.

Write for full catalogue sent free on demand to:—

INTERNATIONAL LABOUR OFFICE
GENEVA, Switzerland

Development

The Superheater Company, Manufacturers of Elesco superheaters, feed water heaters and exhaust steam injectors, has long been associated with the railroad industry and has contributed much to the high standards and low costs which characterize modern equipment.

The Company's engineers, for instance, have taken active part in every step of locomotive development, have cast aside retarding precedents and have met railroad requirements with railroad dispatch and efficiency.

Their development of devices like the superheater, feed water heater and exhaust steam injector, therefore, has been no flight of fancy, but the result of the closest sort of application to practical requirements. Every factor has b en studied and re-studied by each member of the staff—every type has been carefully analyzed and tested both in this country and abroad.

The result is equipment which meets every criticism of the skeptic and all requirements of active servive

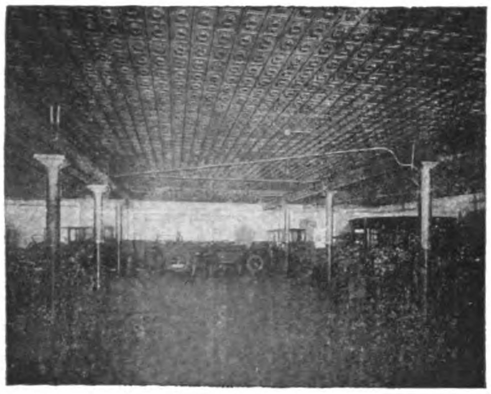
THE SUPERHEATER COMPANY

17 East 42nd Street
NEW YORK

Peoples Gas Building
CHICAGO

Eastern Representative:
George E. Spengler, 1 Tin Ying Hutung, Peking, North China

Kawasaki Dockyard Co., Ltd., Kobe, Japan.
Licensed under Schmidt and other patents.



Safe, Sanitary, Economical

Berloy Metal Ceilings are attractive. Everyone of the thousands of designs are a perfect replica in steel of beautiful molded plaster, so that they serve a decorative as well as a useful purpose. But this distinctive, decorative effect is only one advantageous feature.

Berloy Metal Ceilings are fire-resistive, rodent-proof and durable. They cannot crack, crumble or disintegrate. This makes them desirable where people congregate or where valuable things are stored. Their fire-resistive qualities render them essential where, especially, the hazard of fire must be avoided.

We show above one class of building where these qualities are especially valuable—a large public garage in a populous American city.

Our 35 years of experience and our unsurpassed facilites enable us promptly to meet the most exigent requirements.

Write for further details of our celebrated Metal Products: "Acme" Culverts, Toncan Metal Lumber, Berloy Diamond Mesh Lath, Ribplex (Ribbed lath), Steel Filing Equipment, Steel Lockers, Industrial Steel Bins and Shelving, Automotive Steel Shelving, Berloy Metal Ceilings, etc.

THE

BERGER MFG. CO.

512-O West 25th Street, New York, U.S.A.

Subsidiary of the United Alloy Steel Corporation, Canton, Ohio.

Cable Address: "BERLOY"

Distributor:
J. E. Hayes Engineering Corporation, 508 Glen Line, Building, Shanghai, China.

BERLOY

5 Big Bull Dog Features that simplify PIPE THREADING

"Wider Range" 4 to 8 sizes threaded by each tool.
"No Backing-Off" the dies open and release the pipe.
"3 Lever Control" Dies reset instantly to size.
"Quick Grip Vise" and quick action die-head.
"Self Contained" no loose bushings or breakable small parts.

If your buying agent cannot supply you, write us for attractive terms and complete information on this convenient tool.

OSTER

The Oster Manufacturing Co.

Manufacturers of the most complete line of pipe-threading tools in the world.

2085 E. 61st Pl. Cleveland, Ohio, U.S.A.

THE

North-China Daily News

Established in 1850 as a weekly; in 1864 as a daily

To the Reader

The "North-China Daily News" writes the history of China. It records the pulse of its politics; it reports the conditions of its finance and its markets; and it chronicles the daily doings of its people.

To the Advertiser

The greatest purchasing power in China is that possessed by readers of the "North-China Daily News." It is the newspaper which is found in every office, consular or commercial; it is the newspaper most frequently quoted both by the foreign and vernacular press; and it is the one newspaper which combines a quality with a quantity circulation—being the largest both in size and circulation in China. It was the first newspaper to publish audited circulation statements.

Subscription: Mex. $28 per annum.

(Postage Extra).

The North-China Herald

Is the weekly edition of the "North-China Daily News" for readers abroad. It contains 95 per cent. of news and is the best medium for keeping in touch with events in China when out of reach of the daily.

Subscription: Mex. $16 per annum.

(Postage Extra).

Copies of either of the above publications will be sent to anyone interested on request.

NORTH-CHINA DAILY NEWS & HERALD, LTD.,
Shanghai.

Telegraphic Address: "Herald Shanghai."—All Codes.

A NORTH-CHINA
TRADE DIRECTORY

The North-China Desk Hong List

Is the only Trade Directory of North China issued annually. Its information is most accurate and complete. Published regularly since 1865 it has grown to 900 pages. In addition to the names and addresses of every foreign firm, resident, and missionary in China it contains the following classified information:

SHANGHAI HONG LIST.—All firms, institutions, missions, consulates, etc., in Shanghai, with staffs, arranged alphabetically.

TRADE DIRECTORY.—A list of all Shanghai firms under their professional or trade headings.

AGENCIES.—Agencies held by Shanghai firms are listed alphabetically, with the firm's name after them.

STREET DIRECTORY.—A list of the streets of Shanghai in English and Chinese, with the occupants of all foreign and many Chinese houses, offices, and stores.

SHANGHAI WHO'S WHO.—An alphabetical list of the men of Shanghai, with their business addresses.

RAILWAYS.—A list of the Northern Railways of China, with their foreign and native staffs, including those resident in Shanghai.

RESIDENTIAL DIRECTORY.—A complete list of the foreign residents of Shanghai, arranged alphabetically, with their private addresses.

OUTPORT HONG LIST.—A list of Northern and Central China cities and outports with foreign firms and institutions and their staffs.

OUTPORT WHO'S WHO.—An alphabetical list of foreign men in Northern and Central China, compiled from the Outport and Railway Sections of this work.

OUTPORT LADIES' LIST.—An alphabetical list of foreign ladies, not engaged in mission work, resident in Northern and Central China.

OUTPORT MISSIONARIES.—Classified alphabetically by provinces. Under the names of the provinces are given the towns where missions are established, with list of residents. This is divided into two sections: (1) Protestants, (2) Roman Catholics. Mission Institutions, such as Schools, Colleges, etc., will be found under the respective Ports in which they are instituted.

MISSIONS WHO'S WHO.—An alphabetical list of missionaries of each denomination, compiled from the previous section.

GENERAL.—Consular, postal, exchange and other information.

PRICES:

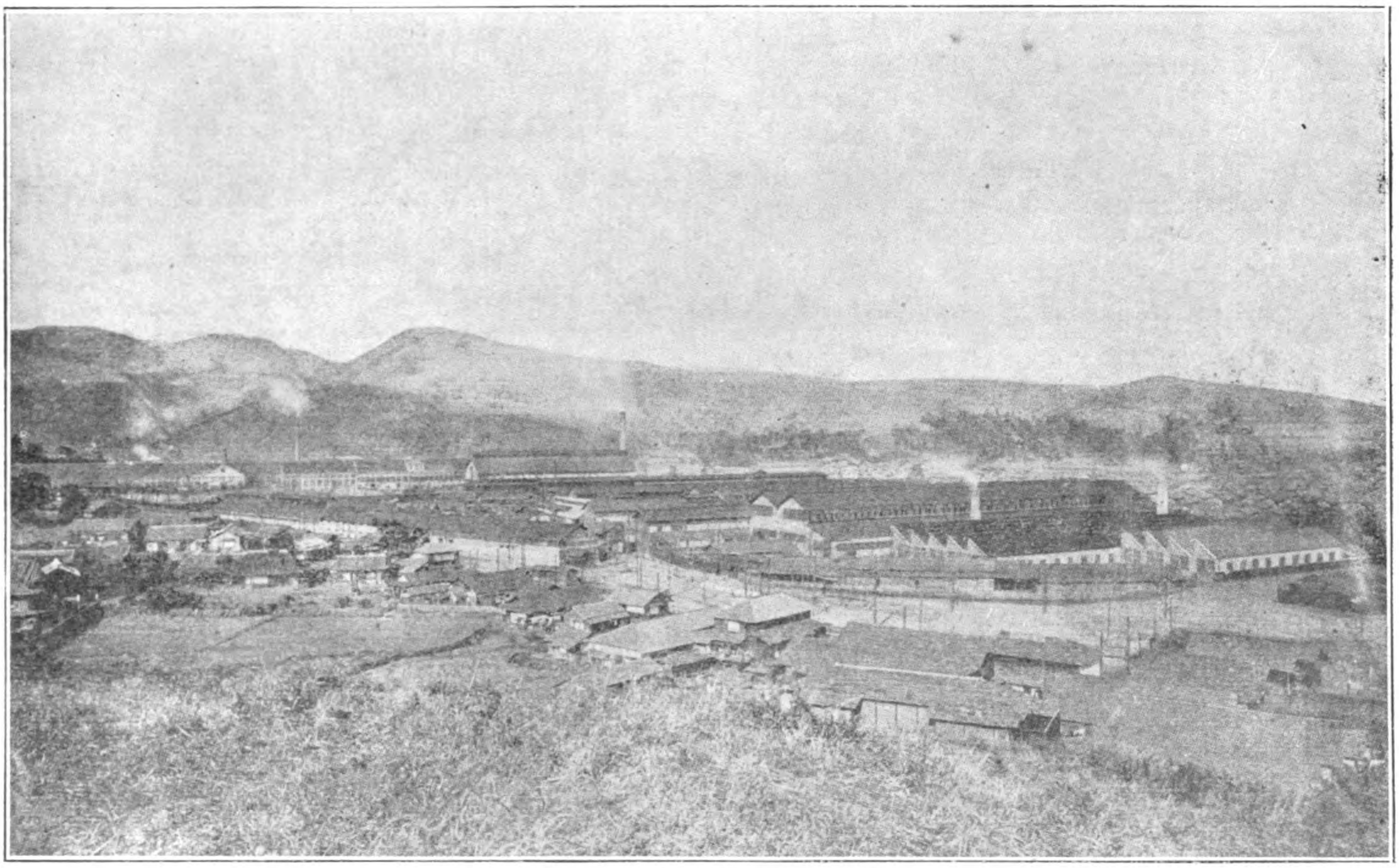
$10 with Shanghai map **$8** without map

On Sale at the Offices of

The North-China Daily News

Shanghai

HIDACHI ENGINEERING WORKS



General View of Hidachi Engineering Works

Location of Plant :

SUKEGAWA, IBARAKI PREFECTURE, JAPAN.

Sales Departments :

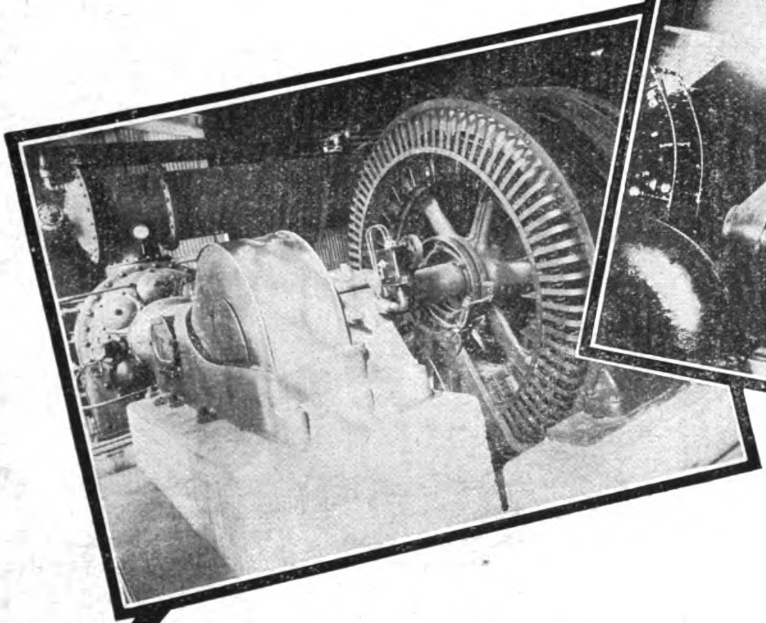
KUHARA MINING COMPANY OFFICES, 1 ITCHOME, YAESUCHO, KOJIMACHI-KU, TOKYO.

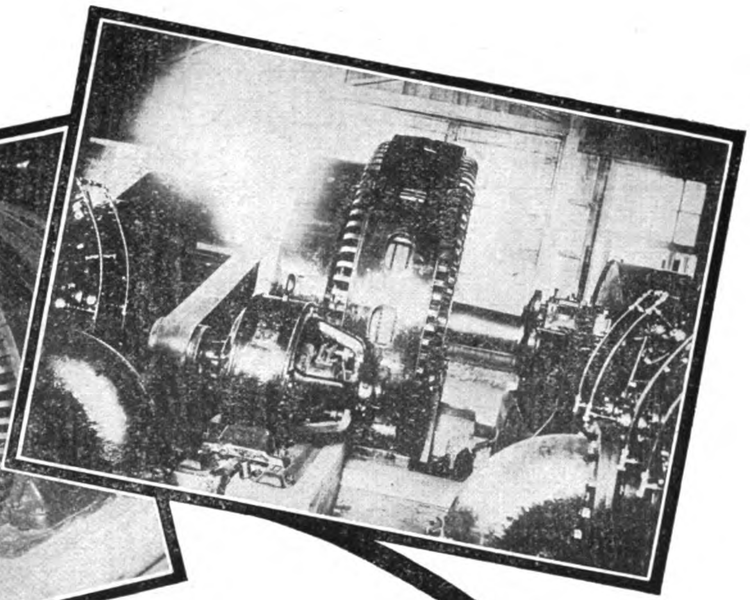
KUHARA MINING COMPANY OFFICES, 90 NICHOME, KITAHAMA, HIGASHI-KU, OSAKA.

Articles Manufactured :

DYNAMOS, ELECTRIC MOTORS, TRANSFORMERS, DISTRIBUTOR PLATES, TURBINE PUMPS, CRANES, WINCHES, AND VARIOUS KINDS OF HYDRAULIC WHEELS.

Also Agents for Hoden Oil, Used for Transformers.





SERVING MANY INDUSTRIES

Westinghouse synchronous motors are serving many industries.

Metal mines, railroad shops, foundries, metal working plants, coal mines, steel mills, and hundreds of others are taking advantage of Westinghouse experience in building synchronous motors so that they may be assured of this most reliable source of power.

Using these motors reduces breakdown hazards to an almost negligible consideration.

The high efficiency and obtained power factor reduce power costs and improve operating conditions, giving:

Continuity of service, High efficiency at all loads, Lower maintenance costs

Westinghouse Electric International Company

Shanghai — Peking — Tientsin — Hongkong

Catton-Neill Engineering & Machinery Co., Manila

Westinghouse Electric Company of Japan, Tokyo

W WESTINGHOUSE ELECTRIC

Westinghouse

X82961

Capital (Fully Paid-Up):
Yen 100,000,000

Reserve Fund:
Yen 83,500,000

CORRESPONDENTS AT ALL THE CHIEF COMMERCIAL CITIES IN THE WORLD

The Yokohama Specie Bank, Ltd.

Established 1880

DIRECTORS:

President: KENJI KODAMA, Esq.
Vice-President: REITARO ICHINOMIYA, Esq.
YUKI YAMAKAWA, Esq.
MASUNOSUKE ODAGIRI, Esq.
BARON KOYATA IWASAKI
KONOJO TATSUMI, Esq.
FUKUSABURO WATANABE, Esq.
PRINCE IWAO MATSUKATA
BARON KAISAKU MORIMURA
KIMPEI TAKEUCHI, Esq.
TARO HODSUMI, Esq.
KUNIZO MOGAMI, Esq.
NAOZO IGARASHI, Esq.

Head Office: YOKOHAMA
Manager: T. OKUBO, Esq.

TOKYO BRANCH
No. 1. Nichome, Eirakucho, Kojimachi-ku.
Manager: E. TSUYAMA, Esq.

SHANGHAI BRANCH
No. 24 The Bund
Manager: G. HASHIDZUME, Esq.

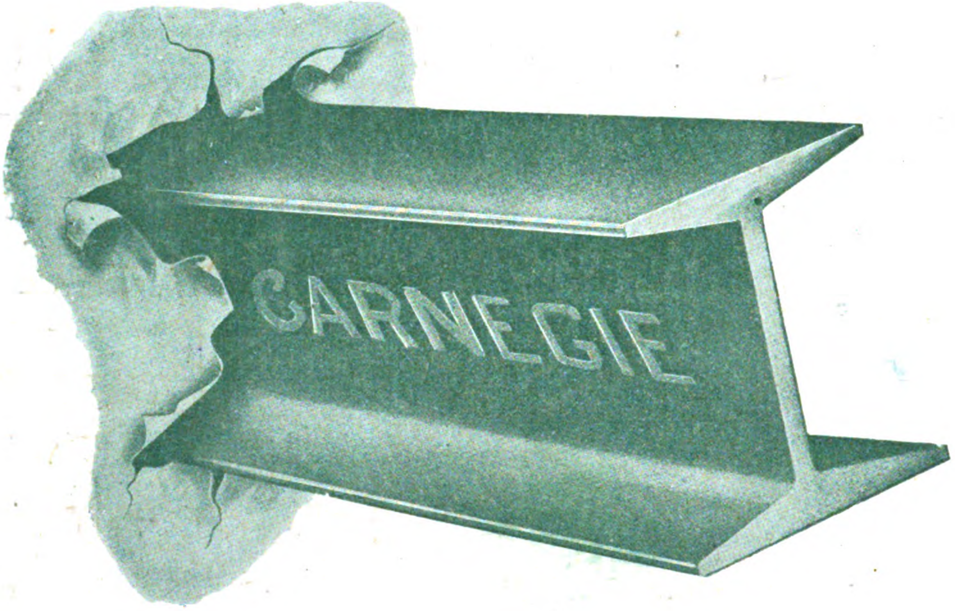
BRANCHES AND AGENCIES.

Batavia
Bombay
Buenos Aires
Calcutta
Canton
Changchun
Dairen (Dalny)
Hamburg
Hankow
Harbin
Hongkong
Honolulu
Kaiyuen
Karachi
Kobe
London
Los Angeles
Lyons
Manila
Mukden
Nagasaki
Nagoya
Newchwang
New York
Osaka
Peking
Rangoon
Rio de Janeiro
Saigon
Samarang
San Francisco
Seattle
Shanghai
Shimonoseki
Singapore
Sourabaya
Sydney
Tientsin
Tokyo
Tsinanfu
Tsingtao
Vladivostock
Yokohama

LONDON BANKERS

LLOYDS' BANK, LTD.
WESTMINSTER BANK, LTD.
NATIONAL PROVINCIAL BANK, LTD.
THE MIDLAND BANK, LTD.

Interest allowed on Current Accounts and Fixed Deposits on terms to be ascertained on application.
Every description of Bank business transacted.
For particulars, apply to the managers.



The Product Is a Reflection of Its Maker

The imprint of the name "Carnegie" in steel represents years of conscientious effort to give steel users better products.

That this effort has been reflected in "Carnegie" products is evidenced by their popularity.

CARNEGIE STEEL COMPANY

General Offices - Carnegie Building - 434 Fifth Avenue
PITTSBURGH—PENNSYLVANIA

UNITED STATES STEEL PRODUCTS CO.

30 Church Street, New York, N. Y.

EXPORT REPRESENTATIVES:

Tokyo Office:
Yusen Building, Marunouchi

Shanghai Office:
Union Building—1 Canton Road

Printed by the North-China Daily News and Herald, Ltd., for the Proprietor.